Bracklyn Wind Farm

Chapter 5: Biodiversity

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5.1 Introduction

5.1.1 Background and Objectives

Woodrow Sustainable Solutions Ltd was commissioned to undertake an ecological impact assessment of the proposed development to inform this Biodiversity chapter. This chapter assesses all aspects of ecology including ornithology.

This EIAR chapter provides an assessment of the likely and significant effects of the proposed Bracklyn Wind Farm near Raharney, Co. Westmeath and its associated grid connection infrastructure (which extends into County Meath) on biodiversity and the ecology of the receiving environment.

The objectives of the assessment are to:-

- Produce a baseline study of the existing ecological environment in the vicinity of the proposed development;
- Identify likely positive and negative effects of the proposed development on biodiversity during the construction, operational and decommissioning phases of the development;
- Identify mitigation measures to avoid, remediate or reduce likely or significant negative effects; and,
- Assess likely or significant cumulative effects of the proposed development as a result of other developments.

5.1.2 Description of the Proposed Development

A full description of the proposed development is presented in **Chapter 3**. In summary, the proposed development comprises the following main components:-

- 9 no. wind turbines with an overall tip height of 185m, and all associated ancillary infrastructure;
- Upgrades to the turbine component haul route;
- Construction of a 110kV electricity substation and installation of 6.3km of underground electricity line between the proposed substation and the existing Corduff-Mullingar 110kV overhead electricity line; and
- All associated and ancillary site development, excavation, construction, landscaping and reinstatement works, including provision of site drainage infrastructure.

The majority of the proposed development is located within the administrative area of County Westmeath; while approximately 2.5km of underground electricity line and the proposed end masts will be located within County Meath. Additionally, candidate quarries which may supply construction materials are also located within County Meath.

The indicative turbine component haul route is also located within the counties of Waterford, Kilkenny, Carlow, Kildare and Dublin.

5.1.3 Statement of Authority

Woodrow Sustainable Solutions Ltd (Woodrow) is an established and accomplished environmental consultancy committed to delivering robust ecological assessment services for clients in the private and public sectors. Woodrow provides an in-house team of ecologists and environmental professionals whose primary specialisms include botany, habitats, birds, bats, mammals, invertebrates and aquatic ecology.

Woodrow's investment in high-technology field equipment and software, and the development of our own field-data collection app (Eco-Log) ensures reliability and confidence in our work. Woodrow staff are fully conversant with wildlife legislation in both Ireland and the UK, and work to exacting standards, according to established guidelines issued by the Chartered Institute of Ecology and Environmental Management (CIEEM). All the ecological surveys were undertaken by appropriately experienced surveyors. For ornithological and bat surveys Woodrow staff were assisted by trusted sub-contracted fieldworkers regularly utilised by the company.

- Habitat and botanical surveys were conducted by Kristi Leyden (KL), Julie Kohlstruck (JK), Dr. Philip Doddy (PD), Liam Bliss (LB) and Mike Trewby (MT). Kristi and Julie, assisted by Liam complied the habitat reporting sections. Kristi was also responsible for compiling the preliminary ecological scoping report;
- Aquatic and fisheries assessment surveys were conducted by Patrick Quinn (PQ) and Nicole Fleming (NF), with reporting reviewed by Patrick;
- The list of ornithological surveyors that conducted surveys from October 2018 to March 2021 included: Declan Manley (DM), Ken Westman (KW), Hugh Delaney (HPD), Hazel Doyle (HD), Kristina O'Connor (KOC), Ciaran Smyth (CS), Joe Kelly (JK), Caroline Lalor (CL) and Mike Trewby (MT). Mike Trewby, assisted by Liam Bliss were responsible for compiling the sections covering ornithology; and
- Bat surveys on the site were led by Krisiti Leyden (KL), who was assisted by Rachel Irwin (RI). Other personnel involved in bat surveying for Bracklyn Wind Farm included: Róisín Nigfhloinn (RN), Aoife Moroney (AF), Oisín O'Sullivan (OO), Julie Kohlstruck (JK), Nicole Fleming (NF), Declan Manley (DM), Daelyn Purcell (DP) and Mike Trewby (MT). Data analysis and compilation of the bat report was conducted by Oisín O'Sullivan, with input from Aoife Moroney and Rachel Irwin. All reporting for bat surveys has been reviewed and approved by Will Woodrow.

An overview of survey effort is provided in **Table 5.1** and surveys can be traced to surveyors by their initials.

5.1.3.1 Key Woodrow personnel

Will Woodrow MSc MSc (Arch) CEcol MCIEEM Company Director and Principal Ecologist. Will is an experienced ecologist with over 30 years of experience in ecological surveys and assessment. He worked with the RSPB in the UK, in different capacities between 1985 and 2001, including managing nature reserves, working as a Conservation Officer in the East Anglia Region and working in Head Office within the Reserves Ecology and Species and Habitat Policy teams. Will has been running his own consultancy since 2004, and has built up a large body of experience in the field of ecological impact assessment. Will is a Chartered Ecologist and full member of the Chartered Institute of Ecology and Environmental Management (CIEEM). Will has completed an HND in Conservation Management (1989), a MSc in European Environmental Policy & Regulation at Lancaster University in 1994 and a MSc (Arch) in Advanced Environmental & Energy Studies at the University of East London (2006).

Róisín Nigfhloinn BSc MSc MCIEEM Principal Ecologist. Róisín has completed an honours BSc specialising in Botany and a MSc in Ecology and Management of the Natural Environment. She regularly carries out reporting on Ecological Impact Assessments to inform Natura Impact Assessments/Appropriate Assessments carried out by statutory authorities. Furthermore, she has more than ten years' experience in habitat, mammal, bird and bat surveys for a number of large infrastructure schemes,

commercial and residential projects. Róisín is an experienced Ecological Clerk of Works (ECoW) and is an NPWS licenced bat surveyor.

Kristi Leyden BSc MSc ACIEEM Senior Ecologist. Kristi holds a BSc Agr (Hons) in Agri-Environmental Sciences and a M.Sc. in Ecological Assessment. Kristi is an experienced ecologist with over seven years' experience as an ecological consultant in Ireland and the U.K. She has carried out field work, predominately on habitats and protected mammals, and reporting, including Ecological Impact Assessment (EcIA) and Natura Impact Statement (NIS), on a wide range of developments, some of which include quarries, wind farms, hydro schemes and residential and commercial developments.

Mike Trewby BSc PGDip MCIEEM Senior Ecologist. Mike worked for Birdwatch Ireland from 2003 to 2010 conducting research on red-billed chough, red grouse and breeding seabirds. Prior to joining Woodrow in 2016, Mike worked as an independent ornithological consultant and he has over 20 years fieldwork and research experience in the field of ecology. Mike regularly undertakes impact assessments for large scale developments and is a full member of CIEEM. Mike's qualifications include a Post Graduate Diploma in Environmental Studies at University of Strathclyde (2002) and BSc in Zoology & Botany from University of Namibia (1997).

Julie Kolstruck BSc MSc Field Ecologist. Julie has a BSc and MSc in Landscape Ecology, which she completed in 2020. A semester of the MSc was spent at NUI Galway where she studied models on European environmental legislation and its implementation in Irish law. Julie has carried out extensive vegetation and habitat surveys for research projects in Northern Germany, Central America and South America. In her current role at Woodrow, she is working on projects employing JNCC Phase 1, Fossitt and National Vegetation Classification (NVC) habitat classification survey techniques. In addition to her botanical identification skills, Julie has developed experience undertaking other ecological surveys including mammal, bat, amphibian and invertebrate surveys. Her abiotic skill set includes chemical analysis and pedological/ geological mapping of soil and chemical and morphological quality assessment of waterbodies. Julie is currently applying for membership of CIEEM.

Dr Philip Doddy BSc PhD ACIEEM Ecologist. Philip has completed a PhD in Aquatic Sciences, a BSc (Hons) in Freshwater & Marine Biology, and a diploma in Amenity Horticulture. Philip carries out botanical monitoring, site surveys and habitat mapping, and compiles EcIAs, NIS reports, screening reports and vegetation monitoring reports. He has also carried out research on calcareous lakes and pools, microbial communities, and ecological succession.

Rachel Irwin BSc GradCIEEM Graduate Ecologist. Rachel spent two seasons coordinating the company's bat surveys under the direction of Will Woodrow. Over this time, she has developed considerable experience in PRF surveys for bats, emergence/re-entry roost surveys, activity transects and deployment of static bat detectors for numerous large wind farms sites in both the Republic of Ireland and Northern Ireland; as well as other developments including quarries and smaller residential projects. Rachel was also developing expertise in conducting roost searches of buildings, bridges and trees under the supervision of licenced members of Woodrow staff - Róisín NigFhloinn and Will Woodrow. During her time at Woodrow, Rachel has become accomplished at manual identification of bat sonograms utilising Kaleidoscope and BatExplorer. Towards the end of each active bat season, she was responsible for compiling bat reports. She also assists senior members of staff with reporting for Ecological Impact Assessment (EcIA), Biodiversity Chapters for

Environmental Impact Assessment Reports (EIAR) and to inform the Appropriate Assessment (AA) process.

Oisín O'Sullivan BSc GradCIEEM Graduate Ecologist. Oisín has completed a BSc in Ecology and Environmental Biology at University College Cork. His final year thesis involved bat surveys of urban habitats in Cork City. His work as a graduate ecologist with Woodrow is focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Oisín has developed a high level of proficiency with Kaleidoscope, Ecobat and BatExplorer, the analysis software used to assess bat calls and activity. Oisín also possesses marine and freshwater habitat survey skills from his time studying at UCC. Since joining Woodrow, Oisín has contributed to the writing of multiple bat activity reports.

Aoife Moroney BSc MSc Graduate Ecologist. Aoife has completed a BSc in Engineering at University College Dublin and MSc in Environmental Engineering (specialising in Environmental Management) at the Technical University of Denmark and the Royal Institute of Technology, Sweden. She is currently undertaking a Post-graduate Certificate in Ecological Survey Techniques at the University of Oxford. She has also been involved with multiple conservation and research projects in southern Africa. Aoife has developed a high level of proficiency with Kaleidoscope, Ecobat and BatExplorer, the analysis software used to assess bat calls and activity. Since joining Woodrow Aoife has developed a high level of proficiency in running collision models for wind farm developments. She is in the process of applying for membership of the CIEEM.

Liam Bliss BSc GradCIEEM Fieldwork Co-ordinator. Liam has a BSc in Biology from Maynooth University. Liam oversees a team of sub-contractors whose main focus is ornithological surveys for wind farms. As part of this role, he draws up their maps, schedules trips so as to ensure appropriate survey coverage, and handles, checks and inputs their data. In particular, he is proficient in using ArcGIS mapping, including viewshed analysis, managing Excel and has acute organisational skills utilising management software such as Asana and Teamwork. Since joining Woodrow, Liam has become competent in undertaking mammal surveys and has been developing his skills in habitat surveying, through supervised on the job training and attending online botanical training workshops.

5.1.4 Legislation, Policy and Guidance

A number of pieces of national and international legislation and policy are applicable to developments in Ireland that have the potential to impact on ecological receptors. This section aims to contextualise legislation with respect to the proposed development.

The below legislation has been included to offer background information on the typical environmental legislation pertaining to such developments.

5.1.4.1 International Legislation

EU Habitats Directive

'The Habitats Directive' provides the basis of protection for Natura 2000 sites, namely Special Areas of Conservation ("SACs"). The full title of this Directive is 'Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora'. Article 6 of the EU Habitats Directive requires that any plan or project that may have a significant effect on a Natura 2000 site must be subject to an

Appropriate Assessment. An Appropriate Assessment is required in order to ascertain the potential impact of a development on the reasons for which the Site is designated, and thereby ascertain the potential for adverse impact on the integrity of the Site. A development that may adversely impact the integrity of a site may not be consented except in the absence of feasible alternative solutions and in the event that a proposal is of imperative reasons of overriding public interest. The report outlining whether or not a development may adversely affect the integrity of a European Site is known as a Natura Impact Statement (NIS).

The Habitats Directive also provides for the protection of species listed under Annex IV of the Directive wherever they occur. These species include marsh fritillary, river lamprey, Atlantic salmon, common frog, all bat species, mountain hare, otter and pine marten.

EU Birds Directive

'The Birds Directive' establishes a system of general protection for all wild birds throughout the European Union. The full title of this Directive is 'Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds'. Annex I of the Birds Directive comprises 194 bird species that are rare, vulnerable to habitat changes or in danger of extinction within the European Union. For these species, Member States must conserve their most suitable territories in number and size as Special Protection Areas ("SPAs") – which are considered to be Natura 2000/European Sites. Similar actions should be taken by Member States regarding migratory species, even if they are not listed in Annex I.

Bern and Bonn Convention

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982) exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries.

EU Water Framework Directive

In response to the increasing threat of pollution and the increasing demand from the public for cleaner rivers, lakes and beaches, the EU developed the Water Framework Directive (WFD). The full title of this Directive is 'Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy'. This Directive is unique in that, for the first time, it establishes a framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater, and their dependent wildlife/habitats under one piece of environmental legislation. The Water Framework Directive is linked to a number of other EU directives in several ways. These include Directives relating to the protection of biodiversity (Birds and Habitats Directives).

UN Convention on Biological Diversity (CBD)

The CBD entered into force on 29 December 1993. It has 3 main objectives:-

- The conservation of biological diversity;
- The sustainable use of the components of biological diversity; and
- The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources.

Parties to the CBD are required to submit a National Biodiversity Action Plan and report annually on the status of biodiversity and measures to address and reverse loss of biodiversity. Ireland's National Biodiversity Strategy and Action Plan (2017-2021) was submitted December 2017.

5.1.4.2 National Legislation

The Wildlife Act (1976) (as amended)

The Wildlife Act 1976 gives protection to a wide variety of birds, animals and plants in the Republic of Ireland (RoI). It is unlawful to disturb, injure or damage their breeding or resting place wherever these occur without an appropriate licence from National Parks and Wildlife Service (NPWS). The Act (as amended in 2000) protects all birds, their nests and eggs. Wilful destruction of an active nest from the building stage until the chicks have fledged is an offence. The Act also provides a mechanism to give statutory protection to Natural Heritage Areas (NHAs). The amendment in 2000 broadens the scope of the Wildlife Acts to include most species, including the majority of fish and aquatic invertebrate species which were excluded from the 1976 Act.

EC (Birds and Natural Habitat) Regulations 2011

The EU Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive 1992), provides protection to particular species and their habitats across Europe. The Habitats Directive is transposed into Irish law through the EC (Birds and Natural Habitats) Regulations 2011.

Annex IV of the EU Habitats Directive provides protection to a number of named species wherever they occur. These species are protected under Regulations 29 and 51 of the Habitats Regulations 2011.

Planning and Development Act 2000, as amended

For the purposes of an application for planning permission the protection of biodiversity is provided for in the 2000 Act, as amended, and the Planning and Development Regulations 2001, as amended, which incorporate provisions of the Habitats and Birds Directives as well as the Wildlife Act 1976 as amended, the Water Framework Directive, and the biodiversity provisions of the County Development Plan.

Flora (Protection) Order (FPO), 2015

The current list of plant species protected by Section 21 of the Wildlife Act, 1976 is set out in the Flora (Protection) Order, 2015, which supersedes orders made in 1980, 1987 and 1999.

It is illegal to cut, uproot or damage the listed species in any way, or to offer them for sale. This prohibition extends to the taking or sale of seed. In addition, it is illegal to alter, damage or interfere in any way with their habitats. This protection applies wherever the plants are found and is not confined to sites designated for nature conservation.

The European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009) and as amended

The regulations establish legally binding quality objectives for all surface waters and environmental quality standards for pollutants for purposes of implementing provisions of E.U. legislation on protection of surface waters. These regulations clarify the role of public authorities in the protection of surface waters and also concern the protection of designated habitats.

S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations, 1988

The River Boyne is listed under the first schedule S.I No. 283/1988. Section 3. (1) of the regulations states that fresh waters specified in the First Schedule, being waters capable of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Corgonus*), are hereby designated as salmonid waters for the purposes of these regulations.

Section 3. (2) outlines that Salmonid waters shall meet the quality standards specified in the Second Schedule on the basis of and subject to the conditions so specified.

The objective of this designation type is the maintenance of water quality for salmon and trout freshwater species. Legal backing was first established under the directive 78/659/EEC 'On the quality of freshwaters needing protection or improvement in order to support fish life' commonly known as the Freshwater Fish Directive. This was superseded by the European Communities (Quality of Salmonid Waters) regulations, S.I. No 84 of 1988. The 1988 Directive defines freshwaters as being waters capable of supporting salmon (*Salmo Salar*), trout (*Salmo trutta*), char (*Salvelinus* species) and whitefish (*Coregonus* species) and are hereby designated as Salmonid waters. A local authority shall carry out or cause to be carried out, sampling of Salmonid waters in its functional area in respect of the parameters specified in the second schedule of the 1988 regulation. Parameters included in these regulations for monitoring include suspended solids, dissolved oxygen and hydrocarbons. Other parameters are also mentioned along with a specified sampling regime for the analysis of these parameters.

S.I. No. 477/ 2011 - Regulation 49 and 50 of European Communities (Birds and Natural Habitats) Regulations 2011

This Act makes it an offence to plant, spread, or otherwise cause to grow any of the plant species listed in Schedule III Part I of this (Department of Arts, Heritage and the Gaeltacht, 2011). The onus is placed on developer to undertake pre-construction invasive species surveys to determine the occurrence of invasive species and if any Third Schedule species are identified there is a legal requirement to provide evidence that all reasonable steps were taken to avoid committing an offence. Typically, this involves the production of bio-security method statement for the site.

European Union Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2009 to 2018

The purpose of these Regulations is to support the achievement of favourable conservation status for freshwater pearl mussels. To that end, they;

(a) Set environmental quality objectives for the habitats of the freshwater pearl mussel populations named in the First Schedule to these Regulations that are within the boundaries of a site notified in a candidate list of European sites, or designated as a Special Area of Conservation, under the European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94/1997),

(b) Require the production of sub-basin management plans with programmes of measures to achieve these objectives, and

(c) Set out the duties of public authorities in respect of the sub-basin management plans and programmes of measures.

5.1.4.3 National Policy

The National Heritage Plan (published in 2002) is currently under review and a new plan is proposed by the Government to run in Ireland up to 2030[1]. Along with the Heritage Plan, The National Biodiversity Action Plan 2017-2021[2] set out strategies for the conservation and management of Ireland's heritage. A key element of both plans is an enhanced role for local authorities in heritage awareness and management, to be given effect through the preparation and implementation of County Heritage Plans and Biodiversity Action Plans. In addition, Article 6 of the Directive obliges member states to undertake an 'Appropriate Assessment' (AA) for any plan or project which may have a likely significant effect on any European Site. The outcomes of such AA's fundamentally affect the decisions that may lawfully be made by competent national authorities in relation to the approval of plans or projects.

The National Biodiversity Action Plan 2017-2021 (NBAP) emphasises the requirement for National, Regional and Local Governments to ensure that the conservation and sustainable use of biodiversity for human well-being is at the forefront of their work. This stemmed from the United Nations 'Convention on Biological Diversity's Cancun Declaration' (CBD, 2016) which defines biological diversity, or biodiversity, to mean "*the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes genetic diversity within species, across species and of ecosystems.*" Ireland's Vision for Biodiversity is set out in the NBAP and states: "*That biodiversity and ecosystems in Ireland are conserved and restored, delivering benefits essential for all sectors of society and that Ireland contributes to efforts to halt the loss of biodiversity and the degradation of ecosystems in the EU and globally.*"

5.1.4.4 Local Policy

The main footprint of the proposed development falls within County Westmeath, with a section of the proposed grid connection route falling in County Meath. Both counties have Biodiversity Action Plans (BAPs), which include the following policies in relation to biodiversity and proposed developments.

County Westmeath Biodiversity Action Plan 2014-2020

This plan is considered a working document informing on legislation in relation to biodiversity; and provides a summary of Co. Westmeath's priority species and habitats including the potential threats. Section 6 of this BAP provides a list of actions with following considered relevant (* denotes a priority action point):-

- Action Point 10*: Focus on the restoration and/or creation of natural and semi natural habitats in areas affected by development (settlements, roads, etc.), where it can be demonstrated that resultant development will not have a negative impact on Natura 2000 sites;
- Action Point 15*: Ensure the appropriate siting of electric power lines, overhead cables and wind turbines, in order to protect areas of high biodiversity and important bird flight paths, where it can be demonstrated that resultant development will not have a negative impact on Natura 2000 sites;

1 Updates on timelines for publication of Heritage Ireland 2030 are available online at: https://www.gov.ie/en/publication/34423-heritage-ireland-2030-indicative-timeline/ (Accessed May 2021).
2 The National Biodiversity Action Plan – Available online at: https://www.npws.ie/legislation/national-biodiversity-plan (Accessed August 2020).

- Action Point 17*: Promote the planting of new native species hedgerows on land in public ownership and privately owned farmland, outside of Natura 2000 sites;
- Action Point 18*: Retain where possible, habitats within developments including hedgerows;
- Action Point 33: Work with local businesses to enhance company grounds for Biodiversity, including the creation of bee- and wildlife- friendly habitats;
- Action Point 54: Request that Bat and Badger Sett Surveys are carried out before developments proceed on green field sites; and
- Action Point 60: Monitor both surface and ground waters on nutrient sensitive SAC's on a regular basis in an attempt to prevent and eliminate eutrophication, in particular Lough Owel and Scragh Bog.

County Meath Biodiversity Action Plan 2015-2020

The aim of this plan is to provide a framework and series of actions to conserve, enhance and raise awareness of Co. Meath's biodiversity and to maximise the contribution that it makes to the social, economic and environmental wellbeing of the county, taking into account local, national and international, including European priorities.

'Theme 2: Best Practice in Natural Heritage Conservation and Management' is relevant to the proposed development, including:

- Action Point 2.6: Promote the retention of existing natural habitats and the creation of new wildlife habitats in new developments implemented through Policies in County Meath Development Plan 2013-2019 Draft Green Infrastructure Strategy for County Meath; and
- Action Point 3.5: Identify woodlands of nature conservation value in Meath based on the results of the NPWS National Woodland Survey.

'Theme 4: Incorporating Biodiversity into the role of the local authority, including:-

- Action Point 4.8: Ensure that biodiversity is a key element of the Climate Change Strategy developed for County Meath by MCC.

5.1.4.5 Guidance

Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities (2010)

The 'Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities' ("the Appropriate Assessment Guidance")[3] provides methodological and legislative guidance on Appropriate Assessment for any developments that may impact on Natura 2000 sites in Ireland. These guidelines are highly relevant in assessing the potential impact on neighbouring Natura 2000 sites.

CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal

The 'CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine'[4] (the CIEEM Guidelines"), published by the

3 Department of Environment, Heritage and Local Government (2010) Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities – Available at: https://www.npws.ie/sites/default/files/publications/pdf/NPWS_2009_AA_Guidance.pdf (Accessed August 2020).
4 CIEEM (2018, Sept 2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester. Updated

Chartered Institute of Ecology and Environmental Management ("CIEEM"), are the acknowledged reference on ecological impact assessment and reflect the current thinking on good practice in ecological impact assessment across the UK and Ireland. They are consistent with the British Standard on Biodiversity, which provides recommendations on topics such as professional practice, proportionality, pre-application discussions, ecological surveys, adequacy of ecological information, reporting and monitoring. These CIEEM Guidelines have the endorsement of the Institute of Environmental Management and Assessment ("IEMA"), the Chartered Institute of Water and Environmental Management (CIWEM), Northern Ireland Environment Agency (NIEA), Scottish Natural Heritage (SNH), The Wildlife Trusts and other leading environmental organisations.

Guidelines on the information to be contained in Environmental Impact Statements (EIS)

The Environmental Protection Agency (EPA) 'Guidelines on the information to be contained in Environmental Impact Statements'[5], which were published in 2002, were prepared in response to the 1992 Environmental Protection Agency Act (Section 72), which states that those preparing and evaluating Environmental Impact Statements (EIS) shall have regard to such guidelines. The aim of these guidelines is to improve the quality of Environmental Impact Statements in Ireland, and as such, they address a wide range of project types and potential environmental issues. This was revised in 2015[6]. The new revised guidelines also incorporate experience arising from EU and Irish court cases, appeals and various pieces of new legislation adopted since the publication of the previous (2002) guidelines.

"The revised EPA Guidelines" provide guidance on the principles and associated practice of preparing Environmental Impact Statements, with the aim of ensuring that the information that they contain is available in a format that is clear, concise and accessible to the greatest number of people.

EPA Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)

The Environmental Protection Agency '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*' ("the EPA Draft Guidelines")[7] have been produced by the EPA in response to the adoption of revised Environmental Impact Assessment Directive 2014/52/EU. All Environmental Impact Assessment Reports submitted to the EPA or other consent authorities on or after the 16 May 2017 must meet the requirements of this Directive. The main aim of the EPA Draft Guidelines is to help those involved in EIA in the period prior to the transposition to the new national legislation. There is a focus on the obligations of developers who are preparing EIARs for the various types of projects covered by the Directive. They are also intended to provide all parties in the EIA process, including competent authorities (CAs) and the wider public, with a standard to measure whether EIARs are fit for purpose. As such they help to ensure that adequate and relevant information will inform decisions

September 2019 – Available online at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-Sept-2019.pdf (Accessed August 2020).

5 EPA (2002) Guidelines on the information to be contained in Environmental Impact Statements. EPA, 2002.

6 EPA (2015 in Draft) Revised Guidelines on the Information to be Contained in Environmental Impact Statements, DRAFT, September 2015.

7 EPA (2017 in Draft) Guidelines on the Information to be contained in Environmental Impact Assessment Reports. – Available at: EPA_EIAR_Guidelines.pdf (Accessed May 2021).

regarding planning consent. The revised EPA Draft Guidelines state "*A biodiversity section of an EIAR, for example, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement, but it should refer to the findings of that separate assessment*". This approach has also been adopted in this chapter, in terms of referencing the conclusions of the NIS (Woodrow, 2021).

All Ireland Pollinator Plan 2021-2025

The main function of the All-Ireland Pollinator Plan is to create a framework to bring together pollinator initiatives across the island to combat the decline of pollinators. There are six main objectives to the plan, with 186 actions. Action 93 is relevant to wind farm developments which actions the publishing of "*guideline documents with evidence-based pollinator actions that are industry-specific*" (NBDC, 2021)[8]. These guidelines have been published for windfarms in partnership with representative groups from the wind energy sector, namely Wind Energy Ireland and RenewableNI – see Pollinator-friendly management of Wind Farms (NBDC *et al*. 2021)[9]

5.1.5 Limitations to Assessment

The information contained in this chapter includes robust data which has been used to assess the likely significant effects of the proposed development on biodiversity. No substantial limitations were identified in terms of scale, scope or context in the preparation of this assessment.

The following minor survey and data analysis limitations were encountered and have been fully accounted for in the impact assessment:-

- In relation to habitat mapping, parts of the woodland/plantation surveyed were inaccessible due to a dense impenetrable understory of brambles, cherry laurel and holly, as well as deep drainage ditches. Where access was restricted, areas were assessed remotely using binoculars and through examination of habitat types in adjacent areas;
- Limitation(s) in the use of the Environmental Protection Agency (EPA) online map viewer[10] were identified for investigating hydrological flow through the proposed development site, as some of the drainage channels and streams mapped were found to be no longer in existence. The Office of Public Works (OPW) online map viewer[11] was found to provide accurate representation of the main arterial drainage within the proposed development site and was utilised as a complementary reference. In addition, ground truthing of the surface water hydrology within the development area has been undertaken and hydrological connectivity to the River Boyne and River Blackwater SAC/SPA was reviewed with reference to **Chapter 7**;
- Limitations relating to bat surveying and data analysis are addressed at **Annex 5.5**. One interpretational limitation that should be noted is that there are caveats on interpretation of percentile outputs for bat activity levels generated by the application of Ecobat, as forwarded by the SNH *et al*. (2019) guidelines for the

8 NBDC (2021). All-Ireland Pollinator Plan 2021-2025 National Biodiversity Centre. A Heritage Council Programme. Available at: https://pollinators.ie/aipp-2021-2025/
9 NBDC, Wind Energy Ireland & RenewableNI (2021). Pollinator-friendly management of Wind Farms. Guidelines 12. National Biodiversity Data Series No. 25 National Biodiversity Centre. A Heritage Council Programme. Available at: https://pollinators.ie/wp-content/uploads/2021/04/Windfarm_Pollinator_Guidelines-WEB.pdf
10 EPA online map viewer at https://gis.epa.ie/EPAMaps/
11 OPW online map viewer available at https://www.floodinfo.ie/map/drainage_map/#

assessment of bat activity levels. Ecobat is an analytical tool that ranks bat activity across all the seasonal deployments of static bat recording equipment. Ecobat generates percentile outputs, by comparing the site activity data from the proposed development site, to other data sets in the wider area (up to 200 km). Limitations were identified in relation to the pool of the comparative data sets for Ireland, which were considered to be below thresholds levels to allow for realistic comparisons between sites. This was compounded by a very thorough approach to manual identification of all sound files generated for the proposed development. This was judged to inflate percentile outputs for the proposed development site, as the small pool of comparative data sets was likely to be affected by less thorough analysis in some instances and was also likely to be collected from sites with inherently less bat activity, including upland sites or those on industrial cut-away bog. The issue is discussed fully at **Annex 5.5** and readers should be fully cognisant of the limitations when interpretating Ecobat percentiles;

- The potential for limitations has been reviewed in relation to optimal timings for some ornithological surveys undertaken during the 2020 breeding season, as a result of travel restrictions in place during the Corvid-19 'lockdown' (activated on 27 March 2020). The implications of any unavoidable alterations to survey timings were made with reference to CIEEM (2020)[12], which provided guidance on temporary alternative approaches to ecological survey and assessment that could be applied as a result of the Covid-19 pandemic. For reference, **Table 5.1** gives dates for survey effort employed at the proposed development site, with **Annex 5.2** providing further details on survey effort. Based on Government travel restrictions and advice; as well as guidance from the Chartered Institute of Ecology and Environmental Management (CIEEM) and the Irish Wind Energy Association (IWEA); all Woodrow ecological surveyors were stood-down from undertaking site visits over the early stages of the 2020 breeding season. The deployment of ornithological surveyors to Bracklyn was placed on hold from 27 March 2020, with time critical survey elements resuming on 21/22 April 2020. This included VP watches; however, the hold was extended until 08 May 2020 for breeding season walkovers. Dates in early May are beyond the recommended survey window for first visits when employing O'Brien & Smith (1992)[13] survey methodology for lowland breeding waders, targeting territorial snipe and lapwing in this instance. Lapwing in particular can start breeding early in the season and the potential for missing breeding activity was considered. However, any early breeding attempts would have been detected during March visits. In addition, VP3 and VP4 covered the core potential breeding habitat for lapwing at the proposed development site (tillage fields) and VP surveys were conducted in April. Therefore, it is considered that the data collected from breeding season walkover surveys is sufficient to facilitate robust assessment of potentially sensitive bird species breeding in the environs of the wind farm site.

12 CIEEM (2020). Guidance on Ecological Survey and Assessment in the Republic of Ireland and Northern Ireland During the Covid-19 Outbreak (Version 1). Published 30 May 2020 Chartered Institute of Ecology and Environmental Management (CIEEM), Winchester, UK

13 O'Brien, M. & Smith, K.W. (1992). Changes in the status of waders breeding on wet lowland grassland in England and Wales between 1982 and 1989. *Bird Study* 39: 165-176

5.1.6 Appropriate Assessment - Natura Impact Statement

The proposed development has been the subject the of a Natura Impact Statement (NIS) for Appropriate Assessment (Woodrow, 2021), which assesses the presence of source-receptor connectivity between the proposed development site and Natura 2000 sites within 15km of the proposed development site, as outlined in DoEHLG (2010)[14] guidelines (based on review by Scott Wilson *et al*., 2006)[15]. The 15km study area is an arbitrary distance within which the initial desktop search was undertaken; in some cases, the zone of influence of a proposed development may be much shorter depending on the ecological feature being considered or it could occasionally extend significantly beyond this distance. For example, where there is hydrological connectivity to a designated site, via a river network, the study area could extend significantly further than 15km.

5.2 Methodology

5.2.1 Desktop Survey

Prior to the commencement of ornithological surveys in 2018, an initial desktop study was conducted to determine a list of avian target species which consisted of sensitive species occurring or potentially occurring in the vicinity of the proposed development; and included examining the potential for ecological connectivity with European Sites designated for birds (Special Protection Areas; SPAs). This initial study was updated during 2019 and 2020 as part of a project scoping exercise to identify the full suite of protected and potentially sensitive species and habitats recorded in the environs of the proposed project. The desktop survey informed the iterative project design process and enabled an assessment of the likely ecological effects of the proposed development; and provided information on the species and habitats that could be affected by the development. These initial desktop surveys also facilitated and fostered a targeted approach to ecological surveying.

Primary sources of information for the desktop study included:-

- Site layout plans and project design drawings provided by Galetech Energy Services and Jennings O'Donovan & Partners;
- Ortho-imagery and 6-inch mapping was viewed using Bing Maps, Google Earth Pro, Google Maps, and Ordnance Survey Ireland – GeoHive;
- NPWS Designations Viewer was used to identify the location of sites designated for nature conservation, including International Sites (RAMSAR and OSPAR sites), European Sites (SPAs and Special Areas of Conservation (SACs)) and National Sites (Natural Heritage Areas (NHAs). Proposed natural Heritage Areas (pNHAs), National Parks, Nature Reserves and Wildfowl Sanctuaries). Shapefiles and metadata for designated sites have been downloaded and are updated annually for use by Woodrow ecologists on local GIS;
- Environmental Protection Agency (EPA) Mapviewer which was used to investigate hydrological connectivity to sites designated for nature conservation, aquifer vulnerability and groundwater vulnerability;

14 Department of Environment, Heritage and Local Government (2010) Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities

15 Scott Wilson, Levett-Therivel Sustainability Consultants, Treweek Environmental Consultants & Land Use Consultants. (2006). *Appropriate Assessment of Plans*.

- Office of Public Works (OPW) national flood information portal, specifically the floodinfo.ie mapviewer which was used to investigate flood risk in the area and the influence of arterial drainage;
- A data request was submitted to and received from the National Parks & Wildlife Service (NPWS) for ecological datasets within 10 km of the proposed development site;
- Species records were collated from the National Biodiversity Data Centre (NBDC) database with the search area extended to 10km from the proposed development site. This map viewer was used to examine other data sets including: bat landscapes (habitat suitability indices), BWI: Bird sensitivity to wind energy, Kingfisher survey 2010, Ancient and long-established woodland, and National survey of native woodland (2010);
- Cummins *et al*. (2010). *Assessment of the distribution and abundance of Kingfisher Alcedo atthis and other riparian birds on six SAC river systems in Ireland*;
- A data request was submitted to and received from Bat Conservation Ireland (BCI) for the area extending 10km from the proposed development site;
- NPWS site synopses for Natura 2000 Sites including:-
    - NPWS (2014a) - Site synopsis for the River Boyne and River Blackwater SAC;
    - NPWS (2010) - Site synopsis for the River Boyne and River Blackwater SPA;
    - NPWS (2014b) - Site synopsis for the Lough Derravarragh SPA;
    - NPWS (2014c) - Site synopsis for the Lough Owel SPA;
    - NPWS (2014d) - Site synopsis for the Lough Iron SPA;
    - NPWS (2014e) - Site synopsis for the Lough Ennell SPA; and
    - NPWS (2012) – Site synopsis for the Garriskil Bog SPA.

The NBDC, NPWS, BCI and Cummins *et al*. (2010) datasets were interrogated to generate a list of historic records for important and protected species, or the likelihood of their occurrence within, or in the vicinity of, the proposed development site). Important and protected species are classified as those identified in the Wildlife Act (as amended), listed under the FPO, EU Habitats and Species Directive and in the EU Birds Directive.

5.2.2 Field Surveys

A summary of survey effort is provided in **Table 5.1** and the following ecological surveys were undertaken:-

- Habitat mapping (Fossitt, 2000), with Annex I habitat assessments where required;
- Invasive species surveys;
- Invertebrate habitat suitability assessment (marsh fritillary);
- Aquatic and fisheries assessments (salmon/lamprey suitability, Q-values);
- Amphibian and reptile suitability assessments;
- Bird surveys (compliant with SNH, 2017);
- Terrestrial (non-volant) mammal surveys; and
- Bat surveys (compliant with SNH *et al*., 2019).

5.2.3 Ecological Study Areas

Field surveys conducted to inform the ecological impact assessment were undertaken with regard to:-

- potential for occurrence ecological receptors based on site conditions (e.g. substrate, hydrology) for habitats and habitat suitability/availability for species; and
- the specific sensitivities of ecological receptors in relation to the potential zone of influence of the proposed development during construction (decommissioning) and operational phases.

The following provides an overview of the study areas employed:-

- High level habitat surveys were initially undertaken within the lands-made-available for the project and these were refined to ensure detailed mapping of the habitats within the proposed development area.
- Locations of non-native invasive species have been mapped within the proposed development area.
- Habitat availability for invertebrates (excluding aquatic species) was assessed within the land-made-available for the project and once the proposed development area was defined it was determined that there was no habitat suitability for potential important invertebrate receptors.
- Aquatic and fisheries assessments (including aquatic invertebrates – crayfish) covered waterbodies within the proposed development site and those with downstream hydrological connectivity to the proposed development area.
- Amphibian and reptile habitat suitability assessments were undertaken within the proposed development area.
- A range of different study area were used for bird surveys including:
  - 500m turbine buffer: Vantage point watch to assess avian collision risk;
  - 2km turbine buffer: Breeding raptor surveys and hen harrier winter roost surveys targeting suitable habitat; and
  - 5km turbine buffer: Wider area wintering bird surveys.

  Note: Initially the buffers were applied to the potential build area
- For terrestrial mammal surveys species-specific surveys areas have been covered based on receptor sensitivities to proposed development actives. Scope surveys covered the land-made-available and were latterly refined to cover the proposed development area, with the final round of surveys (May 2021) ensuring coverage of the proposed works corridor/infrastructural footprint with regard to species-specific sensitivities and habitat availability, including:
  - 150m up and downstream of proposed construction works for otter;
  - suitable habitat within 100m of proposed construction work for pine marten;
  - suitable habitat within 50m of proposed construction work for badger and squirrel
- Initial scoping surveys for bats assessed habitat availability within the lands-made-available and this survey area was latterly refined to covering an area within 300m of proposed turbine location and within 30m of other proposed infrastructure including substation, access tracks and grid connection route. Within these areas roost inspections and emergence-re-surveys for potential roost features (PRFs) classified as high and moderate were undertaken. Bat activity surveys as required by SNH *et al*. (2019) to assess potential effects of operational turbines covered the proposed development area where turbines are proposed.

Ecological surveys	Description	Dates & personnel (initials)
Site scoping	Initial walkover of site, walkover to identify ecological constraints and inform site layout, undertaking multidisciplinary surveys including habitat mapping, invasive species surveys, amphibian/reptile habitat suitability assessments, mammal surveys and bat habitat assessments (PRF surveys) – Ecological Scoping Report prepared.	03 & 04-Mar-2020 RI & KL 17-Apr-2019 HD & HPD
Habitat surveys	Habitat descriptions and classification to Fossitt (2000) level 3, concentrating on highlighting areas of conservation importance – semi-natural woodland areas. Invasive species surveys were also undertaken	03 & 04-Mar-2020 KL
		19 & 22-May-2020 KL & PD
		17 & 28-Sep-2020 JK & LB
	Habitat mapping – Annex I bog woodland	29-May-2021 JK
Aquatic & Fisheries Assessment	Salmon/lamprey suitability surveys (River Hydromorphology Assessment Techniques - RHAT) and baseline water quality assessment (Q-values). Also conducted otter survey and kingfisher habitat suitability assessment surveys	14 & 15-Oct-2020 PQ & NF
Invertebrate, amphibian & reptile	As part of a multidisciplinary approach to surveying, habitat suitability assessment for marsh fritillary, smooth newt and common lizard were undertaken and species recorded if found to be present Note: Dedicated torchlight newt surveys were undertaken on the scrape near the met mast on 10 & 27-May-2021	21-Dec-2019 MT 25-Jan-2020 MT 17-Arp-2019 HD 03 & 04-Mar-2020 RI & KL 19-May-2020 JK & PD 17 & 28-Sep-2020 JK & LB 14 & 15-Oct-2020 PQ & NF 09-Feb-2021 MT & OOS 06-Apr-2021 JK & OOS 10-May-2021 OOS & AM 27-May-2021 MT
Bird surveys Annex 5.2 provides more details for effort details	Vantage point (VP) watches 4 VPs x 36 hours/VP/ season (minimum) Total: 2-year study with 578. 25 VP hours collected In addition, VP watches were conducted over a third winter 2020-21 (4 VPs x 36 hours). Note: VP data was reviewed, however and where relevant any additional information has been included in this assessment.	<u>Non-breeding season 2018-19</u> 25-Oct-2018 to 15-Mar-2019 MT, KW, HD, HPD, KOC, CL
		<u>Breeding season 2019</u> 19-Mar-2019 to 29-Aug-2019 DM, KW, HD, HPD, KOC, CL
		<u>Non-breeding season 2019-20</u>

Ecological surveys	Description	Dates & personnel (initials)
		01-Oct-2019 to 10-Mar-2020 DM
		Breeding season 2020 20-Mar-2020 to 24-Aug-2020 DM, KOC, JK
		Non-breeding season 2020-21 14-Oct-2019 to 12-Mar-21 DM, CS
	Winter walkover surveys	21-Dec-2018 HPD & MT 07-Jan-2019 KW 25-Jan-2019 HPD & MT 08-Mar-2019 KW & HPD 18-Feb-2020 DM 22-Dec-2020 DM 10-Feb-2021 DM
	Breeding bird walkover survey	17-Apr-2019 HD & HPD 11-Mar-2020 DM 08-May-2020 DM 26-Jun-2020 DM 30-Jul-2020 KW
	Dusk woodcock/snipe surveys	10-Jun-2019 KW 21-Jun-2019 DM 08-May- 2020 DM 27-May-2020 DM 02-Jun-2020 DM 09-Jun-2020 DM
	Wider area wintering waterbird surveys	28-Nov-2018 KW 07-Jan-2019 KW 17-Jan-2019 KW 25-Jan-2019 MT & HPD 08-Feb-2019 KW & HPD 15-Mar-2019 KW 29-Nov-2019 DM 30-Dec-2019 DM 29-Jan-2020 DM 11-Feb-2020 KW 19-Oct-2020 DM 14-Nov-2020 DM

Ecological surveys	Description	Dates & personnel (initials)
		09-Dec-2020 DM 19-Feb-2021 DM 15-Mar-2021 DM
	Hen harrier roost searches	30-Oct-2019 DM 29-Nov-2019 DM 30-Dec-2019 DM 29-Jan-2020 DM 19-Oct-2020 DM 27-Nov-2020 DM 09-Dec-2020 DM 08-Feb-2021 DM 27-Feb-2021 CS 15-Mar-2021 DM
	Wider area (2 km turbine buffer) breeding raptor surveys	15-Mar-2019 KW 05-Jun-2019 KOC 09-Jun-2019 KOC 24-Jun-2019 KOC 08-Jul-2019 KOC 12-Jul-2019 KW 20-Mar-2020 KW 23-Mar-2020 KW 27-Apr-2020 KW 24-May-2020 KOC 27-May-2020 DM 29-May-2020 KOC 16-Jul-2020 DC 31-Jul-2020 KW
Bat surveys Annex 5.5 provides more details for survey effort	Habitat suitability assessment and potential roost availability/suitability surveys	03 & 04-Mar-2020 RI/KL
	Potential roost feature - PRF surveys	11-Mar-2020 RI 21-May-2020 RI
	Building inspection under license	05-Aug-2020 RN
	Assessment of proposed tree felling areas for bat roost suitability Bat roost suitability along grid connection route	09-Feb-2021 OOS 06-May-2021 OOS & JK 10-May-2021 OOS & AM 09-Feb-2021 MT & OOS 27-May-2021 MT
	Potential tree roost inspection surveys – under license	06-May-2021 OOS 10-May-2021 OOS

Ecological surveys	Description	Dates & personnel (initials)
	Deployment of static bat detectors Three deployments of minimum 10-nights covering spring, summer & autumn	Spring 10 units: 21-May-2020 Summer 11 units: 23-Jun-2020 Autumn 11 units: 25-Aug-2020
	Continuously recording static at height	23-Jun to 05-Oct-2020
	Weather station (3G remote data)	21-May to 05-Oct-2020
	Bat transect and roost emergence/re-entry surveys	08-Jun-2020 Dusk transect RI (plus one)
		05 & 06-Aug-2020 Emergence/ re-entry surveys plus dusk/dawn transect RN, AF, JK, NF
		25-Aug-2020 Emergence surveys at crypt RI (plus one)
		02 & 03-Sep-2020 Emergence/ re-entry surveys plus dusk/dawn transect DM, AF, DP, NF
		10-May-2021 Emergence surveys at T4 & T5 treelines plus dusk transect covering grid route OOS & AM
Protected terrestrial mammals survey	Habitat suitability and field signs surveys for badger, otter, Irish hare, red squirrel, pine marten and other mammals. Recording of field signs for terrestrial mammal signs was undertaken during multi-dispensary site walkovers, including when undertaking habitat surveys, bat habitat suitability surveys and bird surveys.	21-Dec-2019 MT 25-Jan-2020 MT 17-Arp-2019 03 & 04-Mar-2020 RI & KL 19 & 22 May-2020 JK & PD 17 & 28-Sep-2020 JK & LB 14 & 15-Oct-2020 PQ & NF 09-Feb-2021 MT & OOS 06-Apr-2021 JK & OOS 10-May-2021 OOS & AF

Ecological surveys	Description	Dates & personnel (initials)
Grid connection route	Multidisciplinary surveys, including habitat mapping & invasive species (out of season), mammal surveys, bat habitat suitability surveys (PRF surveys)	09-Feb-2021 MT & OOS
	Bat activity transect	10-May-2021 OOS & AF
	Multidisciplinary surveys, including invasive species, confirmation of habitat types, breeding birds	27-May-2021 MT
Substation	Multidisciplinary surveys, including habitat mapping & invasive species, mammal surveys, bat habitat suitability surveys (PRF surveys)	10-May-2021 AF & OOS

Table 5.1: Overview of Ecological Surveys

5.2.3.1 Habitat Surveys

Preliminary ecological surveys and habitat surveys of the lands-made-available (i.e. within the landholding) for the proposed development were undertaken in March 2020, and were used to identify habitat related constraints and inform project design, as detailed in **Chapter 2** and **Chapter 3**. These surveys identified sensitive and rare woodland habitats and raised bog within the lands-made-available and habitats with the potential to qualify as priority habitats listed under Annex I of the EU Habitats Directive (92/43/EEC). Habitat surveys were updated in May 2020, September 2020 and May 2021. These surveys focused on areas around the proposed turbine locations and access tracks, as revised (see **Chapter 2**), and the location of the proposed substation and grid connection route. Habitats along the grid connection route were mapped initially in December 2020 (out of season) and were subsequently updated in May 2021. A site visit in May 2021 focused on the bog woodland adjacent to T10 to define areas qualifying as Annex I bog woodland. The location of the proposed substation was visited in May 2021.

During habitat surveys, target areas were walked and ecological features of interest were recorded using EcoLog (an ecological field data app developed by Woodrow). During the survey, consideration was given to identifying important or protected habitats, such as Annex I habitats, invasive alien species, and habitats with the potential to support protected species. Particular attention was paid to searching suitable habitat for rare or protected flora species to determine whether they were present within, or close to, the proposed development site. Those species listed by the FPO are afforded legal protection under the Wildlife Act 1976, as amended.

Habitat surveys and mapping was undertaken following Smith *et al*. (2011)[16], with all habitats classified into recognised communities defined by Fossitt (2000)[17] and cross-referenced to Annex I habitats. Given the higher level of classification required by, and protection afforded to, Annex I habitats, careful consideration was given to species composition, location, and physical characteristics of the surveyed habitats,

16 Smith G.F., O'Donoghue P., O'Hara K. & Delaney E. (2011). *Best practice guidance for habitat survey and mapping*. The Heritage Council
17 Fossitt J.A. (2000), "*A guide to habitats in Ireland*. The Heritage Council

as described in European Commission (2013)[18]. In cross checking habitat classifications for semi-natural woodland, reference was made to Rodwell (1991)[19], Hall *et al*. (2004)[20], Perrin *et al*. (2008)[21] and Perrin *et al*. (2010)[22]. Cross & Lynn (2013)[23] was used to assess areas supporting habitat types with the potential to qualify as the Annex I priority habitat Bog Woodland.

All habitat surveys were conducted during the optimum time of year.

5.2.3.2 Aquatic Surveys

Aquatic surveys were conducted at 7 no. locations within, and adjacent to, the proposed development site on 14 &15 October 2020 and included the follow methodology:-

- An ecological assessment of the watercourses within and draining the proposed development site (notably with respect to white-clawed crayfish, salmon and lamprey suitability) was conducted at key locations. Sections of waterbodies directly affected by the proposed development (i.e. crossing points) were walked and assessed using the Life Cycle Unit (LCU) Approach, where aquatic habitats are classified according to type: nursery, holding, spawning; and quality: excellent (1) to marginal (4), as detailed in Kennedy,1984[24] and O'Connor & Kennedy, 2002[25];
- River Hydromorphology Assessment Techniques (RHAT) were also undertaken. RHAT allows for the classification of watercourse hydromorphology based on a departure from naturalness and assigns a morphological classification directly related to that of the WFD: high, good, moderate, poor and bad, based on semi-qualitative and quantitative criteria;
- While conducting stream assessments, banks and drains were searched for signs of otter activity and were assessed for kingfisher suitability; and
- At 4 no. sample points, biological scoring of the streams associated with the proposed development site was carried out to provide for Q-rating of each watercourse. This was undertaken using macro-invertebrate sampling (kick-sampling). As detailed in Toner *et al*. (2005)[26], macro-invertebrate samples were converted to Q-ratings and assigned to WFD status classes. Basic water quality parameters were measured using portable meters to provide a baseline profile of chemical quality in the principal watercourses. These included temperature, pH, dissolved oxygen, conductivity and turbidity.

18 European Commission (2013) *The Interpretation Manual of European Union Habitats* - EUR28
19 Rodwell, J S (ed.) (1991) *British Plant Communities. Volume 1. Woodlands and scrub*. Cambridge University Press, Cambridge
20 Hall, J.E.; Kirby, K.J. & Whitbread, A.M. (2004). *National Vegetation Classification: Field guide to woodland*. Joint Nature Conservation Committee (JNCC)
21 Perrin P., Martin J., Barron S. O'Neil F., McNutt K. & Delaney A. (2008) *National Survey of Native Woodlands 2003-2008*. Volume I: Main report. Botanical, Environmental & Conservation Consultants Ltd. report submitted to the NPWS
22 Cross, J.; Perrin; P. & Little, D. (2010). *The Classification of Native Woodlands in Ireland and its Application to Native Woodland Management*. Native Woodland Information Note No. 6. NPWS, BEC Consultants Ltd & Woodlands of Ireland
23 Cross, J. & Lynn, D. (2013). Results of a monitoring survey of bog woodland. *Irish Wildlife Manuals*, No. 69. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
24 Kennedy G.J.A. (1984) Evaluation of techniques for classifying habitats for juvenile salmon (*Salmo salar* L.) *Proceedings of the Atlantic Salmon trust workshop on stock enhancement*.
25 O'Connor L. & Kennedy, R.J (2002). A comparison of catchment-based salmon habitat survey techniques on three rivers in N. Ireland. Fisheries Management & Ecology, 9, 149-161
26 Toner P., Bowman J., Clabby K., Lucey L., McGarrigle M., Concannon C., Clenaghan C., Cunningham P., Delaney J., O'Boyle S., MacCárthaigh M., Craig M. & R. Quinn et al. (2005) *Water Quality in Ireland 2001–2003*. EPA – Environmental Protection Agency, Johnstown Castle, Co. Wexford

A map showing the locations of aquatic assessments in relation to the proposed development is provided at **Figure 5.4**.

5.2.3.3 Invertebrate Surveys

As outlined in **Table 5.1**, multi-disciplinary walkover surveys of the lands-made-available for the proposed development were covered on various dates. During surveys, habitat suitability assessments for various protected invertebrates were undertaken and specifically included assessments for marsh fritillary *Euphydryas aurinia*. The suitability of habitats for other species including *Vertigo* snails (whorl snails) and Kerry slugs *Geomalacus maculosus*, as well as aquatic invertebrate species; specifically freshwater pearl mussels *Margaritifera margaritifera* and white-clawed crayfish *Austropotamobius pallipes;* was assessed.

Habitat suitability assessments in the field, combined with information on species distribution complied during the desk-based study, ensured that all proposed wind farm infrastructure, including met mast, substation, grid connection routes and areas for temporary infrastructure (deposition areas, site compound) have been sufficiently assessed for invertebrate species. Assessments were undertaken in accordance with those described in NRA (2009)[27].

Initially, ecological surveys were to include odonata (dragonfly and damselfly) surveys of the bog pool (Bracklin Lough) located along the south-eastern boundary of the lands-made-available for the project. However, as outlined at **Chapter 2**, infrastructure was removed from this general location, thereby avoiding this potentially sensitive habitat and associated invertebrates. This negated any requirement for specific odonata surveys. Moreover, initial scoping surveys, ongoing multi-disciplinary surveying and the desk-based study determined that, based on a lack of suitable habitats, no specific terrestrial invertebrate surveys were required, including marsh fritillary web surveys or surveys for *Vertigo* species. The Kerry slug has a distribution in Ireland limited to the southwest of the country and has not been recorded from Co. Westmeath or Co. Meath (NPWS, 2019)[28].

In relation to aquatic invertebrates, the network of ditches and channels draining the proposed development site are within the River Boyne catchment, which does not support a freshwater pearl mussel population (NPWS, 2019). Therefore, no surveying or assessment was required for this species. No specific white-clawed crayfish surveys were undertaken beyond a habitat assessment of the surface water features within the proposed development site. Based on NPWS (2019), there are no records for the 10-km square covering the proposed development site [N65], although it is within the range for this species which is known to occur in the catchment for the Stonyford River. The proposed development site is at the upper reaches of a tributary of the Stonyford River that is subject to periodic drainage maintenance works, which has a negative effect on the occurrence of this species. Therefore, it is considered unlikely that crayfish occur in the main ditch/stream flowing through the proposed development site.

27 NRA - National Roads Authority (2009). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. Available from https://www.tii.ie/technical-services/environment/planning/Ecological-Surveying-Techniques-for-Protected-Flora-and-Fauna-during-the-Planning-of-National-Road-Schemes.pdf

28 NPWS (2019). *The Status of EU Protected Habitats and Species in Ireland*. Volume 3: Species Assessments. Unpublished NPWS report. Ed. by: Deirdre Lynn, D. & O'Neill, F.

5.2.3.4 Amphibian & Reptile Surveys

Only 2 no. species of amphibian and 1 no. species of reptile has the potential to occur within the proposed development site, including: common frog *Rana temporaria*, smooth newt *Lissotriton vulgaris* and common lizard *Zootoca vivipara*. Multi-disciplinary walkover surveys were undertaken within the lands-made-available for the project; and covered all turbine locations, associated internal infrastructure and the grid connection route. During initial scoping surveys any habitat potentially suitable for smooth newt and common lizard was identified. If occurring within the within the zone of influence of the proposed development (i.e. likely to occur within the works corridor), these habitats were targeted with species appropriate surveys to determine presence or absence. No specific frog surveys were considered necessary and frogs were recorded on an *ad hoc* basis when observed during site walkovers, with particular attention given to breeding sites supporting frog spawn.

Scoping surveys noted very few ponds or drains considered capable of supporting smooth newts, based on criteria outlined in JNCC (2003)[29], due to flowing water, heavy shading, as well as the presence of wildfowl and predatory fish, e.g. in Bracklin Lough and some of the main drainage ditches. In addition, the design of the proposed development avoids directly impacting on any areas of standing water within the proposed development site, including drainage ditches. The only exception is an ephemeral scrape adjacent to the proposed permanent met mast that will be used for spoil storage during construction. A habitat suitability assessment considered the pool to be of poor quality for breeding newts. When determining suitability, consideration was given to several factors including the suitability of surrounding terrestrial habitat, the size and permanence of the water feature, the water quality, shading, potential presence of waterfowl/fish, proximity to other ponds/ditches, and macrophyte cover (typically required for laying eggs on). Despite the apparent limited suitability of the scrape; as a precaution, 2 no. torchlight surveys were conducted in May 2021.

The common lizard is the only reptile native to Ireland and is protected under the Wildlife Acts (as amended). This species has a widespread distribution on the island of Ireland, and there is no evidence of any significant declines (King *et al*., 2011[30]). Based on NBDC Biodiversity Maps, there are relatively few records in Co. Westmeath and Co. Meath. The species is mainly associated with coastal and heathland habitats in Ireland (Farren *et al*., 2010)[31]; and at the proposed development site, potentially suitable habitats for lizards are limited to the remnants of raised bog on the south-eastern periphery of the lands-made-available for the project. The footprint of the proposed development avoids these areas, thereby negating the requirement for specific lizard surveys.

5.2.3.5 Ornithological Surveys

Scottish Natural Heritage (SNH) (2017) guidelines[32] provide recommended survey methodologies for the assessment of avian populations within and adjacent to

29 Joint Nature Conservation Committee - JNCC (2003). Herpetofauna Workers Manual. Available at: http://jncc.defra.gov.uk/page-3325

30 King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

31 Farren, A., Prodöhl, P.A., Laming, P. & Reid, N. (2010). *Distribution of the common lizard (*Zootoca vivipara*) and landscape favourability for the species in Northern Ireland*. Amphibia-Reptilia 3 Vol 31 p387

32 Scottish Natural Heritage, now NatureScot - SNH (2017). *Recommended Bird Survey Methods to Inform Impact*

proposed onshore wind farms. The survey methodologies utilised for the various field ornithological surveys are outlined in the following sections and adhere to the relevant SNH guidance. **Annex 5.2** provides further detail on ornithological study areas and the survey effort implemented, including survey dates, duration and weather conditions.

2-years of ornithological surveys are recommended by the SNH guidelines, unless it can be clearly demonstrated that a single year of data is sufficiently robust and appropriate for assessing the potential impacts of the proposal. After the first year of ornithological surveys the survey area was found to present minimal avian constraints; however, taking a precautionary approach it was decided to complete second year of ornithological survey to ensure full compliance with SNH guidelines. The full suite of SNH (2017) ornithological surveys were continued over the non-breeding season 2020-21.

Vantage Point (VP) Watches

VP watches record flight-line activity through the 500m buffer around the proposed turbines to provide data on selected target species for assessing avian collision risk. 4 no. VPs were selected and these were retained throughout the survey period. The VPs selected to cover the proposed development site are compliant with the SNH (2017) guidelines, which stipulate that viewsheds from VPs should not extend more than 2 km and that the angle of view should also not be extended beyond an arc of 180 degrees

The 4 no. VPs provided comprehensive coverage of the rotor swept area for the entire 500m turbine buffer – defined as a buffer extending out 500m from the proposed turbine locations. **Figures A5.2.1** to **A5.2.4** in **Annex 5.2** illustrate the location of the VPs, viewsheds and the extent of the turbine buffer.

Based on viewsheds extending 2km, the viewsheds of the VPs all overlap and in particular the viewshed of VP3 overlaps with VP1. To a lesser extent there is overlapping viewsheds between VP1 and VP2 and between VP3 and VP4. Therefore, it is acknowledged that as a function of coverage (survey effort), the flight seconds reported cumulatively for all the VP watches will provide an overestimate for flight times. This is corrected for in collision risk modelling. The topographical flatness over the eastern part of the turbine buffer combined with the mature woodland along the south-eastern boundary necessitated the use of overlapping VP viewsheds to capture flight line activity on either side of the woodland. Similarly, the gradual and small reduction gradient from proposed turbine T2 to T1 necessitated the use of VP4, although this vantage point overlapped somewhat with VP3.

The conducting of VP watches simultaneously by 2 no. surveyors was largely avoided and over the 2-year study, simultaneous VP watches were only undertaken during Year 1 for logistical reasons and only occurred on 7 no. of 96 no. survey days over the 2-year study. When simultaneous VP watches did occur, care was taken to ensure that the viewsheds of the VPs did not overlap significantly, i.e. watches from VP1 and VP3 were not undertaken at the same time to avoid overlap.

To limit observer fatigue, surveyors did not typically undertake VP watches of more than 3-hours in duration without a break, unless inclement periods of weather meant watches were paused for short durations until conditions improved.

Assessment of Onshore Wind Farms. SNH Guidance Note (Version 2: March 2017 update)

Target species for which flight-line data was captured were defined as all raptor species and all water bird species. As such, all species with populations potentially at risk from wind farm developments were surveyed, including species of conservation concern and those susceptible to collision due to flight behaviour. Based on population sensitivity and/or proximity of the proposed development site to Special Protection Areas (SPAs), the primary target species identified for the proposed development site were, wintering Greenland white-fronted goose and whooper swan associated with SPAs in the wider area. While kingfisher is a Qualifying Interest (QI) of the River Boyne and River Blackwater SPA, VP watches are not considered an appropriate methodology for assessing this species and based on low flight trajectory collision risk for this species is considered to be very low.

As detailed SNH (2017), it is considered that passerines are at low risk from collision with wind turbines; as flight behaviour makes them less susceptible to collisions and populations dynamics (e.g. high fecundity, rapidly attaining sexual maturity) means that any fatalities due to collision are unlikely to impact on passerine communities at the population level. The exception may be rarer breeding passerines, which in Co. Westmeath/ Co. Meath would include whinchat, tree sparrow and yellowhammer. However, the small size of these species makes them difficult to detect from VPs; and therefore, walkovers or species-specific surveys (e.g. tape-lure surveys) provide a better of method of accessing the baseline populations.

As detailed in **Annex 5.2**, for each VP a minimum of 36 hours watches has been collected for each season, defined as the breeding season and non-breeding season, i.e. 72 hours per year. For this proposed development, data has been collected amounting to 578.25 hours of watches for the 500m turbine buffer. An additional 36 hours per VP was collected during the 2020-21 non-breeding season (i.e. an additional 144 hours).

Collision Risk Modelling

For target species generating sufficient levels of flight time within the zone of collision risk, data sets were run through a Collision Risk Model (CRM), as detailed in SNH (2000)[33] and Band *et al*. (2007)[34], employing avoidance rates as given in SNH (2016 & 2018)[35, 36] to provide estimates of the number of collisions per annum and for the lifetime of the proposed wind turbines (30 years). A detailed method statement, along with results, is provided in **Annex 5.7**.

Breeding Bird Surveys

Breeding bird surveys aim to provide information on the distribution of breeding birds throughout the proposed development site and ornithological study area, highlighting the locations of sensitive species to be flagged as ecological constraints, e.g. breeding waders or raptors. Details for survey effort are provided in **Annex 5.2**.

It was determined that the proposed development site may support lowland breeding waders (specifically snipe and lapwing) and surveys running from 'dawn to 3-hours

33 Scottish Natural Heritage (2000). Windfarms and Birds - *Calculating a theoretical collision risk assuming no avoiding action*. SNH Guidance Note.
34 Band, W., Madders, M., & Whitfield, DP., (2007). Developing Field and Analytical Methods to Assess Avian Collision Risk at Wind Farm Sites. In: de Lucas, M., Janss, G. & Ferrer, M. (Eds) 2007. Birds and Wind Farms – Risk Assessment and Mitigation. *Quercus Editions*, Madrid, 259-279
35 Scottish Natural Heritage (2016). Avoidance rates for the onshore SNH wind farm collision risk model.
36 Scottish Natural Heritage (2018). Avoidance rates for the onshore SNH wind farm collision risk model.

after' or 'late afternoon to dusk' (as detailed in O'Brien & Smith 1992)[37] were employed to identify breeding behaviour, such as chipping or drumming snipe. Evening surveys were continued over the dusk period to determine the distribution of breeding (roding) woodcock on the site (as detailed in Gilbert *et al*., 1998)[38]. During dusk surveys, surveyors would also have been listening for other crepuscular and nocturnal species, including owls and nightjars.

The woodland edge of the proposed development site, facing out into the surrounding bog, was assessed as providing nesting habitat for tree nesting merlin and these areas were assessed during walkovers, as well as during VP watches conducted from VP1 and VP2.

Winter Walkovers

Winter walkover surveys aim to provide information on the distribution of birds wintering throughout the site, highlighting the locations of sensitive species to be flagged as ecological constraints. Winter walkovers are important in providing context to VP watch data and to facilitate validation of bird numbers utilising the study area. Details for survey effort are provided in **Annex 5.2**.

Breeding Season Raptor Surveys

SNH guidelines recommend surveying the wider area (hinterland) for up to 2km from the site for most breeding raptor species. A combination of 'mini-VPs', as well as driven and walked transects were used to search potential nesting habitat within the hinterland over the breeding seasons of 2019 and 2020. Survey methods for breeding raptors follow those outlined in Hardey *et al*. 3nd Ed. (2013)[39].

Winter Waterbird Surveys

In order to determine density of use by wintering bird populations, and especially to identify any foraging or roost sites for swans and geese, point count surveys (in accordance with those employed for IWebS) were undertaken to survey all publicly accessible/viewable loughs and other wetlands within *c*. 5-6km of the proposed turbine locations. Surveys were undertaken over winter seasons during 2018-19, 2019-20 and 2020-21. Details of survey effort are provided in **Annex 5.2.**

In relation to assessing the effect of proposed wind farm developments on wildfowl roosts, specifically roosts utilised by geese; SNH survey guidelines recommend undertaking fortnightly roost surveys (as detailed in Gilbert *et al*., 1998)[40]. Monitoring should encompass roost sites within 1km of the proposed development site.

Aside from the small bog pool (Bracklin Lough) there are no suitable loughs for roosting swans or geese within 1km of the proposed development site. The proposed development site, including the 500m turbine buffer, is not documented as supporting nationally or internationally important numbers of wintering waterbirds or any sensitive

37 O'Brien, M. & Smith, K.W. (1992) Changes in the status of waders breeding on wet lowland grassland in England and Wales between 1982 and 1989. *Bird Study* 39: 165-176

38 Gilbert, G., Gibbons, D.W., Evans, J. (1998). *Bird Monitoring Methods – A manual of techniques for key UK species*. RSPB

39 Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. (2013). *Raptors: A field guide to survey and monitoring* (Third Edition). The Stationary Office, Edinburgh.

40 Gilbert, G., Gibbons, D.W., Evans, J. (1998). *Bird Monitoring Methods – A manual of techniques for key UK species*. RSPB.

wintering wetland species, especially swans or geese (Crowe 2005[41], Boland & Crowe 2012[42], Lewis *et al*., 2019b[43]).

Hen harrier Roost Searches

SNH (2017) guidance stipulates in relation to surveying for communal raptor roosts, including those of hen harriers, that:-

> "*Any roost sites within 2km of a proposed wind farm site should be identified*".

With respect to the proposed development, the approach to surveying for hen harrier roosts was determined by two factors, including:-

- Availability of potentially suitable roosting habitat in the vicinity of the proposed development, as described by Clarke & Watson (1990)[44] and in the Irish national hen harrier winter roost survey guidelines (O'Donoghue, 2012[45] – subsequently updated 2019); and
- Hen harrier activity observed during VP watches, site walkovers and wider area surveys.

SNH (2017) defers to Hardey *et al*. (2009)[46] for specific roost survey methodology requiring surveyors to employ professional judgement in identifying and targeting potential roosts based on observed flight activity within or adjacent to a site. Hardey *et al*. (2009) recommend locating birds in the late afternoon and then attempting to track them back to roosts. There was no hen harrier activity recorded over the first winter (2018-19) and no targeted hen roost searches were conducted.

Areas of suitable hen harrier roosting habitat were identified in the raised bog and fringing scrub to the east and south of the 500m turbine buffer. These areas were targeted with speculative hen harrier roost searches employing the roost watch methodology detailed in O'Donoghue (2019)[47]. Details of survey effort are provided in **Annex 5.2**.

5.2.3.6 Mammal surveys (terrestrial, arboreal & aquatic)

The proposed development site was systematically surveyed for mammal species. **Table 5.1** provides a list of survey dates, which were conducted simultaneously with other surveys. The main focus of mammal surveys was to identify the presence of otter *Lutra lutra* or their resting places such as layups or holts (Reid *et al*., 2013)[48], and badger *Meles meles*, or their resting places/setts (Smal, 1995)[49]. Based on habitat availability, surveyors examined the proposed development site for evidence of other mammals

41 Crowe, O. (2005). *Ireland's Wetlands and their Waterbirds: Status and Distribution*. BWI, Co. Wicklow
42 Boland, H. & Crowe, O. (2012). *Irish wetland bird survey: waterbird status and distribution 2001/02 – 2008/09*. BirdWatch Ireland, Kilcoole, Co. Wicklow.
43 Lewis, L. J., Burke, B., Fitzgerald, N., Tierney, T. D. & Kelly, S. (2019b). Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16. *Irish Wildlife Manuals*, No. 106. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland.
44 Clarke, R. & Watson, D. (1990). The Hen Harrier *Circus cyaneus* Winter Roost Survey in Britain and Ireland, *Bird Study*, 37:2, 84-100
45 O'Donoghue, B. (2012). Hen harrier roost types & guidelines to roost watching. NPWS, Ely Place, Dublin
46 Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. (2009). *Raptors: a field guide for surveys and monitoring*. Stationery Office, Edinburgh
47 O'Donoghue, B. (2019). Survey Guide: Hen harrier roost types and guidelines to roost watching. IHHWS - Irish Hen Harrier Winter Survey
48 Reid, N., Hayden, B., Lundy, M.G., Pietravalle, S., McDonald, R.A. & Montgomery, W.I. (2013). National Otter Survey of Ireland 2010/12. *Irish Wildlife Manuals* No. 76. NPWS, DoAHG, Dublin, Ireland
49 Smal, C. (1995). *The Badger and Habitat Survey of Ireland*. Stationary Office, Government Publications Dublin

which would be likely to occur, including pine marten *Martes martes*, red squirrel *Sciurus vulgaris* and Irish mountain hare *Lepus timidus* subsp. *hibernicus*. Surveyors would also record signs and/or sightings of invasive mammals, like the American mink *Neovison vison* and grey squirrel *Sciurus carolinensis* if encountered during surveys.

The survey approach included the identification of potentially suitable habitat, detection of field signs such as tracks, markings, feeding signs, droppings and scent-points as well as by direct observation. The surveys were undertaken in accordance with guidelines referenced by CIEEM and giving cognisance to Irish survey guidelines, such as those produced by Transport Infrastructure Ireland (NRA, 2009)[50].

Given the general proximity of works to surface water features, it was deemed appropriate to extend the mammal surveys to 150m up- and downstream of the footprint of the proposed development for otter, with surveys for badger extended to areas within 50m. A final site walkover of the study area, including the grid connection route, was completed in May 2021.

5.2.3.7 Bat surveys

Annex 5.5 provides a detailed description of all methodologies employed during bat surveys conducted for the proposed development and comprise:-

- Desktop study;
- Roost assessment surveys;
- Bat activity surveys – roost emergence/ re-entry surveys;
- Bat activity surveys – walked/ driven transects and point counts;
- Static bat detector surveys;
- Monitoring of climatic conditions;
- Calibration and testing of recording equipment; and
- Analysis

In terms of analysis, SNH *et al*. (2019) guidelines recommend using the online tool Ecobat[51] (or equivalent) to allow for a measure of relative bat activity using a ranking system, which allows for the classification of bat activity across a site as low through to high. As discussed in **Annex 5.5** (see **Section 1.5.4 & Section 2.8**), due to uncertainties surrounding the application of the Ecobat in the context of Irish bat populations, bat pass outputs were analysed using both Ecobat and bat passes per hour (bp/h) classified to take account of a study by Kepel *et al*. 2011[52], as sourced from Tosh *et al*. (2014)[53].

The benefits of utilising the analytical approach employed by Ecobat are clear, in that it facilitates a comparison of the data collected at the study site with bat survey information collected from similar geographic areas during similar times of the year. For the Ecobat report produced for the proposed development, the database reference records used in the analysis were limited to those:-

50 NRA (2009). *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*. NRA - National Roads Authority

51 Ecobat website: http://www.ecobat.org.uk/

52 Kepel, A., Ciechanowski, M., Jaros, R. (2011). How to assess the potential impact of wind turbines on bats using bat activity surveys? A case study from Poland, XII European Bat Research Symposium, August 22-26, 2011, Vilinusm Lithuania.

53 Tosh, D.G., Montgomery, W.I. & Reid, N. (2014). A review of the impacts of wind energy developments on biodiversity. Report prepared by the Natural Heritage Research Partnership (NHRP) between Quercus, Queen's University Belfast and the Northern Ireland Environment Agency (NIEA) for the Research and Development Series No. 14/02.

- within the geographic region (200 km buffer);
- that utilised Wildlife Acoustic detectors; and
- records within a 30-day timescale.

However, up until recently, the Ecobat reference system was strongly oriented on UK bat populations and it was not clear whether reference data sets were relevant to Ireland. Comparative Irish data sets are now starting to surpass thresholds to allow for more robust assessments. The data set for the proposed development was compared to reference data from 2,693 to 9,156 nights, which is still considered relatively low; and likely to include a high proportion of upland sites or sites with industrial cut away bog that will generate comparatively low levels of bat activity. This, combined with the inclusion of bat passes from noise files, could be a distorting factor in the use of the Ecobat software analysis tool as the methods used by other independent contributors to the Ecobat database cannot be ascertained. There is therefore a very high likelihood for inflation of the median activity results from Ecobat.

The percentiles generated by Ecobat for specific nights of bat activity allows for the objective classification of bat activity into categories ranging from low through to high. As Ecobat uses median percentile data, it is less influenced by large variance in the data as averages such as bp/h can be. **Table 5.2** shows the levels of bat activity categories by Ecobat percentile scores, which is suggested by SNH *et al.* (2019) for use in the assessment of risk to local bat populations from wind farm developments.

Ecobat Percentile	Bat Activity Level
81 - 100	**High**
61 - 80	**Moderate/High**
41 - 60	**Moderate**
21 - 40	**Moderate/Low**
0 - 20	**Low**

Table 5.2: Bat Activity Categorised by Percentile Scores

Source: SNH *et al.* (2019)

The activity levels were also examined in terms of bat passes per hour (bp/h). In order to provide additional context for what constitutes significant levels of activity, the bp/h data has been presented taking account of Kepel *et al.* 2011. This study sought to attribute significance levels to bat activity recorded during wind farm surveys and, for the purpose of wind farms in Ireland, the activity levels of this study have been adapted into bands representing low, medium, and high levels of bat activity; as illustrated in **Table 5.3**.

Ecobat Percentile	*Nyctalus* species	*Pipistrelle* species	All bats
High	> 6.5	> 6.5	> 10.0
Medium	3.6 to 6.5	3.6 to 6.5	4.1 to 10.0
Low	0.0 to 3.5	0.0 to 3.5	0.0 to 4.0

Table 5.3: Bat Activity Levels (associated with bp/h)

5.2.4 Impact Assessment

Ecological surveys for the proposed development were undertaken following specific guidelines for habitats and species, as outlined in the preceding sections, and with reference to the legislation and policy outlined in **Section 5.1.4**. The importance of the habitats and species present is evaluated using the guidance document *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal, and Marine* published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2018, update 2019). This document outlines an accepted approach for the evaluation of potential impacts from such developments. This approach is outlined in the following sections.

5.2.4.1 Identifying Ecological Features within the Zone of Influence

Information obtained during the desk study and field surveys identifies ecological features which are likely to be affected by the proposed development and as such, occur within the 'zone of influence' of the proposed development.

The zone of influence depends on the type of development taking place, its likely impacts and the presence of ecological connections which enable such impacts to affect sensitive ecological features. The zone of influence may extend well beyond the boundaries of the proposed development site, due to the presence of ecological connections with an ecological feature of interest. Similarly, ecological features that have no ecological connection with the proposal are not within its zone of influence, regardless of their proximity to the proposed development, as no pathway for impacts exists.

All ecological and/or hydrological connections which provide pathways for impacts between the proposed development site and ecological features in the surrounding area are identified and described in the ecological baseline.

In terms of the zone of influence for construction works, potential for direct effects to occur were assessed within 20m of the proposed site infrastructure, including temporary features (site compound, deposition areas) and for the grid connection route this was reduced to a 5m corridor along the route. This assessment area is referred to as the works/construction corridor within this chapter. Indirect effect on ecological receptors to works occurring with the construction corridor are assessed with regard to types of works proposed and the sensitives of the receptor, as published.

In terms of the zone of influence for the proposed development once operational the infrastructural footprint is assessed and for operational turbines species-specific sensitivities are assessed as pertaining to birds and bats.

5.2.4.2 Evaluating Ecological Features within the Zone of Influence

Those ecological features which occur within the zone of influence, such as nature conservation sites, habitat or species are then evaluated in geographic hierarchy of importance. The categories used for this evaluation are listed in **Table 5.4**.

The status of a species requiring protection at an international level does not necessarily impose an 'International' conservation value on any single example of that species found at a site. Approaches to attributing nature conservation value to species have been previously developed for groups such as birds and bats. Specific assessment criteria employed for assessing avian and bat populations are detailed below.

'Important ecological features' (also referred to as key ecology receptors – KERs) are defined as those features which are within the zone of influence and are evaluated as being of Local Importance or greater.

Importance Criteria
International Importance
• Sites, habitats and species populations of importance in a European context; • 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA), candidate Special Area of Conservation; • Site that fulfils 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;[54] • 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 species of animal and plants listed in Annex II and/or IV of the Habitats Directive and/or Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; • Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971); • Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979); • Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979); • World Heritage Sites (implications for biodiversity value only); and • Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance

• Sites, habitats and species populations of importance in a national context, including any site designated or proposed as a Natural Heritage Area (NHA), Statutory Nature Reserve, Refuge for Fauna and Flora protected under the Wildlife Acts and/or National Park;
• Undesignated site fulfilling the criteria for designation as a NHA, Statutory Nature Reserve, 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 national level) of the following:-
  ○ Species protected under the Wildlife Acts; and/or-
  ○ Species listed on the relevant Red Data list- and
• Site containing 'viable areas'[55] of habitat types listed in Annex I of the Habitats Directive

County (Regional) Importance
• Resident or regularly occurring populations (assessed to be important at the County level)[56] of the following:-

54 See Articles 3 and 10 of the Habitats Directive

55 A 'viable area' is defined as an area of a habitat that, given the particular characteristics of that habitat, was of a sufficient size and shape, such that its integrity (in terms of species composition, and ecological processes and function) would be maintained in the face of stochastic change

56 It is suggested that, in general, 1% of the County population of such species qualifies as a County important population. However, a smaller population may qualify as County important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle

Importance Criteria
○ 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 Biodiversity Action Plans (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; and • Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance
• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; • 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; • 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.
Local Importance (lower value)
• Habitats and species populations of less than local importance but of some value; and • Sites or features containing non-native species with some importance in maintaining habitat links.

Table 5.4: Geographic Frame of Reference

Source: Adapted from Guidelines for Assessment of Ecological Impacts of National Road Schemes (2009)

5.2.4.3 Identification and Characterisation of Impacts and Effects

When describing ecological impacts and effects, reference should be made to the following characteristics:-

- Positive or negative;
- Extent;
- Magnitude;
- Duration;
- Timing;
- Frequency; and
- Reversibility.

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 characteristics (CIEEM, 2018, updated 2019).

5.2.4.4 Significant Effects on Important Ecological Features

For the purpose of EcIA a 'significant effect', in ecological terms (whether negative or positive), is an outcome to an important ecological feature resulting from an impact, that either supports or undermines biodiversity conservation objectives for that ecological feature. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. National / local nature conservation policy). As such, effects can be considered significant in a wide range of geographic scales, from 'International' to 'Local'. Consequently, 'significant effects' should be qualified with reference to the appropriate geographic scale (CIEEM, 2018, updated 2019).

5.2.4.5 Assessment of Residual Impacts and Effects

After characterising the likely impacts of the proposed development, and assessing the significance of likely effects on the 'Important Ecological Features', mitigation measures are proposed to avoid and/or mitigate the identified ecological effects. Once measures to avoid and mitigate ecological effects have been finalised, assessment of the residual impacts and effects should be undertaken, to determine the overall significance of effects on the Important Ecological Features.

5.2.4.6 Assessment of Cumulative Impacts and Effects

Cumulative effects can result from individually insignificant, but collectively significant, actions occurring over a period of time or concentrated in a location (CIEEM, 2018). Different types of actions can cause cumulative impacts and effects. As such, these types of impacts may be characterised as:-

- Additive/incremental – in which multiple activities/projects (each with potentially insignificant effects) add together to contribute to a significant effect due to their proximity in time and space (CIEEM, 2018, updated 2019); or
- Associated/connected – where a development activity 'enables' another development activity e.g. phased development as part of separate planning applications. Associated developments may include different aspects of the project which may be authorised under different consent processes. It is important to assess the potential impacts of the 'project' as a whole and not ignore impacts that fall under a separate consent process (CIEEM, 2018, updated 2019).

5.2.4.7 Assessment Criteria for Bats

In order to undertake an assessment of the likely effect of the proposed development on bats, it is important to take into account not only what bat species and numbers are present on the site, but also how susceptible those species are to impacts from wind turbines and how susceptible populations of the species occurring are to the impacts in an Irish context.

SNH *et al.* (2019) provides guidelines for conducting risk assessment for bat species occurring on wind farms, however it is not fully clear how the assessment methodology relates to Irish bat populations. Therefore, the assessment of the proposed development site draws on several sources to emulate the SNH guidance, including

Marnell *et al.* (2009)[57] and Wray *et al*. (2010)[58] - see **Table 5.5**. For collision risk of bat species to wind turbines (see **Table 5.6**), SNH *et al*. (2019) is used which updates previous species risk assessment published in Natural England (NE, 2014)[59].

As listed in **Table 5.5**; on an all-Ireland basis, Leisler's bats are considered to be *Near Threatened*, while all other species are categorised as *Least Concern* (Marnell *et al.*, 2009).

As shown in **Table 5.6**, Leisler's bats and Nathusius' pipistrelles are considered as *high risk* of direct impacts from with wind turbines, as they regularly fly in the open and at height, which may put them at risk of collision or barotrauma. The SNH *et al*. (2019) guidelines consider both common and soprano pipistrelles to be at *high risk* of direct impacts from wind turbines based on a study investigating bat collisions at wind farm sites across the UK (Mathews *et al*, 2016), which found both these species to be amongst the most commonly recorded casualties during searches of turbines. The SNH *et al*. (2019) guidelines provide an update to Natural England guidance, which had classified common and soprano pipistrelle as *medium risk* species (NE, 2014), based on flight behaviours of common and soprano pipistrelles that habitually fly low and close to landscape features, such as hedgerows. *Myotis* species and brown long-eared bats are considered as *low risk* based on the behaviour and foraging techniques of these species.

Based on population status in Ireland and risk level in relation to adverse interactions with turbines, it is important to ascertain which bat populations may be threatened due to impacts from wind turbines, and this assessment is shown in **Table 5.7**. On the basis of this information, it is clear that particular attention should be paid to Leisler's bats and Nathusius' pipistrelles, which are believed to be susceptible to impacts from wind turbines and have populations of *high population vulnerability*, in the context of wind farm developments in Ireland. Leisler's bats are generally considered to forage habitually at height in more open landscapes and are less associated with habitat features than other bat species. Nathusius' pipistrelles are known to be migratory and may fly at height during migration. This assessment adheres to SNH *et al*. (2019) guidance, under which common and soprano pipistrelles are considered to have *medium population vulnerability* to wind farm developments in Ireland due to species behaviour. Whiskered bats are also classed as *moderately vulnerable*, due scarcity in Ireland. Brown long-eared bats and the two other Irish *Myotis* species (Daubenton's bat and Natterer's bat) are considered to have *low vulnerability* to wind farm developments in Ireland.

Species	**Rarity in Ireland** Wray *et al*. (2010)	**Irish status** (Marnell *et al*., 2009)
Daubenton's bat *Myotis daubentonii*	Rarer (Frequent/widespread)	Least concern
Whiskered bat *Myotis mystacinus*	Rarest (Scarce/widespread)	Least concern

57 Marnell, F., Kingston, N. & Looney, D. (2009). *Ireland Red List No. 3: Terrestrial Mammals*, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
58 Wray, S., Wells, D., Long, E. & Mitchell-Jones, T. (2010) *Framework for valuing bats in Ecological Impact Assessment*, CIEEM journal. Edition 70. Pg. 23 – 25. December 2010.
59 Natural England (2014). *Bats and onshore wind turbines: Interim Guidance* 3rd Ed. Natural England Technical Information Note TIN051, Natural England, Peterborough.

Natterer's bat *Myotis nattereri*	Rarer (Scarce/widespread)	Least concern
Leisler's bat *Nyctalus leisleri*	Rarer (Frequent/widespread)	Near threatened
Common pipistrelle *Pipistrellus pipistrellus*	Common (Widespread)	Least concern
Soprano pipistrelle *Pipistrellus pygmaeus*	Common (Widespread)	Least concern
Nathusius'pipistrelle *Pipistrellus nathusii*	Rarer (Rare/restricted)	Least concern
Brown long-eared bat *Plecotus auritus*	Rarer (Frequent/widespread)	Least concern

Table 5.5: Conservation status of Bat Species in Ireland (Marnell *et al*. 2009)

Collision risk		
Low risk	**Medium risk**	**High risk**
Myotis species Brown long-eared bat	Common pipistrelle (NE, 2014) Soprano pipistrelle (NE, 2014)	Leisler's bat Nathusius' pipistrelle Common pipistrelle (SNH, 2019) Soprano pipistrelle (SNH, 2019)

Table 5.6: Level of Collision Risk

Sources: Adapted from Natural England (2014) & SNH *et al*. (2019)

Ireland		Collision risk		
		Low risk	**Medium risk**	**High risk**
Relative abundance	Common species		Common pipistrelle Soprano pipistrelle (NE, 2014)	Common pipistrelle Soprano pipistrelle (SNH *et al*., 2019)
	Rarer species	Daubenton's bat Natterer's bat Brown long-eared bat		Leisler's bat Nathusius' pipistrelle
	Rarest species	Whiskered bat		

Table 5.7: Level of Vulnerability of Bat Populations in Ireland

Sources: Adapted from Wray *et al*. (2010), Natural England (2014) & SNH *et al*. (2019)

Population Vulnerability: Yellow = ***low*** Beige = ***medium*** Red = ***high***

In terms of value bat populations, the nature conservation value of a receptor is based upon a geographic hierarchy of importance, as outlined in **Table 5.4**. The approach to attributing nature conservation value to bat species follows Wray *et al*. (2010); and **Table 5.8** summaries the method for scoring foraging habitat and commuting features

after considering the conservation status, the number of bats recorded and the occurrence or potential occurrence of roosts.

Score	Species	Score	Number of bats	Score	Roosts/ potential roosts nearby	Score	Foraging habitat characteristics Type and complexity of linear features
2	Common	5	Individual bats	1	None	1	Site without established vegetation e.g. urban
						1	Absence of (other) linear features
				3	Small number	2	Suburban areas or intensive agriculture
						2	Unvegetated fences and large field sizes
5	Rarer	10	Small number	4	Moderate number or not known	3	Isolated woodland, less intensive agriculture etc
						3	Walls, with many gaps or flailed hedgerows, isolated well grown hedgerows, and moderate field sizes
				5	Large number or close to protected areas for bats	4	Large connected woodland blocks, mixed agriculture etc
						4	Well-grown and well-connected hedgerows, small field sizes)
20	Rarest	20	Large number	20	Close to or within SAC for bats	5	Mosaic of pasture, woodlands and wetlands
						5	Complex network of mature well-established hedgerows, small fields and rivers/streams

	Importance	Score
	International	> 50
	National	41-50
	Regional	31-40
	County	21-30
	Local	11-20
	Not important	1-10

Table 5.8: Valuation of Sites & Foraging Areas/Commuting Routes

5.2.4.8 Assessment Criteria for Birds

Ornithological impact assessment follows Percival (2003)[60], which requires that an evaluation is undertaken of the population status and trends for the bird species recorded to determine the nature conservation importance, which is based on links to European Sites (Natura 2000 Site), Annex 1 status on EC Birds Directive and conservation status as listed on the BoCCI - Bird of Conservation Concern in Ireland 2014-2019 (Colhoun & Cummins, 2013)[61], which was updated during the assessment period by BoCCI 2020-2026 (Gilbert *et al*., 2021)[62]. Other recent publications were also reviewed to provide up to date population assessments, including those in Crowe *et al*. (2014)[63] and Lewis *et al*. (2019a)[64], which provide details on the status and population trends for some species based on the results of the Countryside Bird Survey (CBS) between 1998 and 2016. The published results from species-specific studies were also consulted, such as the results of National Breeding Hen Harrier Surveys conducted every 5-years and annual reports published by the Greenland White-fronted Goose Study. Summaries for wintering waterbird populations are provided by Crowe (2005)[65], Boland & Crowe (2012)[66] and Lewis *et al*. (2019b)[67]). Seabird (inland breeding gulls and cormorants) distribution and population trends are taken from Cummins *et al*. (2019)[68].

BoCCI (2020-2026), is the agreed list of priority bird species for conservation action on the island of Ireland produced by BirdWatch Ireland and the RSPB Northern Ireland. Birds are classified into three separate lists (Red, Amber and Green), based on the conservation status of the bird and, hence, conservation priority. Red List birds are of high conservation concern, Amber List birds are of medium conservation concern and Green List birds are not considered to be threatened. There are currently 54 no. Red listed species and 71 no. Amber listed species.

The process of ascertaining whether a likely effect is significant or not, employed by Percival (2003), used in this assessment requires certain factors to be taken into account:-

- The nature conservation importance of the species present and potentially affected; and
- The magnitude of the potential effect.

60 Percival, S. M. 2003. *Birds and wind farms in Ireland: A review of potential issues and impact assessment*. Ecology Consulting, Coxhoe, Durham
61 Colhoun, K., & Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014-2019. *Irish Birds*. 9: 523-544.
62 Gilbert, G., Stanbury, A. & Lewis, L. (2021). Birds of Conservation Concern in Ireland 2020-2026. *Irish Birds* 9: 523-544
63 Crowe, O., Musgrove, A.J. & O'Halloran, J. (2014). Generating population estimates for common and widespread breeding birds in Ireland. *Bird Study* 61(1): 82-92
64 Lewis, L. J., Coombes, D., Burke, B., O'Halloran, J., Walsh, A., Tierney, T. D. & Cummins, S. (2019a) Countryside Bird Survey: Status and trends of common and widespread breeding birds 1998-2016. *Irish Wildlife Manuals*, No. 115. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland.
65 Crowe, O. (2005). *Ireland's Wetlands and their Waterbirds: Status and Distribution*. BirdWatch Ireland, Rockingham, Co. Wicklow
66 Boland, H. & Crowe, O. (2012). *Irish wetland bird survey: waterbird status and distribution 2001/02 – 2008/09*. BirdWatch Ireland, Kilcoole, Co. Wicklow.
67 Lewis, L. J., Burke, B., Fitzgerald, N., Tierney, T. D. & Kelly, S. (2019b). Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16. *Irish Wildlife Manuals*, No. 106. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland.
68 Cummins, S., Lauder, C., Lauder, A. & Tierney, T. D. (2019) The Status of Ireland's Breeding Seabirds: Birds Directive Article 12 Reporting 2013 – 2018. *Irish Wildlife Manuals* No. 114. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland

By integrating the assessments on nature conservation importance and magnitude of effects, the significance of likely effects can be ascertained. **Table 5.9** to **Table** 5.13 outline the stages of the assessment process.

Nature Conservation Importance

The sensitivity or Nature Conservation Importance of bird species present at the proposed development was determined according to the definitions given in **Table 5.9,** which have been transposed directly from Percival (2003).

Sensitivity	Definition
Very High	• Species that form the cited interest of Special Protection Areas (SPAs) & other statutorily protected nature conservation areas.
High	• Species that contribute to the integrity of an SPA but which are not cited as species for which the site is designated. • Ecologically sensitive species including: divers, common scoter, hen harrier, golden eagle, red-necked phalarope, roseate tern & chough. • Species present in nationally important numbers (>1% Irish population).
Medium	• Species on Annex 1 of the EC Birds Directive. • Species present in regionally important numbers (>1% regional (county) population). • Other species on the BirdWatch Ireland's red list of Birds of Conservation Concern (that are not already included in a category above).
Low	• Any other species of conservation interest, including species on the BirdWatch Ireland's amber list of Bird of Conservation Concern not covered above.

Table 5.9: Determining Factors of Avian Sensitivity

(Source: Percival, 2003)

Magnitude of Effects

In terms of methods used to evaluate the magnitude of effects, 'Effect' is considered to be a change in the population of a given bird species present during (or beyond) the life of the proposed development. Where the effect on a population has varying degrees of likelihood, the probability of these differing outcomes needs to be considered. Effects can be adverse, neutral or favourable.

The overall magnitude of effects is determined by taking three factors into account:-

- The behavioural sensitivity of the species;
- The spatial magnitude of the effect; and
- The temporal magnitude of the effect.

Behavioural sensitivity is related to a species' ecological function and behaviour, and is defined using the broad criteria set out in **Table 5.10**. The judgement takes account of information available on the responses of birds to various stimuli (e.g. predators, noise and disturbance by humans). Behavioural sensitivity can differ even between similar species and within a particular species. Some populations and individuals may be more sensitive than others; notably with respect to certain activities (such as the early stages of nesting). Effects are also judged in terms of magnitude in space and time. 5 no. levels of spatial magnitude are defined in **Table 5.11** and temporal magnitude is defined in **Table 5.12**.

Behavioural sensitivity	Definition
High	• Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting reactions to disturbance events (guide: >20 minutes).
Moderate	• Species or populations that appear to be warily tolerant of human activities or exhibit short-term reactions to disturbance events (guide: 5-20 minutes).
Low	• Species or populations occupying areas subject to frequent human activity and exhibiting mild and brief reaction (including flushing behaviour) to disturbance events.

Table 5.10: Determining Factors for Behavioural Sensitivity

(Source: Percival, 2003)

Sensitivity	Definition
Very High	• Total or near total loss of a bird population due to mortality or displacement or reduced productivity in a bird population due to disturbance. • Guide: >80% of population affected
High	• Major reduction in the size or productivity of a bird population due to mortality, displacement or disturbance. • Guide: 21-80% of population affected
Moderate	• Partial reduction in the size or productivity of a bird population due to mortality, displacement or disturbance. • Guide: 6-20% of population affected
Low	• Small but discernible reduction in the size or productivity of a bird population due to mortality, displacement or disturbance. • Guide: 1-5% of population affected
Negligible	• Very slight reduction in the size or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. • Guide: < 1% population affected

Table 5.11: Scales of Spatial Magnitude

(Source: Percival, 2003)

Magnitude	Definition
Permanent	• Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need >25 years to reach maturity, or restoration of ground after removal of a development. Such exceptions can be termed very long-term effects).
Temporary	• Long term (15 - 25 years or longer - see above) • Medium term (5 – 15 years) • Short term (up to 5 years)

Note: Based on Percival (2003) operational impacts of wind farms are considered as Temporary – Long Term (with an operational time of around 25 years).

Table 5.12: Scales of Temporal Magnitude

(Source: Percival, 2003)

Significance of Effects

The significance of likely effects on a given bird population is evaluated by using experience and professional judgement to integrate the scales of Nature Conservation Importance (**Table 5.9**), behavioural sensitivity (**Table 5.10**) and the predicted magnitude of spatial and temporal effects (**Table 5.11** & **Table 5.12**). In making judgements on significance, consideration is given to the population status, trends and distribution of the potentially affected species within Ireland.

By combining the bird species importance (population sensitivity) and the estimated magnitude of impact into the matrix in **Table 5.13**, an assessment of the overall significance of effects on bird species can be made.

Significance		Nature Conservation Importance			
		Very High	**High**	**Medium**	**Low**
Magnitude	**Very High**	Very High	Very High	High	Medium
	High	Very High	Very High	Medium	Low
	Moderate	Very High	High	Low	Very low
	Low	Medium	Low	Low	Very low
	Negligible	Not significant	Not significant	Not significant	Not significant

Table 5.13: Significance matrix: Combines effect magnitude & nature conservation importance of receptors

(Source: Percival, 2003)

Percival (2003) suggests the following when interpreting significance ratings:-

- 'Not significant' is considered *de minimis* or inconsequential;
- 'Very low significance' and 'low significance' should not normally be of concern, though normal design care should be exercised to minimise effects;
- 'Medium significance' represents a likely significant effect that requires careful individual assessment. Such an effect warrants a revised project design or appropriate mitigation; and
- 'Very high significance' and 'high significance' represent a highly significant impact on bird populations in EIA terms.

5.3 Description of the Existing Environment

The following sections provide a description of the baseline ecological condition associated with the proposed development site.

5.3.1 Proposed Development Site

The proposed development is situated on a lowland site and the topography of the general area is relatively flat, ranging from 70 to 100 m AOD. The landscape surrounding the proposed development site is dominated by intensely managed agricultural land and a range of habitats associated with cut-away raised bog, including industrial cut-away, re-vegetating cut-away, scrub and bog woodland. The

land west of the proposed location for T2 rises to a local high point that divides the catchments for the River Deel and Stonyford River, which flow on the western and eastern side of the proposed development site, respectively and join the River Boyne to the south/southeast of Ballivor.

The footprint of the proposed development, including turbines, hardstands, access tracks, substation and temporary infrastructure/storage areas (i.e. excluding the grid connection route) are located within the lands of Bracklyn Farm in Co. Westmeath. Within the wind farm site, the landscape is highly modified with open fields of intensively managed grassland and tillage, next to blocks of commercial conifer and broadleaved plantations, planted in what were previously agricultural fields. Much of the length of tracks proposed for connecting site infrastructure will be constructed by upgrading existing forestry tracks and farm lanes and where new tracks are proposed these are within tillage and improved grassland.

Large ditches (most > 100 years old) drain the site and the catchment of the proposed development area converges on a main channel that forms part of the Boyne Arterial Drainage Scheme (OPW ref: C1/32/7/3). This channel is classified as a 1st order stream by the EPA mapping (Indicative flow network: EPA ref: Bolanstown – 07B45). This highly channelised stream flows east through the site from the road at the proposed site entrance, becoming a 2nd order stream before exiting the site to the east of the proposed turbine location for T10. After leaving the site this watercourse flows ESE for c. 7.8 km where it joins the Stonyford River c. 2 km north of Ballivor. This section of the Stonyford River is designated as part of the River Boyne and River Blackwater SAC and SPA.

Bracklyn Farm was historically part of the Bracklyn Estate and parts of the estate would have been managed for shooting. Features from this period of time have been retained or persisted, including the woodlands on the periphery of the lands-made-available (LMA), mature beech treelines/copses and the high incidence of non-native shrubs, like cherry laurel that were planted within woodlands to provide ground cover for game. Likewise, many of the older trees occurring in the site are not native, including beech treelines/copses and probably the rows of Scot's pines occurring along the edge of the bog.

The footprint of the proposed development was designed to avoid old growth and semi-natural woodland. This includes Bracklin Wood, which occurs in a thin band from south of T4/T5 and runs east along the northern edge of the bog; extending from the bog pool (Bracklin Lough) to the former gate lodge for Bracklyn Estate. Parts of Bracklin Wood have been classed as a Type I long-established woodland[69], and the area is listed within the top ten native woodland sites of conservation interest (non-designated) in Co. Westmeath[70]. Likewise, the remnants of raised bog known as Lisclogher Bog, which abuts Bracklin Wood and extends northeast to include the area south of T11 was avoided through project design. Potentially sensitive habitats have been avoided, including raised bog, fen, bog woodland and oak-birch-holly woodland.

69 Perrin, P.M. & Daly, O.H. (2010). A provisional inventory of ancient and long-established woodland in Ireland. *Irish Wildlife Manuals*, No. 46. NPWS, DoEHLG, Dublin, Ireland.

70 County Westmeath Biodiversity Action Plan (2015-2020). Available at: http://www.westmeathcoco.ie/en/media/Westmeath%20Biodiversity%20Action%20Plan%2020142020.pdf

The grid connection route exits the wind farm to the east of proposed turbine T10 and heads ESE for c. 4.5 km, crossing into Co Meath where it will connect to the existing 110 kV Mullingar-Finglas electricity transmission line in the townland of Coolronan. The proposed grid connection route largely follows a local public road (c. 1.9 km). An element in the middle (c. 1.79km) deviates away from the road to follow the channelised 2nd order stream that drains the site (EPA ref: Bolanstown – 07B45), which joins a 3rd order stream as it crosses into Co. Meath (EPA ref: Cartenstown – 07C60). A short section (c. 0.3 km) at the end also deviates away from the road to follow this 3rd order stream (EPA ref: Cartenstown – 07C60 and OPW ref: C1/32/7/3).

For the road sections, the grid connection will be buried below the existing road or under species-poor roadside verges and excavation works will pass through areas where the adjacent land holds semi-natural woodland, treelines, fields of improved grassland, cut away bog, hedgerows and gardens with ornamental plants. There are roadside drainage ditches along sections of the road. These ditches flow parallel to the road and are hydrologically connected to the main channel noted above, which joins the SAC/SPA north of Ballivor.

5.3.2 Existing Ecological Records

Records of all species noted in the vicinity of the proposed development site were obtained from the NBDC, NPWS and BCI databases. Details of all protected and endangered species recorded within 10 km of the proposed development site are summarised in **Table 5.14**, which also shows the likelihood (based on habitat availability) of these species occurring within the proposed development site. Likewise, existing invasive species records from within 10 km of the proposed development site have been provided in **Table 5.15**.

Species name	Hab. Dir. (An. II/ IV)	Birds Dir. (Annex I)	Wildlife Acts	Red List Status	FPO species	BoCCI	Likelihood on Proposed Site	Likelihood within 2 km	Most recent record	Data source
Plants										
Alder Buckthorn (Frangula alnus)				VU			3	na	1982	2
Green-winged Orchid (Anacamptis morio)				EN	Y		4	na	1989	2
Hairy St John's-wort (Hypericum hirsutum)				EN	Y		4	na	2019	2
Holly-fern (Polystichum lonchitis)				VU			4	na	1845	2
Marsh Saxifrage (Saxifraga hirculus)				CR	Y		4	na	1930	2
Meadow Barley (Hordeum secalinum)				VU	Y		4	na	1892	2
Rough Poppy (Papaver hybridum)				RE	Y		4	na	2013	2
Shepherd's-needle (Scandix pecten-veneris)				RE			4	na	1991	2
Slender Cottongrass (Eriophorum gracile)				NT	Y		3	na	1967	2
Smooth Brome (Bromus raceosus)				VU			4	na	1892	2
Wintergreen (Pyrola rotundifolia subsp. rotundifolia)				NT	Y		3	na	1987	2
Molluscs										
Common Whorl Snail (Vertigo (Vertigo) pygmaea)				NT			3	2	1982	1
Duck Mussel (Anodonta (Anodonta) anatina)				VU			4	3	2003	1
Marsh Whorl Snail (Vertigo (Vertigo) antivertigo)				VU			4	3	1982	1
Moss Bladder Snail (Aplexa hypnorum)				VU			4	3	1982	1
Smooth Grass Snail (Vallonia pulchella)				VU			4	3	1982	1
Striated Whorl Snail (Vertigo (Vertigo) substriata)				NT			4	3	1982	1
Whirlpool Ramshorn (Anisus (Disculifer) vortex)				VU			4	3	1982	1
Crustaceans										

Species name	Hab. Dir. (An. II/ IV)	Birds Dir. (Annex I)	Wildlife Acts	Red List Status	FPO species	BoCCI	Likelihood on Proposed Site	Likelihood within 2 km	Most recent record	Data source
White-clawed Crayfish (Austropotamobius pallipes)	Y		Y				4	3	2015	1, 2
Insects										
Dingy Skipper (Erynnis tages)				NT			4	3	2017	1
Marsh Fritillary (Euphydryas aurinia)	Y			VU			4	1	2018	1
Small Heath (Coenonympha pamphilus)				NT			4	1	2012	1
Wall (Lasiommata megera)				EN			3	3	2013	1
Andrena (Andrena) fucata				NT			3	3	2000	1
Andrena (Taeniandrena) wilkella				DD			3	3	2018	1
Large Red Tailed Bumble Bee (Bombus (Melanobombus) lapidarius)				NT			3	3	2020	1
Moss Carder-bee (Bombus (Thoracombus) muscorum)				NT			3	3	2012	1
Kageronia fuscogrisea				NT			3	2	1991	1
Labiobaetis atrebatinus				EN			3	2	1991	1
Amphibians & reptiles										
Common Frog (Rana temporaria)			Y				2	1	2018	1, 2
Smooth Newt (Lissotriton vulgaris)			Y				3	2	2011	1, 2
Common Lizard (Zootoca vivipara)			Y				4	3	2018	1
Birds										
Curlew (Numenius arquata)			Y			R	4	3	2011	1, 2
Kestrel (Falco tinnunculus)			Y			R	1	1	2014	1, 2
Lapwing (Vanellus vanellus)			Y			R	1	1	2011	1, 2
Meadow Pipit (Anthus pratensis)			Y			R	1	1	2011	1
Redwing (Turdus iliacus)			Y			R	1	1	2011	1
Snipe (Gallinago gallinago)			Y			R	1	1	2016	1, 2
Stock Pigeon (Columba oenas)			Y			R	2	1	2011	1
Yellowhammer (Emberiza citrinella)			Y			R	1	1	2016	1, 2
Whinchat (Saxicola rubetra)			Y			R	4	1	2011	1
Woodcock (Scolopax rusticola)			Y			R	1	1	2010	1
Black-headed Gull (Larus ridibundus)			Y			A	1	1	2011	1, 2
Coot (Fulica atra)			Y			A	3	1	2011	1
Cormorant (Phalacrocorax carbo)			Y			A	4	1	2011	1, 2
Goldcrest (Regulus regulus)			Y			A	1	1	2011	1
Great Crested Grebe (Podiceps cristatus)			Y			A	4	1	2010	1
Greenfinch (Carduelis chloris)			Y			A	1	1	2011	1
House Martin (Delichon urbicum)			Y			A	1	1	2011	1
House Sparrow (Passer domesticus)			Y			A	1	1	2011	1
Kingfisher (Alcedo atthis)		Y	Y			A	3	1	2010	1, 2
Lesser Black-backed Gull (Larus fuscus)			Y			A	1	1	1991	1
Linnet (Carduelis cannabina)			Y			A	1	1	2011	1
Little Grebe (Tachybaptus ruficollis)			Y			A	1	1	2011	1
Mallard (Anas platyrhynchos)			Y			A	1	1	2011	1
Mute Swan (Cygnus olor)			Y			A	1	1	2011	1, 2
Sand Martin (Riparia riparia)			Y			A	3	1	2011	1, 2
Sky Lark (Alauda arvensis)			Y			A	1	1	2011	1, 2
Spotted Flycatcher (Muscicapa striata)			Y			A	2	1	2011	1
Starling (Sturnus vulgaris)			Y			A	1	1	2011	1
Swallow (Hirundo rustica)			Y			A	1	1	2011	1, 2
Swift (Apus apus)			Y			A	1	1	2011	1
Teal (Anas crecca)			Y			A	1	1	2011	1, 2
Tree Sparrow (Passer montanus)			Y			A	3	1	2011	1, 2
Tufted Duck (Aythya fuligula)			Y			A	3	1	2010	1, 2

Species name	Hab. Dir. (An. II/ IV)	Birds Dir. (Annex I)	Wildlife Acts	Red List Status	FPO species	BoCCI	Likelihood on Proposed Site	Likelihood within 2 km	Most recent record	Data source
Water Rail (Rallus aquaticus)			Y			A	2	1	1991	1
Wigeon (Anas penelope)			Y			A	3	3	2011	1
Willow Warbler (Phylloscopus trochilus)						A	1	1	2011	1
Bats										
Brown Long-eared Bat (Plecotus auritus)	Y		Y				1	1	2008	1, 3
Lesser Noctule (Nyctalus leisleri)	Y		Y				1	1	2013	1, 3
Daubenton's Bat (Myotis daubentonii)	Y		Y				1	1	2014	1, 3
Natterer's Bat (Myotis nattereri)	Y		Y				3	1	2012	1, 3
Pipistrelle (Pipistrellus pipistrellus sensu lato)	Y		Y				1	1	2012	1, 3
Soprano Pipistrelle (Pipistrellus pygmaeus)	Y		Y				1	1	2012	1, 3
Terrestrial mammals										
West European Hedgehog (Erinaceus europaeus)			Y				3	1	2015	1, 2
Eurasian Pygmy Shrew (Sorex minutus)			Y				3	3	2015	1
Eurasian Red Squirrel (Sciurus vulgaris)			Y				3	3	2018	1, 2
Irish Hare (Lepus timidus subsp. hibernicus)			Y				1	1	2010	2
Irish Stoat (Mustela erminea subsp. hibernica)			Y				2	1	1972	2
Eurasian Badger (Meles meles)			Y				1	1	2016	1, 2
Pine Marten (Martes martes)			Y				2	1	2016	1, 2
European Otter (Lutra lutra)	Y		Y				2	1	2014	1, 2

Table 5.14: Existing ecological records for protected and/or notable species (10 km)

- The second column indicates species list on Annex II & IV of Habitats Directive, with third column indicating bird species listed on Annex I of the Birds Directive and the fourth column shows species protected under the Wildlife Act, as amended
- Key to Red List Status: EX = Extinct; RE = Regional Extinct; CR = Critically Endangered; EN = Endangered; NT = Near Threatened; VU = Vulnerable; LC = Least Concern; DD = Data Deficient
- FPO = Plant species listed on the Flora Protection Order
- BoCCI = Bird of Conservation Concern in Ireland 2020-2026 (Gilbert *et al*. 2021), R = Rid listed, A = amber listed
- Key to likelihood of species presence: 1 = Confirmed; 2 = Likely; 3 = Possible; 4 = Unlikely; 5 = None
- Data sources: 1. NBDC = National Biodiversity Recorded Centre, 2. NPWS = National Parks & Wildlife Service, 3. BCI = Bat Conservation Ireland

Species name	Invasive status	Likelihood on Proposed Site	Likelihood within 2 km	Most recent record	Record Source
Canadian Waterweed (Elodea canadensis)	Third Sch. - High	3	1	2006	NBDC
Japanese Knotweed (Fallopia japonica)	Third Sch. - High	3	1	2015	NBDC
Nuttall's Waterweed (Elodea nuttallii)	Third Sch. - High	3	1	2008	NBDC
Rhododendron (Rhododendron ponticum	Third Sch. - High	3	1	2010	NBDC
American Mink (Mustela vison)	Third Sch. - High	1	1		NBDC
Brown Rat (Rattus norvegicus)	Third Sch. - High	1	1		NBDC
Eastern Grey Squirrel (Sciurus carolinensis)	Third Sch. - High	3	1		NBDC
Fallow Deer (Dama dama)	Third Sch. - High	1	1	2012	NBDC, NPWS
Three-cornered Garlic (Allium triquetrum)	Third Sch. - Med.	3	1	2014	NBDC
Cherry Laurel (Prunus laurocerasus)	High	1	1	2005	NBDC
NZ Flatworm (Arthurdendyus triangulates)	High	3	1		NBDC

House Mouse (Mus musculus)	High	2	2	2015	NBDC
Black Currant (Ribes nigrum)	Medium	3	1	2005	NBDC
Douglas Fir (Pseudotsuga menziesii)	Medium	3	3		NBDC
Pitcherplant (Sarracenia purpurea)	Medium	3	1	1999	NBDC
Sycamore (Acer pseudoplatanus)	Medium	1	1	2019	NBDC
Turkey Oak (Quercus cerris)	Medium	3	3	2005	NBDC
Jenkins' Spire Snail (Potamopyrgus antipodarum)	Medium	3	3		NBDC
European Rabbit (Oryctolagus cuniculus)	Medium	1	1	2013	NBDC
Greater White-toothed Shrew (Crocidura russula)	Medium	2	2	2013	NBDC

Table 5.15: Existing ecological records of invasive species (10 km)

5.3.3 Sites Designated for Nature Conservation

The proposed development site, including the grid connection route is not located within or adjacent to any sites designated for nature conservation. There are a limited number of International and National sites designated for nature conservation in the environs of the proposed development site. For the majority of these relatively distant sites there is no ecological connectivity with the proposed development site. Where there are potential ecological links, these are via tributaries of the River Boyne. The spatial relationships and potential connectivity between areas designated for nature conservation and the proposed development site are described in the following sections. The area extending 15 km from the proposed development was taken as an arbitrary distance within which the initial desktop search was undertaken. In some cases, the zone of influence of a proposal may be much shorter depending on the ecological feature being considered, or it could occasionally extend significantly beyond this distance, for example where there is hydrological connectivity to a designated site via a river network.

Table 5.16 provides a list of the conservation sites assessed as being within the zone of influence of the proposed development, together with the features of interest (important ecological features) for each site and identifies any source-receptor pathways. As outlined in **Section 5.3.3.1** and **Section 5.3.3.2**, although likely significant effects were considered on avian receptors (wintering waterbirds) for the Derravaragh SPA, only two conservation sites were found to be within the zone of influence of the proposed development. This included the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA.

As introduced in the general site description in **Section 5.3.1**, two non-designated conservation sites identified in the Biodiversity Action Plan for Co. Westmeath fall on the periphery of the proposed development site. The two adjoining sites are Bracklin Wood and Lisclogher Bog (see **Figure 5.1**), parts of which occur within the southern boundary of the lands-made-available for the project and the proposed development site (red-line) boundary around T5. As detailed in **Chapter 2**, these potentially sensitive areas were identified during early site scoping and were purposely avoided during the design phase of the project. Together these sites support examples of habitats that are considered important at the county level including long-established woodland (LEW-l), types of natural/semi-natural woodland (including non-Annex I bog woodland and oak-ash-hazel woodland), fen and remnants of raised bog. The impact assessment section of this report examines the potential impacts on these habitats, rather than the integrity of the two non-designated sites recognised as being important at the county level.

Site name [Site Code]	Feature of conservation interest For SACs/SPA these are termed Qualifying Interests (QIs) * = Priority Habitats	Proximity of the feature	Feature within the ZoI? Y/N
River Boyne & River Blackwater SAC [002299]	[1099] River lamprey *Lampetra fluviatilis*	Downstream hydrological connection to spawning sites. The healthiest population of river lamprey are reported as occurring in the lower reaches of the Boyne River main channel downstream of Navan and the Stonyford tributary was considered to only support brook lamprey (O'Connor, 2006[71] and NPWS, 2014[72]).	Y
	[1106] Atlantic salmon *Salmo salar*	Downstream hydrological connection to spawning sites. The River Boyne is considered important for this species, as it represents an eastern river which holds large three-sea-winter fish (NPWS, 2014)[73]. In stream improvement works on the Stonyford River have created spawning habitat for salmon that is reported to being utilised by spawning salmon (IFI, 2014[74] and Boyne Catchment Angling Association).	Y
	[1355] Otter *Lutra lutra*	Hydrological connection to otter foraging habitat. Otter can be found throughout the SAC (NPWS, 2014).	Y
	[7230] Alkaline fens	No source-receptor pathway. The main areas of alkaline fen in the SAC are concentrated in the vicinity of Lough Shesk, Freehan Lough and Newtown Lough which are c. 10 km north of the proposed development.	N
	[91E0] Alluvial forests with *Alnus glutinosa* & *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)*	Downstream hydrological connection to riverine woodlands. Wet woodland fringes many stretches of the River Boyne. The areas are small and there are few similar examples of this type of alluvial wet woodland remaining in the country, particularly in the north-east (NPWS, 2014). Pollution to surface waters is noted as having an impact on alluvial woodland in Ireland, however the occurrence is low (O'Neill *et al.*, 2013)[75]	Y

71 O'Connor W. (2006) A survey of juvenile lamprey populations in the Boyne Catchment. *Irish Wildlife Manuals*, No. 24 NPWS, DoEHLG, Dublin, Ireland.

72 NPWS (2014). Site Synopsis: River Boyne and River Blackwater SAC [Site Code: 00229]. National Park & Wildlife Service

73 NPWS (2014). Site Synopsis: River Boyne and River Blackwater SAC [Site Code: 00229]. National Park & Wildlife Service

74 IFI (2014). Environmental River Enhancement Programme: Annual Report 2014. Inland Fisheries Ireland (IFI) & The Office of Public Works (OPW).

75 O'Neill, F.H. & Barron, S.J. (2013). Results of monitoring survey of old sessile oak woods and alluvial forests. *Irish Wildlife Manuals*, No. 71. NPWS, DoAHG, Dublin, Ireland

Site name [Site Code]	Feature of conservation interest For SACs/SPA these are termed Qualifying Interests (QIs) * = Priority Habitats	Proximity of the feature	Feature within the ZoI? Y/N
River Boyne & River Blackwater SPA [004232]	[A229] Kingfisher *Alcedo athis*	Hydrological connection to kingfisher foraging habitat. The SPA encompasses several downstream kingfisher territories on the River Boyne (NPWS, 2010)[76]. Both the River Deel and Stonyford River are recorded as supporting possible kingfisher breeding territories (Crowe et al., 2008[77] as reported in Cummins *et al.*, 2010[78])	Y

Table 5.16: Conservation Sites & Features of Conservation Interest

5.3.3.1 Internationally Designated Sites

In the context of Ireland, Internationally-designated sites refer to Special Areas of Conservation, Special Protection Areas and Ramsar Sites.

Special Areas of Conservation (SACs) are designated under the EU Habitats Directive and Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EEC). Both these directives have been transposed into Irish law by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended. SACs are designated to afford protection to a suite of habitats and species listed on Annex I and Annex II of the Directive. SPAs provide protection to birds listed on Annex I of the Birds Directive, and also provide protection to populations of migratory species regularly occurring at a site.

Ramsar sites are wetlands considered to be of international importance and are designated under the Ramsar Convention (The Convention on Wetlands), which is an intergovernmental environmental treaty established by UNESCO in 1971 and in effect since 1975.

Figure 5.2 illustrates the distance between the lands-made-available for the project and internationally designated sites that lie within 15 km of the proposal and shows that there are no Ramsar sites within 15 km of the proposed development site. Within 15 km there are seven SACs and two SPAs including:-

- River Boyne and River Blackwater SAC (002299);
- River Boyne and River Blackwater SPA (004232);
- Lough Derravaragh SPA (004043);
- Mount Hevey Bog SAC (002342);

76 NPWS (2010). Site Synopsis: River Boyne and River Blackwater SPA [Site Code: 004232]. National Park & Wildlife Service

77 Crowe, O., G. Webb, E. Collins & Smiddy, P. (2008). *Assessment of the distribution and abundance of Kingfisher Alcedo atthis and other riparian birds on two SAC river systems in Ireland*. A report commissioned by the NPWS & prepared by BirdWatch Ireland.

78 Cummins, S., Fisher, J., Gaj McKeever, R., McNaghten, L. & Crowe, O. (2010). *Assessment of the distribution and abundance of Kingfisher Alcedo atthis and other riparian birds on six SAC river systems in Ireland*. A report commissioned by the NPWS & prepared by BirdWatch Ireland.

- Wooddown Bog SAC (002205);
- Lough Lene SAC (002121);
- Lough Bane & Lough Glass SAC (002120);
- White Lough, Ben Loughs & Lough Doo SAC (001810); and
- Girley (Drewstown) Bog SAC (002203).

As detailed in the NIS to accompany the proposed development (Woodrow, 2021), a screening for Appropriate Assessment was conducted for the proposed development, and of these Natura 2000 sites a hydrological link was identified between the proposed development site and two designated sites, including the River Boyne and River Blackwater SAC, and the River Boyne and River Blackwater SPA.

The Qualifying Interests (QIs)of the River Boyne and River Blackwater SAC (* = priority habitat), include:-

- River lamprey (*Lampetra fluviatilis*) [1099];
- Salmon (*Salmo salar*) [1106];
- Otter (*Lutra lutra*) [1355];
- Alkaline fens [7230]; and
- Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)* [91E0].

The Qualifying Interests (QIs)of the River Boyne and River Blackwater SPA, includes:-

- Kingfisher (*Alcedo atthis*) [A229]

Operational wind farms are known to pose a collision risk to certain species of birds, with swan and geese species noted as being particularly susceptible, due to their wing loading and resultant pattern of flight. As shown in **Figure 5.2**, the Lough Derravaragh SPA is the only Natura 2000 site within 15 km of the proposed development designated for swans or geese; and the Qualifying Interests (QIs) of this SPA include:

- Whooper swan (*Cygnus cygnus*) [A038];
- Pochard (*Aythya ferina*) [A059];
- Tufted Duck (*Aythya fuligula*) [A061];
- Coot (*Fulica atra*) [A125]; and
- Wetland and Waterbirds [A999].

The screening for Appropriate Assessment (Woodrow, 2021), ruled out the other six Natura 2000 sites for further assessment based on distances from the proposed development and the lack of a source-pathway-receptor linkage between the QIs and their specific sensitivities.

Without consideration of the on-site conditions and proposed mitigation measures, and applying precautionary principle, the Screening for Appropriate Assessment concluded that there is potential for *Potential Significant Effect* on River Boyne and River Blackwater SAC, the River Boyne and River Blackwater SPA and the Lough Derravaragh SPA. Therefore, these three Natura 2000 sites proceeded to Stage 2 Appropriate Assessment and a Natura Impact Statement (NIS) was prepared. For both the River Boyne and River Blackwater SAC and SPA it was found that there are possible or likely significant effects on QI species and habitats through a deterioration in water quality caused by the proposed development. Therefore, in the absence of mitigation measures there is a risk of significant effects on these Natura 2000 sites and their QIs.

The Lough Derravaragh SPA is located c. 13 km to the northwest of the proposed development. In terms of collision risk to whooper swans associated with Lough Derravaragh SPA, the inclusion of this species within the potential zone of influence was done on a highly precautionary basis as the SPA is located well beyond the core foraging range of wintering whooper swans, which is given as c. 5 km in the SNH (2016)[79] guidelines for assessing connectivity with SPAs. However, in an Irish context the distribution of wintering waterbirds out of designated sites is often poorly documented and requires further surveying. As detailed in **Section 5.3.8.2**, surveying over three seasons of winter surveys, including searches of the hinterland up to 5 km and VP watches, it was determined that the site of the proposed development is not an important foraging or roosting area for whooper swans. The locations utilised in the wider area were considered to be beyond the zone of influence. There were no regularly used flight paths between roosts and foraging through 500 m turbine buffer, with only small flocks (up to 11 birds) sporadically commuting through the 500 m turbine buffer. Therefore, given the baseline conditions observed the NIS (Woodrow, 2021) objectively concluded that there was no source-receptor pathway between the proposed development and Lough Derravaragh SPA, and that this development would not result in significant effects on the integrity of the SPA.

Given the preceding summary which is based on the finding of the NIS (Woodrow, 2021), it is considered unnecessary to give any further consideration to the Lough Derravaragh SPA within the following sections covering potential impacts on designated sites (**Section 5.4.2.1** & **Section 5.4.3.1**).

5.3.3.2 Nationally Designated sites

In the context of Ireland, nationally-designated sites refer to Natural Heritage Areas (NHAs). NHAs are designated under the Wildlife Amendment Act (2000). Designations are given to features of scientific interest and include significant geological features and areas which support rare or significant flora or fauna populations. As shown in **Figure 5.3** there are five NHAs situated within the 15 km potential zone of influence of the proposed development site, including:-

- Wooddown Bog NHA is c. 11 km SW from the proposed development and is designated for raised bog habitats - there are no links between source and receptor for this NHA;
- Molerick Bog NHA is c. 12 km south from the proposed development and is designated for raised bog habitats - there are no source-receptor links between this NHA and the proposed development site;
- Girley Bog NHA is c. 14 km NE from the proposed development and is designated for raised bog habitats - there are no links between source and receptor for this NHA;
- Lough Derravaragh NHA is c. 13 km NE from the proposed development and is designated for raised bog habitats and wintering waterbirds - there are no source-receptor links between habitats within this NHA and the proposed development site. The potential for ecological links between waterbirds utilising the NHA and the proposed development site was discussed in relation to the Derravaragh SPA (see **Section 5.3.3.1**), which encompasses the same bird

79 Scottish Natural Heritage (2016). *Assessing Connectivity with Special Protection Areas (SPAs)* Guidance (Version 3 – June 2016). SNH

population as the NHA and it is considered that there no links between source and receptor for this NHA; and

- Milltownpass Bog NHA is c. 15 km SW from the proposed development and is designated for raised bog habitats - there are no source-receptor links between this NHA and the proposed development site.

Proposed Natural Heritage Areas (pNHAs) are sites published on a non-statutory basis since 1995, however, they have not been statutorily proposed or designated. These sites are of significance for wildlife and habitats, which often have been superseded by the designation of the site as an SAC or SPA, however, the extent of dual sites can differ and boundaries should be reviewed in relation to the footprint of projects. As shown in **Figure 5.3**, there are eight pNHAs situated within the 15 km potential zone of influence of the proposed development site, including: Lough Shesk, Mount Hevey Bog, Royal Canal, Ballynabarny Fen, Lough Sheever/Slevin's Lough Complex, Aghalasty Fen, Lough Glore and White Lough, Ben Loughs and Lough Doo. All of these pNHA's occur more than 5 km from the proposed development site and no source-receptor pathways were identified. One pNHA (Lough Shesk) is located within the same river catchment as the proposed development site, however there was judged to be no hydrological connectivity as Lough Shesk is upstream of the proposal.

In conclusion all the NHAs and pNHAs located within 15 km of the proposed development were judged to fall beyond the zone of influence. Therefore, no further assessment is required for Nationally designed or proposed sites based on distances from the proposed development and the lack of a source-pathway-receptor linkage between the features of interest and the area of the proposed development.

Figure 5.1: Location of wind farm infrastructure relative to Bracklin Wood and Lisclogher Bog

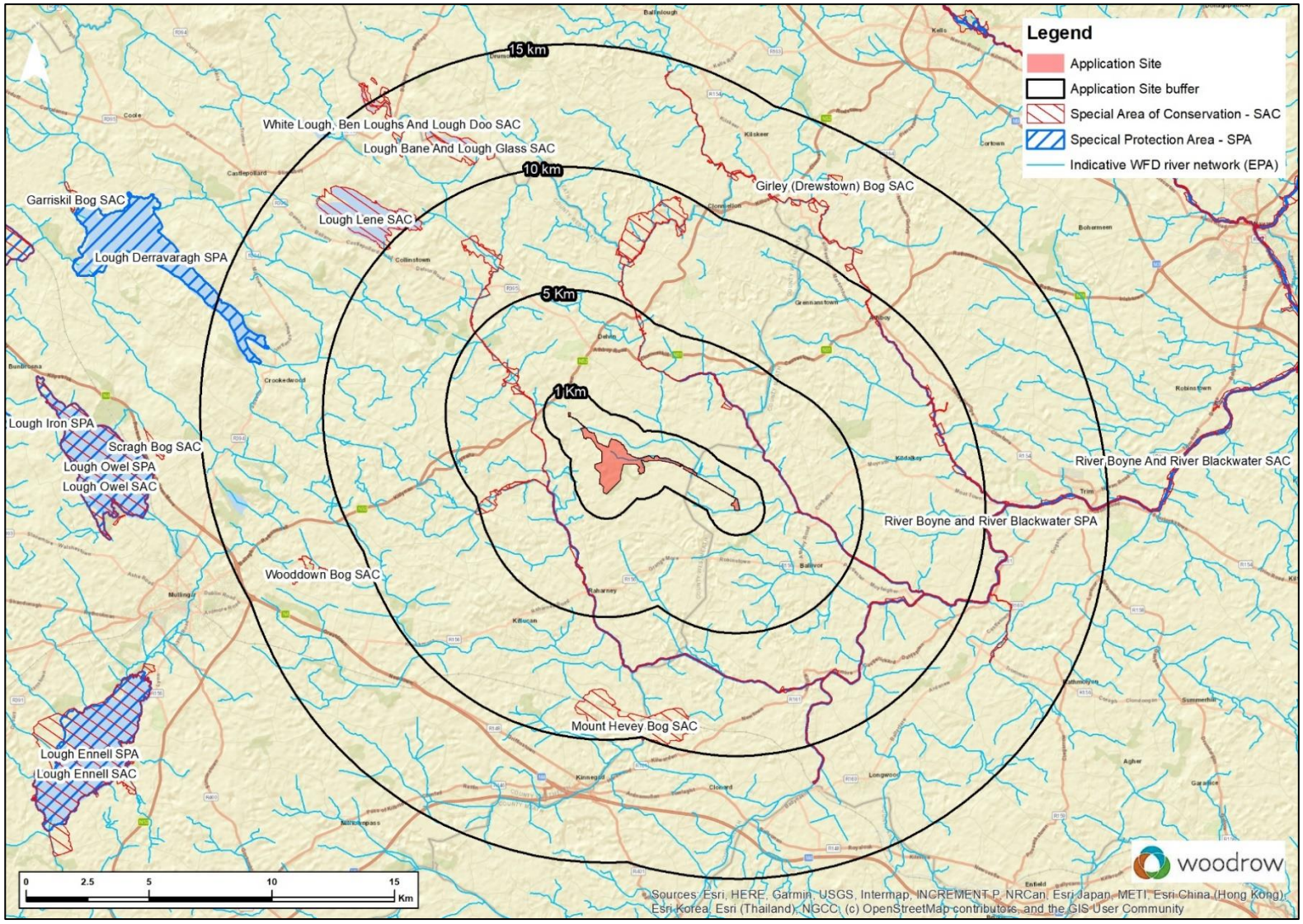

Figure 5.2: Natura 2000 sites within 15km of the proposed development

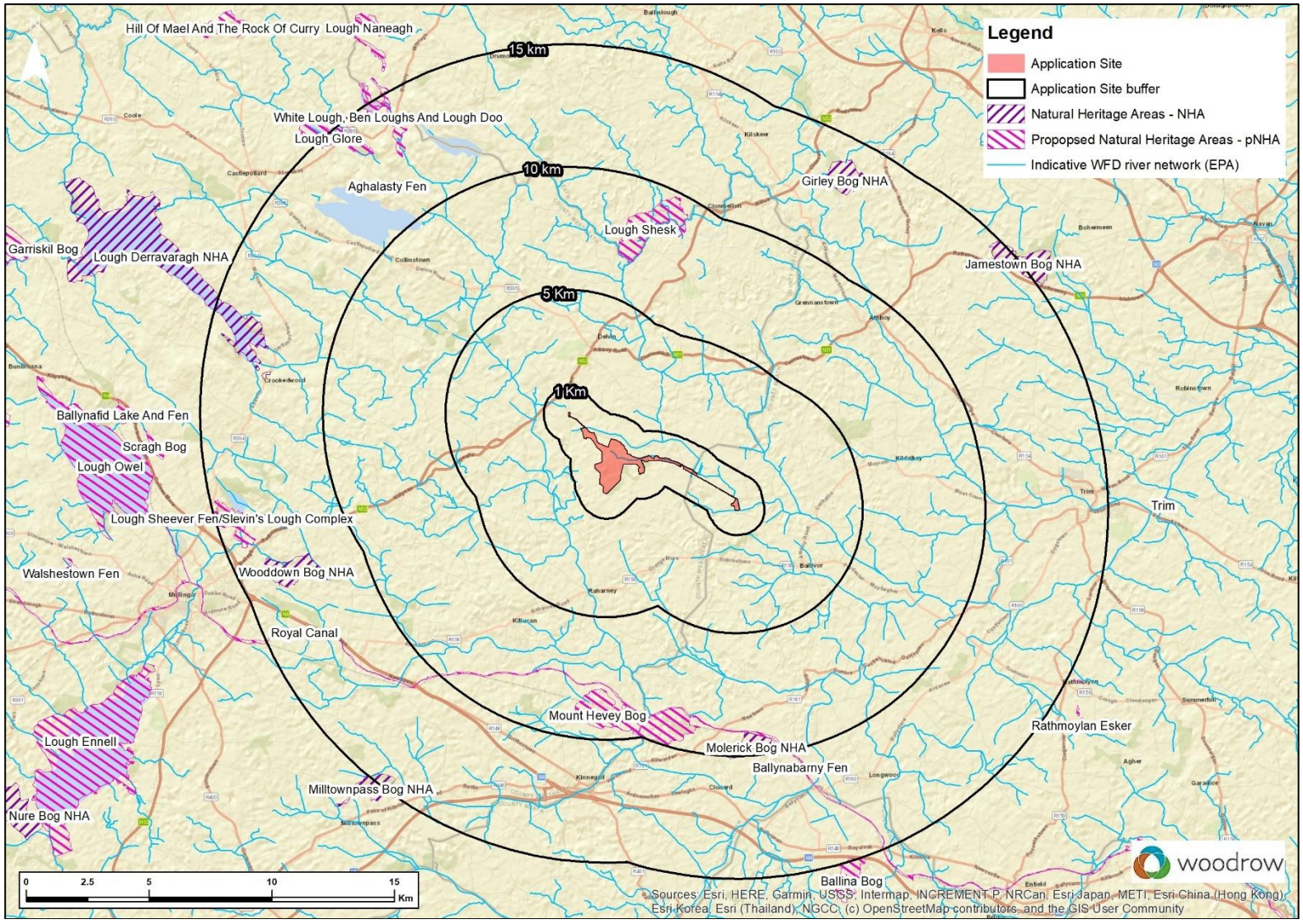

Figure 5.3: NHAs & pNHAs within 15km of the proposed development

5.3.4 Habitats

The existing habitats within the proposed development site, including the grid connection route are listed in **Table 5.17**, which provides Fossitt (2000) habitat types and potential links to Annex I habitat types, along with areas (ha) or lengths for linear features (m). Habitat maps showing habitat types in relation to the proposed turbine layout and proposed development site are provided in **Annex 5.1**, which show polygon and linear habitat features separately for clarity. The habitat maps for the proposed grid connection route are also provided in **Annex 5.1**, along with maps showing the locations of the non-native plant species recorded.

[BC1] Arable Crops

This classification describes land that is "*cultivated and managed for the production of arable crops*" (Fossitt 2000). In 2020 fields within the survey area were under cereal production, however, in some years this is rotated with root crops and oil-seed rape.

Affinity to EU Annex I Habitats: None noted

[BL3] Buildings and Artificial Surfaces

Several agricultural buildings are located within the survey area including a pig unit c. 170 m north of proposed turbine location T03. These actively used buildings are excluded from the proposed development site. There is an abandoned farmstead near the proposed site entrance. A concrete road leads from the pig farm entrance in the west, up to the pig unit. Access to the conifer plantations around T06 and T07 is provided via gravel forestry tracks. There are also several existing gravel farm tracks through the wind farm site. Much of the proposed grid connection route will be excavated below an existing local road running ESE from T10.

Affinity to EU Annex I Habitats: None noted

[FW4] Drainage Ditch

Drainage ditches can be found along roads, farm/forestry tracks, fields and woodlands throughout the survey area. This habitat type was often closely associated with the habitat type hedgerows [WL1]/treelines [WL2]. Species found in this habitat type included fools' watercress (*Apium nodilforum*) and great reedmace (*Typha latifoli*) which often slowed flow through the drainage channels, along with patches of yellow iris (*Iris pseudacorus*), unbranched bur-reed (*Sparganium emersum*), meadow sweet (*Filipendula ulmaria*) and lesser celandine (*Ranuncculus ficaria*). Typically, the steep, channelised banks were dominated by course grasses like Yorkshire fog (*Holcus lanatus*), nettle (*Urtica dioica*), bramble (*Rubus fructicosus*) and ivy (*Hedera helix*), as well as willow trees (*Salix* spp.). Hart's-tongue fern (*Asplenium scolopendrium*) was recorded along drainage ditches within woodlands.

Along the edges and within the conifer plantations there were several ditches without standing water and sparse vegetation. Based on Fossitt (2000) ditches without standing water are not included in this category.

The main channel flowing west to east through the core development area and parallel to the proposed grid connection route forms part of the Boyne Arterial Drainage Scheme (Reference: C1/32/7/3), which is hydrologically connected to the River Boyne and River Blackwater SAC/SPA via the Stoneyford River. There is clear evidence that this watercourse has been dredged over the years and is it highly

channelised into a steep sided ditch along most of its length within and adjacent to the proposed development site. Although classification as FW2 (depositing/lowland river) was considered, the highly channelised nature of this watercourse resulted in classification as FW4 (drainage ditch). The channel originates at the proposed site entrance and is classed as a 1st order stream by EPA mapping (EPA ref: Bolanstown – 07B45) and becomes a 2nd order stream before exiting the site to the east of the proposed turbine location for T10. The channel then joins a 3rd order stream as it crosses into Co. Meath (EPA ref: Cartenstown – 07C60).

Affinity to EU Annex I Habitats: None noted

[FL8] Other Artificial Lakes and Ponds

A shallow artificial scrape is located at the proposed peat deposition area in the vicinity of the proposed meteorological mast. The scrape does fill up periodically after prolonged rainfall; however, it was found to be largely ephemeral with only a small area at the centre holding water for prolonged periods. There was no open water and species present included dense mats of filamentous algae, pondweed (*Potamogeton* species) and duckweed (*Lemna* species) that surrounded a dense clump of unbranched bur-reed (*Sparganium emersum*). These species are indictive of the eutrophic wetland that would be expected to result from nutrient rich runoff from the surrounding tillage fields. The ephemeral edges were dominated by floating sweet-grass (*Glyceria fluitans*) and overall, the scrape was considered to be transitioning towards species poor marsh [GM1] and swamp [FS2]. The drier gently sloped edges between the lower parts of the scrape and the tillage field were dominated by a course, rank growth of grasses such as Yorkshire fog (*Holcus lanatus*) and patches of nettles (*Urtica dioica*).

Affinity to EU Annex I Habitats: None noted

[GA1] Improved Grassland

Areas of improved grassland within the survey area are used as pasture for sheep and cattle. These areas were intensively managed, being drained and regularly fertilised and re-seeded. This habitat type is dominated by introduced agricultural rye grasses (*Lolium* spp.) and is generally considered to have low biodiversity value.

Affinity to EU Annex I Habitats: None noted

[GA2]/ [WS3] Amenity Grassland with Ornamental/Non-native Shrubs

Gardens with mown lawns and non-native shrubbery in a rural setting were observed to occur adjacent to parts of the grid connection route.

Affinity to EU Annex I Habitats: None noted

[GS2] Dry Meadows and Grassy Verges

This category refers to the grassy verges along the edges of roads that were present along parts of the proposed grid connection route. Verges were considered to be species poor and indicative of regular mowing and relatively high nutrient availability. Several lengths were heavily mown and would be more accurately classed as amenity grassland [GA2]. A range of species were recorded including creeping buttercup (*Ranunculus repens*), cleavers (*Galium aparine*), Cow Parsley (*Anthriscus sylvestris*), nettle (*Urtica dioica*), dandelion (*Taraxacum vulgaria*), Yorkshire fog (*Holcus lanatus*), cock's-foot grass (*Dactylis glomerata*), meadow Fox-tail (*Alopecurus*

pratensis) and daisy (*Bellis perennis*). Occasional patches of bracken (*Pteridium aquilinum*) occurred.

Affinity to EU Annex I Habitats: None noted (Good quality examples can correspond to the annexed habitat [6510] lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*))

[PB4] Cutover Bog

Cutover bog occurred adjacent to parts of the proposed grid connection route and was the dominant habitat type on the south side of the local road along which much of the proposed cabling will be placed. Along most sections the bog and the road were separated by drains and scrub. Therefore, areas of cutover bog are unlikely to be directly impacted by the installation of the ducting for cabling. The areas of cutover bog were in various stages of re-vegetating, with peat still being extracted on a local scale from some banks, while others seemed to have been abandoned. Due to ongoing drainage the re-vegetating areas were dominated by bogland species indicative of freer draining conditions, such as ling (*Calluna vulgaris*) and purple moor grass (*Molinia caerulea*); and scrub [WS1] cover was encroaching into the bog from the road. Cotton grass (*Eriophorum* species) was recorded colonising on more recently exploited banks.

Affinity to EU Annex I Habitats: None noted

Note: There was an area identified as supporting the remanent of raised bog habitat within the lands-made-available (LMA) for the project. This section of raised bog is within the area identified as Lisclogher Bog, as shown in **Figure 5.1** and lies to the north of Bracklin Lough. As outlined in **Chapter 2**, the proposed build area was designed to avoid this and other potentially sensitive habitats along the southern periphery of the LMA. It was beyond the proposed development site boundary; and therefore, no further consideration is given to this habitat within the following sections of the impact assessment.

[WD1] (Mixed) Broadleaved Woodland

This habitat type includes broadleaved plantations and smaller areas holding more species rich broadleaved woodland.

According to Fossitt (2000), plantations of broadleaved trees are included in this category. Ash (*Fraxinus excelsior*) plantations made up the majority of the WD1 - broadleaved woodland habitat type occurring within the survey area surrounding the proposed turbine layout. These broadleaved plantations were relatively young, with northern plantations being established for just over 20 years and more recent planting of a smaller area in the south within the last 15 years. All these plantations were planted within fields of improved agricultural grassland.

Two small stands of woodland in the vicinity of the pig unit and an area of woodland in the area of the proposed substation were classified as WD1 - mixed broadleaved woodland. These areas supported several species of trees and scrub including: beech (*Fagus sylvatica*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), alder (*Alnus glutinosa*), ash (*Fraxinus excelsior*), pine (*Pinus silvestris*), bramble (*Rubus fructicosus*) and ivy (*Hedera helix*).

Affinity to EU Annex I Habitats: None noted

[WD4] Conifer Plantation

Various areas within the proposed development site were planted with conifers as single species stands of Sitka spruce, with the occasional blocks of larch. The majority of these plantations were planted simultaneously with the broadleaved plantations and are just over 20 years old. Biodiversity value associated with these areas is generally considered low, although they can provide edge effects for foraging bats in particular.

Affinity to EU Annex I Habitats: None noted

[WL1] Hedgerows

Hedgerows within the survey area were closely associated with drainage ditches. The hedgerows appeared old, dense, and relatively species rich. In combination with drainage ditches they formed the boundary of some of fields in the central area of the proposed development site. Species recorded in hedgerows within the site included dog rose (*Rosa canina*), hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), privet (*Ligustrum vulgare*), bramble (*Rubus fructicosus*), ash (*Fraxinus excelsior*), spindle (*Euonymus europaeus*) and willow (*Salix* spp.). Many of the hedgerows occurred in association with earth banks [BL2].

Affinity to EU Annex I Habitats: None noted

[WL2] Treeline

Treelines form the site boundary for most fields within the survey area. Scrub or hedgerows were often present at the base of these treelines. Species in these habitats included ash (*Fraxinus excelsior*), beech (*Fagus sylvatica*), hawthorn (*Crataegus monogyna*), birch (*Betula spp.*), hazel (*Corylus avellana*), blackthorn (*Prunus spinosa*), Scots pine (*Pinus sylvestris*), sycamore (*Acer pseudoplatanus*), spindle (*Euonymus europaeus*), oak (*Quercus* spp.), elder (*Sambucus nigra*), dog rose (*Rosa canina*), bramble (*Rubus fructicosus*), holly (*Ilex aquifolium*), and ivy (*Hedera helix*). Many of the mature treelines within the proposed development site were dominated by beech trees.

These old and species rich treelines with underlying hedgerows offer a habitat for invertebrates, birds, and mammals. Many of the treelines occurred in association with earth banks [BL2].

Affinity to EU Annex I Habitats: None noted

[WN1]/[WN7] Mosaic of Oak/Birch/Holly Woodland and Bog Woodland

The area of woodland located along the east and south of the survey area can be classified as oak-birch-holly woodland (see **Plate 5.2**) with patches of bog woodland (see **Plate 5.3**). Parts of the woodland known as Bracklin Wood have been classified as long-established woodlands (LEW – type I). LEWs have been continuously wooded since 1830, with the sub-category LEW (I) being used for stands where no evidence of antiquity could be found in older documentation (Perrin & Daly, 2010)[80]. Species found in this area included birches (*Betula* spp.), holly (*Ilex aquifolium*), elder (*Sambucus nigra*), ash (*Fraxinus excelsior*), Scot's pine (*Pinus silvestris*), rowan (*Sorbus aucuparia*),

80 Perrin, P.M. & Daly, O.H. (2010). A provisional inventory of ancient and long-established woodland in Ireland. *Irish Wildlife Manuals*, No. 46. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

oak (*Quercus* spp.), bramble (*Rubus fructicosus)*, bracken (*Pteridium aquilinum*) and ivy (*Hedera helix*).

The oak-birch-holly woodland habitat corresponds to the QL Sessile oak-woodrush (*Quercus petraea – Luzula sylvatica*) woodland type (Cross *et al*., 2010) and supports indicators of the Annex 1 Habitat Old Sessile Oak Woods [91A0] (O'Neil & Barron, 2013)[81]. The sections classified as Bog Woodland [WN7] correspond to the BM Birch – purple moor-grass (*Betula pubescens – Molinia caerulea*) woodland type (Cross *et al*., 2010) which does not correspond to an Annex 1 habitat.

Affinity to EU Annex I Habitats: Yes [91A0] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

[WN7] Bog Woodland

The woodland along the eastern and southern boundary of the lands-made-available (LMA) for the project supported areas of bog woodland [WN7]. The proximity to raised bog on the boundary of the LMA and the drainage network within the site suggests that this habitat is associated with former turf cutting and drainage. Species found in this habitat included downy birch (*Betula pubescens*), willow (*Salix aurita*), broad buckler fern (*Dryopteris dilatata),* soft rush (Juncus effusus), purple moor-grass (*Molinia caerulea*), bilberry (*Vaccinium myrtillus*), ling heather (*Calluna vulgaris*), and some areas had a dense bryophyte cover including *Polytrichum commune* and the peat mosses *Sphagnum fimbriatum* and *Sphagnum fallax*.

A dense bryophyte ground cover, along with the species composition listed above and the dominance of birch in the canopy meets the characteristics outlined in the NPWD Irish Wildlife Manuals No.69[82] for the Annex 1 habitat [91D0] Bog woodland[83]. This habitat type is relatively rare in Ireland and usually occurs on stands with fairly high-water tables (Cross *et al*., 2010[84], Perrin *et al*., 2008[85]). A relatively small area of bog woodland corresponding to Annex I bog woodland was located south of T10 – see **Plate 5.1**. The majority of bog woodland distributed around the periphery of the site occurs on the edge of the remnants of raised bog or on cutaway bog and lacks the peat forming capability (bryophyte layer) to qualify as Annex I. Dominant species included birch and willow, often with a dense understorey of ling, brambles and bilberry, the occurrence of which was thought to be facilitated by drainage of the bog. Notably mature Scots *pines* (*Pinus sylvestris*) were a prominent feature and were probably planted (introduced), as part of woodland management of the former estate at Bracklyn.

Affinity to EU Annex I Habitats: Yes [91D0] '*Bog woodland

[WS1] Scrub

81 O'Neill, F.H. & Barron, S.J. (2013) Results of monitoring survey of old sessile oak woods and alluvial forests. *Irish Wildlife Manuals*, No. 71. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

82 Cross, J. & Lynn, D. (2013) Results of a monitoring survey of bog woodland. *Irish Wildlife Manuals* No. 69. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

83 EC (2007): Interpretation manual of European Union habitats – EUR27.

84 Cross, J.; Perrin; P. & Little, D. (2010). *The Classification of Native Woodlands in Ireland and its Application to Native Woodland Management*. Native Woodland Information Note No. 6. NPWS, BEC Consultants Ltd & Woodlands of Ireland

85 Perrin P., Martin J., Barron S. O'Neil F., McNutt K. & Delaney A. (2008) *National Survey of Native Woodlands 2003-2008*. Volume I: Main report. Botanical, Environmental & Conservation Consultants Ltd. report submitted to the NPWS

Scrub [WS1] occurred adjacent to parts of the proposed grid connection route and scrub cover was encroaching into the bog from the local road, including gorse (*Ulex europaeus*) and grey willow (*Salix cinerea subsp. oleifolia*). Some of the scrubby areas that were more established appeared to be transitioning to a birch dominated woodland on cutaway bog, with an understorey with ling (*Calluna vulgaris*) and bilberry (*Vaccinium myrtillus*) which aligns with [WN7] bog woodland (Fossitt, 2000). In the context of raised bog, scrub encroachment is considered a negative indicator of condition (Mackin *et al*., 2017)[86]; and therefore, at this location scrub is not considered as an important ecological feature (see **Table 5.18**).

Affinity to EU Annex I Habitats: None noted

[WS5] Recently Felled Woodland

All the unfelled conifer plantations within the survey area were found to be < 25 years old and just starting to achieve a size when harvesting is considered. Only a small block of conifer plantation has been recently felled (2019/20) and is located around T10. The area was formerly covered in planted conifers, corresponding to the classification conifer plantation [WD4]. There are dense stands of cherry laurel (*Prunus laurocerasus*) along the margins of this area.

Affinity to EU Annex I Habitats: None noted

86 Mackin, F., Barr, A., Rath, P., Eakin, M., Ryan, J., Jeffrey, R. & Fernandez Valverde, F. (2017). Best practice in raised bog restoration in Ireland. *Irish Wildlife Manuals*, No. 99. NPWS, DoCHG, Ireland.

Code	Fossitt (2000) habitat type	Potential EU Annex I Affiliations	Areas (ha) or Length (m)			Occurrence within construction corridor/operational footprint
			Grid route	Wind farm site	Total	
BC1	Arable crops	No		82.98	82.98	T2 and T3 including access tracks, met mast, large deposition area, temporary site compound
BL3	Buildings & artificial surfaces	No	0.25	4.08	4.33	Concrete and gravel roads through site (including the area of piggery). Houses and tracks along grid connection route (excluding the local metaled road along the grid route)
ED3	Recolonising bare ground	No	0.001		0.001	Adjacent to grid connection route
FW4	1st to 3rd order steams As shown by EPA mapping - indicative flow network Classified as FW4 as most sections are highly channelised and therefore does not strictly fit criteria for FW2 – Depositing/lowland river	No	1,143m	2,127m	3,270m	Main channel through the Site is the Bolandstown (1st/2nd order stream), which joins Carranstown (3rd order) stream where the grid connection route crosses into Co. Meath. Access tracks run adjacent to this channel, as do sections of grid connection route. There are 4 no. of cross points and the T7 hardstand extends across the channel.
	Drainage ditches		471m	10,232m	10,703m	Site drained by extensive network of ditches all flowing into the main channel – access tracks and grid connection route cross or run next to drains, with felling areas around turbines and substation occurring areas with or next to drains
FL8	Other artificial lakes & ponds	No		0.19	0.19	Ecologically poor, ephemeral scrape that will be used as a location for spoil deposition. Area of depression reported, with the maximum extent of the wet area much smaller at 0.06ha.
GA1	Improved grassland	No	23.628ha	45.236	70.89	T1, sections of access tracks to T5 and T11, grid connection route
GA2/WS3	Amenity grassland & Ornamental-non-native shrubs	No	0.15		0.15	Gardens along grid connection route (not in proposed development site)
GS2	Dry meadow & grassy verges	No	0.87	0.78	1.65	Along roadside stretches grid of connection route and existing farm/forestry tracks
PB4	Cutover bog	Possibly	0.48		0.48	Adjacent to grid of connection route

Code	Fossitt (2000) habitat type	Potential EU Annex I Affiliations	Areas (ha) or Length (m)			Occurrence within construction corridor/operational footprint
			Grid route	Wind farm site	Total	
		[7150] Depression on peat substrate of the Rhynchosporion				
WD1	Mixed broadleaved woodland - *older growth/semi-natural*	No		4.72	4.72	Substation and ring fort at T3, also adjacent to access tracks in places and adjacent to grid connection route
WD1	Mixed broadleaved woodland - *plantation*	No		21.78	21.78	T4, turbine felling areas for T4, with small areas at T6, T7
WD4	Conifer plantation	No		57.68	57.68	T5, T6, T7, T11, access tracks to T1, T5, T6, T7, T10, T11, substation, turbine felling areas for T5, T6, T7, T10, T11
WN1	Oak-birch-holly woodland	Unlikely [91A0] Old sessile oak woods with Ilex & Blechnum in the British Isles	0.03	6.95	6.99	Felling area for T11 (unless avoided) and small area in felling area for T10, small sections on grid connection route
WN7	Bog woodland - *Non-Annex I*	No	1.32	3.89	5.21	Felling area at T10, start of grid connection route exiting wind farm site east of T10, with some areas adjacent along other sections of grid route
WN7 - Annex I	Bog woodland - *Annex I*	Yes [91D0] *Bog woodland - small area south of T10		0.199	0.199	Small area within turbine felling area for T10, unless avoided
WS1	Scrub	No	0.05		0.05	Adjacent to grid of connection route (not in proposed development site)
WS5	Recently felled woodland	No		3.45	3.45	T10, within felling area for T10
WL1	Hedgerows	No	464m	601m	1,065m	Adjacent to T3 access track, grid connection route
WL2	Treeline	No	962m	6,810m	7,902m	Felling areas for T4, T5, T7, access tracks, adjacent to grid connection route

Table 5.17: Habitat types within proposed development site (Fossitt, 2000 classifications)

Plate 5.1: Annex I bog woodland

Plate 5.2: Oak-birch-holly woodland [WN1]

Plate 5.3: Bog woodland – non-Annex I [WN7]

[Code] Habitat type (Fossitt, 2000)	**Basis of Evaluation**	**Highest Evaluation**	**Important ecological feature? Y/N**
[BC1] Arable crops	Highly modified and disturbed habitat. Low diversity. This aligns with the geographic valuation: *"Limited biodiversity value"*	Local importance (Lower Value)	N
[BL3] Buildings & artificial surfaces	Existing tracks and ruined cottage This aligns with the geographic valuation: *"Limited biodiversity value"* Note: Cottage was assessed separately for suitability as a bat roost	Local importance (Lower Value)	N
[FW4] Drainage ditch	Specialised and varied habitats provide a home for a wide range of species. This aligns with the geographic valuation: "*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 (Higher Value)	Y

[Code] Habitat type (Fossitt, 2000)	**Basis of Evaluation**	**Highest Evaluation**	**Important ecological feature? Y/N**
[FL8] Other artificial lakes & ponds	Shallow, eutrophic artificial scrape, which is very isolated within an intensive agricultural landscape – high levels of filamentous algae in centre with standing water. *"Limited biodiversity value"*	Local importance (Lower Value)	N
[GA1] Improved grassland	Even sward dominated by introduced agricultural grass species. Low diversity. This aligns with the geographic valuation: *"Limited biodiversity value"*	Local importance (Lower Value)	N
[GA2]/ [WS3] Amenity grassland with Ornamental/non-native shrub	Gardens with mown lawns and non-native shrubbery in a rural setting – only occur adjacent to grid connection route This aligns with the geographic valuation: *"Limited biodiversity value"*	Local importance (Lower Value)	N
[GS2] Dry meadow & grassy verges	The local conditions, mown roadside verges with a limited range of species This aligns with the geographic valuation: *"Limited biodiversity value"*	Local importance (Lower Value)	N
[PB4] Cutover bog	Cutaway areas re-vegetating in many places and possibly capable of regenerating raised bogs; however, no recovery plan in place and where habitat occurs adjacent to grid connection route scrub was encroaching due to drainage. This aligns with the geographic valuation: *"Limited biodiversity value"*	Local importance (Lower Value)	N
[WD1] Mixed broadleaved woodland	Specialised and varied habitats provide a home for a wide range of species. This aligns with the geographic valuation: *"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 (Higher Value)	Y
[WD1] Broadleaved woodland - *Plantation*	Broadleaved plantation of low diversity – commercial plantations of young ash. This aligns with the geographic valuation: *"Habitats and species populations of less than local importance but of some value."*	Local importance (Lower Value)	N
[WD4] Conifer plantation	Conifer plantation of low diversity. This aligns with the geographic valuation: *"Sites or features containing non-native species that is of some importance in maintaining habitat links."*	Local importance (Lower Value)	N
[WN1] Oak-birch-holly woodland	Listed within the top ten native woodland sites of conservation interest (BAP Westmeath 2014-2020[87])	Local importance	Y

87 County Westmeath Biodiversity Action Plan 2014-2020. Available at: http://www.westmeathcoco.ie/en/media/Westmeath%20Biodiversity%20Action%20Plan%2020142020.pdf

[Code] Habitat type (Fossitt, 2000)	**Basis of Evaluation**	**Highest Evaluation**	**Important ecological feature? Y/N**
	This aligns with the geographic valuation: "*Locally 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*." EU Annex I Affiliations: Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]	(Higher Value)	
[WN7] Bog woodland	Listed within the top ten native woodland sites of conservation interest (BAP Westmeath 2014-2020) This aligns with the geographic valuation: "*Locally 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*." EU Annex I Affiliations: *Bog woodland [91D0]	Local importance (Higher Value)	Y
[WN7] Annex I *Bog woodland	Fulfils criteria for EU Annex I priority habitat *Bog woodland [91D0] This aligns with the geographic valuation: "*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*." EU Annex I Affiliations: *Bog woodland [91D0]	Regional (County) Importance	Y
[WS1] Scrub	Scrub encroachment onto raised bog along the grid connection route is a negative indicator for habitat quality	Local importance (Lower Value)	N
[WS5] Recently felled woodland	Highly modified and disturbed habitat. Low diversity. This aligns with the geographic valuation: *"Limited biodiversity value"*	Local importance (Lower Value)	N
[WL1] Hedgerows	Specialised and varied habitats provide a home for a wide range of species. This aligns with the geographic valuation: *"Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological conditions between features of higher ecological value"* The habitat is likely to support breeding birds, mammals, foraging and commuting bats.	Local importance (Higher Value)	Y
[WL2] Treeline	Specialised and varied habitats provide a home for a wide range of species. This aligns with the geographic valuation: *"Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological conditions between features of higher ecological value"*	Local importance (Higher Value)	Y

[Code] Habitat type (Fossitt, 2000)	Basis of Evaluation	Highest Evaluation	Important ecological feature? Y/N
	The habitat is likely to support breeding birds, mammals, foraging and commuting bats.		

Table 5.18: Geographic Evaluation of habitats

5.3.4.1 Non-native Plant Species

Annex 5.1, provides maps showing the distribution of non-native plant species recorded during surveys. **Table 5.19** provides a list of non-native species recorded, along with the legal status of these species as invasive alien species (IAS), risk ratings, notes on propagation pathways and occurrence within the site.

Within the wind farm site, the most abundant and widely distributed non-native species, aside from commercially planted conifers (mostly Sitka spruce and some larch) was cherry laurel (*Prunus laurocerasus*). Other non-native species recorded within the wind farm site were (like cherry laurel) probably planted to provide cover for game birds and included snowberry (Symphoricarpos albus) and evergreen species of honeysuckle shrubs (*Lonicera* species) like Wilson's honeysuckle (*L.* nitida) and box-leaved honeysuckle (*L. pileata*). Beech (*Fagus sylvatica*) and sycamore (*Acer pseudoplatanus*) were also recorded as non-native species. All these species were also recorded along the grid connection route, with other non-native plants noted including two small clumps of montbretia (*Crocosmia* x *crocosmiiflora*), a patch of variegated yellow archangel (*Lamiastrum galeobdolon* ssp. *argentatum*) and a Leyland cypress (X *Cuprocyparis leylandii*) hedge. Two clumps of rhododendron (*Rhododendron ponticum*) were recorded adjacent to the grid connection route within a Leyland cypress treeline; however, these were considered beyond the zone of influence being more than 40 m from the proposed works corridor.

As indicated in **Table 5.19**, of the non-native species recorded cherry laurel, snowberry, evergreen Lonicera shrubs, archangel and montbretia were the species considered to be most at risk of being spread during the construction phase of the project. These species and cherry laurel in particular have the potential for negative impacts on native plants and habitats. No plant species listed under the Third Schedule of the European Communities (Birds and Habitats) Regulations 2011 as 'non-native species subject to restrictions under Regulations 49' were recorded.

Species	Legal status of as Invasive Alien Species - IAS[1]	Risk of impact assessment NBDC[2] & Invasive Species Ireland[3]	Covered in NRA guidance[4]	Propagation pathway Sources of information **2**, **5**	Occurrence within the site † Indicates widespread species where distribution was not mapped fully, as the project was not considered as posing a risk of spreading the species during construction works
Rhododendron *Rhododendron ponticum*	Schedule III	2. Risk of high impact 3. Red listed	yes	Wind dispersed seed and vegetative - suckering	Two clumps of shrubs noted adjacent to grid connection route – considered beyond the zone of influence
Montbretia *Crocosmia X crocosmiiflora*	None	2. Not assessed 3. Amber listed	yes	Vegetative - spreading of corms. Risk of spreading during construction	Two small clumps identified along grid connection route
Sycamore *Acer pseudoplatanus*	None	2. Risk of medium impact 3. Amber listed	no	Winged seeds	† Throughout the site and along grid route, including older specimens in treelines and younger trees in plantations.
Beech *Fagus sylvatica*	None	2. Not accessed 3. Amber listed	no	Seed	† Throughout the site and along grid route. Well represented in older growth woodland and treelines, where large older specimens were recorded.
Sitka spruce *Picea sitchensis*	None	2. Risk of low impact 3. Amber listed	no	Seed – often 'escaping' from plantations into heath and bog land	† Commercial plantations dominated by this species
Larch *Larix* species	None	2. Not accessed 3. Not assessed	no	Seed – slow spreading	† Only a very small proportion planted within the commercial plantations
Leyand cypress X *Cuprocyparis leylandii*	None	2. Not accessed 3. Not assessed	no	Hybrid species – does not spread. Not considered to be invasive, however where introduced can have a negative impact locally – crowding out native species	Noted at two locations along the grid connection route, including a road side hedge and the other a bolted hedgerow around abandoned dwelling – considered beyond the zone of influence
Snowberry *Symphoricarpos albus*	None	2. Risk of medium impact	no	Vegetative – suckering. Risk of spreading during construction	Identified within several hedges along grid connection route and has also been

Species	Legal status of as Invasive Alien Species - IAS[1]	Risk of impact assessment NBDC[2] & Invasive Species Ireland[3]	Covered in NRA guidance[4]	Propagation pathway Sources of information **2**, **5**	Occurrence within the site † Indicates widespread species where distribution was not mapped fully, as the project was not considered as posing a risk of spreading the species during construction works
		3. Amber listed - uncertain risk			planted within wind farm site as cover for game birds
Variegated yellow archangel *Lamiastrum galeobdolon ssp. argentatum*	None	2. Not assessed 3. Not accessed	no	Seed & vegetative - requiring just one stolon with pair of leaves to propagate Risk of spreading during construction	Single patch located along grid connection route
Evergreen shrubs *Lonicera L. nitida/L. pileata*	None	2. Not assessed 3. Not assessed	no	Transplanting of roots, cuttings & seed. Not considered to be invasive, however where introduced can have a negative impact locally – crowding out native species. Risk of spreading during construction	Identified within several hedges along grid connection route and has also been planted within wind farm site as cover for game birds

Table 5.19: List of non-native species

1. Species listed under the Third Schedule of the European Communities (Birds and Habitats) Regulations 2011 as 'non-native species subject to restrictions under Regulations 49'.
2. Impact status based on risk assessments for invasive species in Ireland (Kelly *et al*. 2013 & O'Flynn *et al*. 2014).
Kelly, J., O'Flynn, C., and Maguire, C. (2013). *Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland*. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland. Available online at: https://invasivespeciesireland.com/wp-content/uploads/2013/03/Risk-analysis-and-prioritization-29032012-FINAL.pdf
O'Flynn, C., Kelly, J. & Lysaght, L. (2014). Ireland's invasive soecuies and non-native species – trends in introduction. *National Biodiversity Data Centre Series* No.2, Ireland. Available online at: http://www.biodiversityireland.ie/wordpress/wp-content/uploads/Trends-Report-2013.pdf
3. Information from Invasive Species Ireland website: https://invasivespeciesireland.com/wp-content/uploads/wp-post-to-pdf-enhanced-cache/1/amber-list-recorded-species.pdf
4. National Roads Authority (2010). *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads*. NRA. Dublin. Available online via: http://www.tii.ie/technical-services/environment/construction/
5. Stokes, K., O'Neill, K. & McDonald, R.A. (2004). *Invasive species in Ireland*. Unpublished report to Environment & Heritage Service and National Parks & Wildlife Service. Quercus, Queens University Belfast, Belfast.

5.3.5 Invertebrates

As outlined in **Section 5.2.3.3** covering field survey methodology, habitat suitability assessments in the field, combined with information on species distribution compiled during the desk-based study, ensured that all proposed wind farm infrastructure, including met mast, substation, grid connection routes and areas for temporary infrastructure (deposition areas, site compound) have been sufficiently assessed for invertebrate species. The site was considered unsuitable or unlikely to support protected invertebrate species, including:-

- Marsh fritillary *Euphydryas aurinia*, which are the only insect species occurring in Ireland listed on Annex II of the Habitats Directive that requires EU member states to designate SACs to protect this species and monitor the status of the national population. The closest designate site to proposed development traditionally holding marsh fritillary butterflies is Scragh Bog SAC, which is 18 km SW of proposed development site. There are recent records (2015) from the bog lying to the south of proposed development site (see Biodiversity maps)[88], and an adult butterfly was recorded in this bog during bird surveys. In Ireland the occurrence of this species is largely restricted to locations where the larval foodplant devil's-bit scabious (*Succisa pratensis*) occurs (Harding, 2008[89] and Hickin, 1992[90]). The extent of devil's-bit scabious within the lands-made-available for the project was limited to a few very small patches and it was totally non-existent from areas occupied by the proposed development footprint. The closest significant stands of devil's-bit scabious were recorded around Bracklin Lough, c. 300 m from the closest turbine. Therefore, based on lack of suitable habitat within the potential Zone of Influence, no marsh fritillary web surveys were required and the proposed development site was assessed as unsuitable for this species;
- The initial ecological scoping surveys for the proposed development were to include Odonata (dragonfly and damselfly) surveys of the bog pool (Bracklin Lough) located along the south-eastern boundary of the lands-made-available for the project was identified as highly suitable for Odonata (dragonfly and damselfly). However, as outlined in **Chapter 2** a turbine proposed for this location was omitted and the site layout altered slightly, thereby avoiding this potentially sensitive habitat and associated invertebrates. This negated any requirement for specific Odonata surveys;
- Initial scoping surveys, ongoing multi-disciplinary surveying and the desk-based study determined that based on a lack of suitable habitats no specific terrestrial invertebrate surveys were required for *Vertigo* species. The Kerry slug has a distribution in Ireland limited to the southwest of the country and has not been recorded in Co. Westmeath or Co. Meath (NPWS, 2019)[91]; and
- In relation to aquatic invertebrates, the network of ditches and channels draining the proposed development site are within the River Boyne catchment, which does not support a freshwater pearl mussel population (NPWS, 2019).

88 Biodiversity maps available at: https://maps.biodiversityireland.ie/Map

89 Harding, J.M. (2008). Discovering Irish Butterflies and their Habitats.

90 Hickin, N. (1992). *The Butterflies of Ireland: A Field Guide*. Robert Rinehart, Cork

91 NPWS (2019). *The Status of EU Protected Habitats and Species in Ireland*. Volume 3: Species Assessments. Unpublished NPWS report. Ed. by: Deirdre Lynn, D. & O'Neill, F.

Therefore, no surveying or assessment was required for this species. No specific white-clawed crayfish surveys were undertaken beyond habitat assessment of the watercourses within the proposed development site. Based on NPWS (2019) there were no records for the 10-km covering the proposed development site [N65], although it was within the range for this species, which is known to occur in the catchment for the Stonyford River. However, the proposed development site is at the upper reaches of a tributary of the Stonyford River that is subject to periodic drainage maintenance works, which has a negative effect on the occurrence of this species. Therefore, it is considered unlikely that crayfish occur in the main ditch/stream flowing through the proposed development site. In addition, the predominately heavily shaded ditches and channels in the proposed development site, along with evidence of nutrient enrichment are potential negative factors for the healthy occurrence of populations of this species.

Therefore, overall based on published Irish distribution and/or lack of habitat suitability to support the occurrence of protected invertebrates including marsh fritillary, *Vertigo* species, Kerry slug and freshwater pearl mussel these species could be objectively ruled out as important ecological features requiring further assessment.

White-clawed crayfish by virtue of occurring downstream of the proposed development are considered to be within the potential zone of influence and are carried through for further assessment as important ecological features.

5.3.6 Freshwater Ecology – Fisheries Assessment

The baseline aquatic assessments for the proposed development site are listed in **Table 5.20**. An aquatic assessment map of the existing aquatic environment in relation to the proposed development is provided in **Figure 5.4**, which can be cross referenced with information in **Table 5.20** and **Table 5.21**. **Plate A5.1.2** at the end of **Annex 5.1** provides images showing locations of aquatic surveying.

As indicated in **Table 5.21**, the main drainage channel (modified stream) flowing through the proposed development site (Watercourse A[92]) was found to be unsuitable for spawning salmon and lamprey. The proposed development site is at the upper reaches of a tributary of the Stonyford River that is subject to periodic drainage maintenance works. Drainage has a negative effect on the occurrence of white-clawed crayfish; and therefore, it is considered unlikely that species occurs in this watercourse.

Salmon and lamprey spawning habitat and white-clawed crayfish are noted as occurring downstream of the proposed development. White-clawed crayfish have been recorded from the catchment of the Stonyford River, with the closest existing downstream record coming from the Earl's Bridge Hydrometric area (Station Code: RS07S020400). Salmon and river lamprey are listed as Qualifying Interests (QIs) of the River Boyne and River Blackwater SAC. The healthiest population of river lamprey are reported as occurring in the lower reaches of the Boyne River main channel downstream of Navan and the Stonyford tributary was considered to only support

92 Watercourse A forms part of the Boyne Arterial Drainage Scheme (Reference: C1/32/7/3). This channel is classified as a 1st order stream by the EPA mapping (Indicative flow network: EPA ref: Bolanstown – 07B45). This highly channelised stream flows east through the site becoming a 2nd order stream before exiting the site to the east of the proposed turbine location for T10. The channel then joins a 3rd order stream as it crosses into Co. Meath (EPA ref: Cartenstown – 07C60), which flows adjacent to the point of grid connection and into the Stonyford River.

brook lamprey (O'Connor, 2006)[93]. Salmon run the River Boyne almost every month of the year and the Boyne is considered important for this species, as it represents an eastern river which holds large three-sea-winter fish (NPWS, 2014)[94]. In-stream improvement works on the Stonyford River have created spawning habitat for salmon (Boyne Catchment Angling Association).

Other native fish species recorded from the Stonyford River include brown trout and eels, and non-native species including stoneloach and minnow (O'Connor, 2006). Other notable species occurring in the Boyne catchment that are reliant on health fish stocks include otters and kingfishers, which are QIs of the River Boyne and River Blackwater SAC and SPA, respectively.

93 O'Connor W. (2006) A survey of juvenile lamprey populations in the Boyne Catchment. *Irish Wildlife Manuals*, No. 24 NPWS, DoEHLG, Dublin, Ireland.

94 NPWS (2014). Site Synopsis: River Boyne and River Blackwater SAC [Site Code: 00229]. National Park & Wildlife Service

Water Quality Site	WQ1	WQ2	WQ3	WQ4
Date surveyed	15 Oct. 2020	15 Oct. 2020	15 Oct. 2020	15 Oct. 2020
River/Stream name	Deel River	Boyne river	Stonyford	Stonyford (upstream)
River sub-basin	Deel [Raharney]_040	Boyne_060	Stonyford_040	Stonyford_040
River/Stream order	4th Order	6th Order	4th Order	4th Order
EPA code	07D01	07B04	07S02	07S02
Q-Value	Q4	Q4	Q3-4	Q3-4
WFD Class	A	A	A	A
WFD Status	Good	Good	Moderate	Moderate
Dissolved O_2 %	96.5	99.4	106.3	105.7
Dissolved O_2 mg/l	10.95	11.25	12.02	11.97
pH.	8.35	8.30	8.29	8.28
Conductivity	767	772	771	785
Turbidity NTU	1.0	1.0	1.6	0.3
Temperature	10.10	10.40	10.30	10.30
Figure Ref.	Annex 5.1 Plate A5.1.2 Image A	Annex 5.1 Plate A5.1.2 Image B	Annex 5.1 Plate A5.1.2 Image C**Error! Reference source not found.**	Annex 5.1 Plate A5.1.2 Image D

Table 5.20: Water Quality Results

Salmon suitability sites	A	B	C
Date surveyed	14 Oct. 2020	14 Oct. 2020	14 Oct. 2020
River/stream name	Bolandstown	Cartenstown	Graffanstown
River sub-basin	Stonyford_040	Stonyford_040	Deel (Raharney)_030
River/Stream order	1st Order	1st Order	1st Order
EPA code	07B45	07C60	07G10
Salmon suitability	No	No	No
Substrate	Silty, Sandy, Fine	Sandy	Silty, Sandy Fine
Description	Abundant vegetation growth along steep drainage banks upstream. Livestock crossing further downstream. Nutrient enrichment	Abundant vegetation growth with gradual sloping drainage banks with rich grass growth. Very little flow movements due to drainage being blocked by illegal dumping.	Abundant vegetation growth along steep drainage banks upstream.
Anthropogenic impacts	Agriculture, Forestry	Illegal dumping, Forestry, Road infrastructure	Agriculture
Flow	Slow	Slow	Slow
Figure Ref.	Annex 5.1 Plate A5.1.2	Annex 5.1 Plate A5.1.2	Annex 5.1 Plate A5.1.2

	Image E	Image F	Image G

Table 5.21: Salmon/Lamprey Habitat Suitability Results

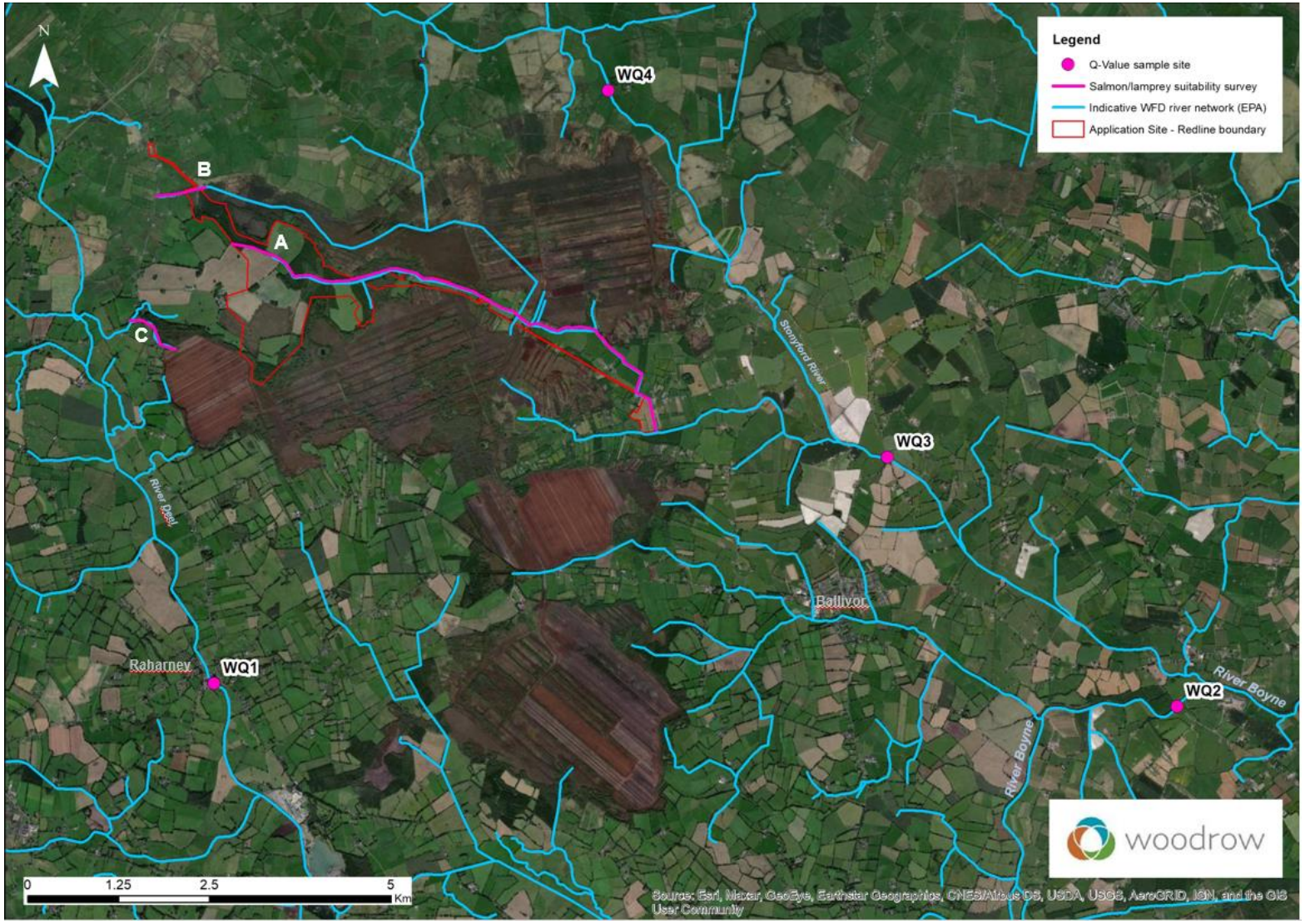

Figure 5.4: Aquatic assessment map for the proposed development

5.3.7 Amphibians & Reptiles

There are no NBDC/NPWS records of smooth newt in the vicinity of the proposed development (see Meehan, 2013)[95]. However, this species is notably under recorded and often occurs where suitable ponds or other standing water occurs. There were relatively few waterbodies occurring with the proposed development site that were assessed as having suitability for newts (and frogs), as most of the drains are flowing; and any areas periodically holding standing water are heavily shaded and often populated with fish (e.g. Bracklin Lough). In addition, the proposal largely avoids direct impacts to water features. The exception was a shallow scrape, which was located adjacent to the proposed met mast. The scrape will be utilised as a peat deposition area.

A habitat suitability assessment considered the scrape to be of poor quality for breeding newts and no frog spawn was recorded in the early spring or tadpoles later in the season. The scrape, which dries out regularly is relatively isolated within large fields of tillage, and ground disturbance related to agricultural activities limits connectivity, potential prey items and availability of hibernacula; as well as resulting in nutrification, likely to promote the occurrence of thick mats of filamentous algae noted during survey visits. Despite the apparent limited suitability, as a precaution two torchlight surveys were conducted in May 2021. No newts or frogs were recorded and the pond was considered unsuitable for amphibians due to isolation within an intensive agricultural landscape, nutrification and ephemeral nature.

Overall, frogs were typically recorded in areas adjacent to the works corridor, often associated with less shaded vegetation along drains and occasionally within wetter patches of fields of improved grassland. However, frogs were not considered common or widespread throughout the proposed development site, and appeared to be more or less absent (unrecorded) from tillage fields. Suitable spawning sites for frogs and especially newts with the proposed development site was considered very limited and through avoidance of potential habitat, the proposed development was considered highly unlikely to significantly impact on any amphibian populations. Therefore, these amphibian species could be objectively ruled out as important ecological features requiring further assessment.

No common lizards were encountered during any site visits. The closest record for this species is c. 5.6 km from Bracklyn, with records being relatively sparse for the region and typically associated with areas of raised bog. The construction corridor for the proposed development was assessed as unsuitable for common lizard, due to the intensive nature of agricultural activities which are adjacent to forestry plantations. The highest likelihood of this species occurring in the area is along the fringes of remnant raised bog on the periphery of the Bracklyn landholding. These areas of potentially suitable habitat have been totally avoided by the proposal. Likewise, the proposed grid connection route avoids any potentially suitable lizard habitat.

Overall, the proposed development was considered unlikely to significantly impact on any common lizard populations or potentially suitable habitats for this species, due

95 Meehan, S. (2013) IWT National Smooth Newt Survey. Available at: https://iwt.ie/wp-content/uploads/2017/09/Newt-Survey-2013.pdf

to lack of habitat suitability. Therefore, **common lizard could be objectively ruled out as an important ecological feature requiring further assessment**.

5.3.8 Avian Ecology

This section summaries the results from a two-year ornithological study conducted for the proposed development site between Oct-2018 and Aug-2020, which was conducted in compliance with SNH (2017) survey guidelines for assessment of potential ornithological impacts at onshore wind farms. An additional season of full SNH (2017) specification surveys were undertaken over another non-breeding season covering the period Oct-2020 to Mar-2021. The results from the additional season were reviewed and this provides useful information in support of the finding from the previous two winter seasons. Additional information has been incorporated into this assessment where relevant, including hen harrier observations.

Annex 5.2 provides details on survey effort, with **Annex 5.3** and **Annex 5.4** providing maps illustrating survey results, including flight line maps and distribution of birds recorded during site walkovers and wider area surveys. **Table 5.22** provides a species list for all the birds recorded within the ornithological study area over the two-year study, along with conservation status and notes on species occurrence, including seasonality, breeding status, abundance, distribution and assessment of habitat availability/associations. Target species accounts are provided in:-

- **Section 5.3.8.2** for Annex I species;
- **Section 5.3.8.3** for Red listed species;
- **Section 5.3.8.4** for Amber listed species;
- **Section 5.3.8.5** for the general avian assemblage; and
- **Section 5.3.8.6** for Green listed target species (waterbirds/raptors).

For all the target species (raptors and waterbirds) occurring within the area extending 500 m from the proposed turbine layout, **Table 5.23** provides the flight seconds for each species within different height bands; as recorded during vantage point (VP) watch surveys undertaken from October 2018 to August 2020.

Note: The flight line data from the additional season (winter 2020-21) has not been included in this results table. The working and results of a collision risk model are provided in **Annex 5.7**, with **Table 5.27** in **Section 5.4.3.5** providing a summary of predicted collisions risk based on the two years of flight line data (Oct-2018 to Aug-2020).

5.3.8.1 Ornithological Study

For all the surveys undertaken, 81 bird species were recorded within or directly adjacent to the 500 m turbine buffer, of which 11 were red listed and 23 were amber listed on BoCCI 2020-2026 (Gilbert *et al.*, 2021) – see **Table 5.22** for full species list.

As indicated in **Table 5.22**, there were 47 species of birds recorded breeding within the 500 m turbine buffer and an additional 15 species recorded breeding within the 2 km turbine buffer.

The eight species listed on ***Annex 1*** of the EC Bird's Directive recorded, included:-

- Little egret
- Whooper swan
- Greenland white-fronted goose
- Golden plover

- Hen harrier
- Merlin
- Peregrine
- Gyrfalcon

The 11 ***Red listed*** species (BoCCI 2020-2026) recorded, included:

Breeding pop.	Passage	Wintering pop.	Breeding & wintering pop.
• Woodcock • Kestrel • Barn owl • Swift • Meadow pipit • Grey wagtail • Yellowhammer		• Redwing	• Golden plover • Lapwing • Snipe

The 23 ***Amber listed*** species (BoCCI 2020-2026) recorded, included:

Breeding pop.	Passage	Wintering pop.	Breeding & wintering pop.
• Hen harrier • Goshawk • Merlin		• White-fronted goose	• Cormorant • Whooper swan • Mute swan • Mallard • Teal • Black-headed gull • Lesser black-backed gull

- Amber listed passerines recorded breeding in the 500 m turbine buffer included: goldcrest, willow warbler, skylark, spotted flycatcher, starling, linnet, greenfinch;
- Amber listed passerines recorded breeding or likely to be breeding within the 2 km turbine buffer included: house martin, sand martin, swallow, house sparrow; and
- Amber listed passerines recorded and not considered breeding in the vicinity included: wheatear.

Other birds Green listed on the BoCCI (2020-2026) recorded within or directly adjacent to the 500 m turbine buffer that were considered as target species, due to their classification as waterbirds or birds of prey, included: little egret, grey heron, little grebe, green sandpiper, jack snipe, sparrowhawk, buzzard, peregrine, gyrfalcon, long-eared owl

Based on observed usage of the 500 m turbine buffer over the two-year ornithological study (Oct-2108 to Aug-2020) and with consideration given to supplementary information provided by a third winter (Oct-2020 to Mar-2021), the potential for likely significant effects were identified:-

- Displacement and collision risk for small flocks of Red listed (medium sensitivity) golden plover (typically < 100 birds) occasionally forging in the tillage fields in the western part of the 500m turbine buffer over the winter;

- Displacement and collision risk for Red listed (medium sensitivity) breeding woodcock utilising ground cover provided by the woodland and associated scrub within the 500m turbine buffer;
- Displacement and collision risk for Red listed (medium sensitivity) lapwing attempting to breed (one pair in one breeding season - 2019) within the tillage fields surrounding the proposed location for T3;
- Collision risk for Red listed (medium sensitivity) kestrels regularly foraging within the 500m turbine buffer (breeding site adjacent to buffer);
- Collison risk for Red listed (medium sensitivity) swifts foraging within the 500m turbine buffer (relatively low density of use)
- Collision risk and displacement of Green listed buzzards foraging and breeding within 500m turbine buffer; and,
- Direct and/or indirect disturbance to a range of Amber listed (Low sensitivity) breeding passerines nesting in scrub, hedgerow, treelines and woodland habitats within or adjacent to the works corridor.

As listed in **Table 5.23** showing flight times recorded for target species during VP watches, apart from mallard, teal, golden plover, lapwing and snipe, there was sporadic commuting flights through the 500 m turbine buffer undertaken by small numbers of other potentially sensitive waterbird species; most notably whooper swan (2 flight lines through the buffer involving 4 and 7 birds) and Greenland white-fronted geese (1 flight line of 45 birds through the buffer). Similar low densities of use by other waterbird species were also recorded for cormorant, little egret, grey heron and all gull species (black-headed gull and lesser black-backed gull).

Apart from the occasional usage of the 500 m turbine buffer by relatively low numbers of golden plover, the buffer and the surrounding area did not support any significant numbers of foraging/roosting waterbirds over the winter. The max counts for the bog pool south of T4 being 65 teal and < 10 mallard. Relatively low densities of wintering/passage snipe, jack snipe and green sandpiper were recorded, mostly utilising the southern bog on the periphery of the 500 m turbine buffer.

Lough Allala and associated fields, was the closest wetland found to regularly support whooper swans (up to 56 birds). This area is located > 2.5 km northwest of the 500m turbine buffer and is considered beyond the zone of influence for the proposed development. Lough Allala was also found to support low numbers of other waterbirds, including: cormorant (up to 4 birds), heron (1 bird), mute swan (up to 4 birds), mallard (< 10 birds), teal (< 10 bird), little grebe (1 to 2 birds) coot (1-2 birds), moorhen (up to 7 birds) and occasional flocks of lapwing (< 50 birds).

Usage of the 500 m turbine buffer by raptor species of higher conservation concern, including: hen harrier, goshawk, merlin and peregrine was found to be very low, with no breeding or roosting sites located within the 2 km turbine buffer. A barn owl breeding site was located within 1.4km of the closed proposed turbine, with another possible site c. 3.5km to the north.

Apart from snipe, woodcock and a failed lapwing breeding attempt, no other notably sensitive breeding species, e.g. merlin, hen harrier, barn owl or other breeding waders, were recorded within or directly adjacent to the proposed works corridor. All snipe breeding activity was found to be beyond the zone of influence for construction activity and operational displacement effects (c. 400m).

Some of the species list above as species of conservation concern or green list target species, were not found to be regularly occurring species within or adjacent to the 500 m turbine buffer, including:-

- Little egret;
- Greenland white-fronted goose;
- Wintering hen harrier (observed on 3 dates over three winters of surveying);
- Goshawk;
- Gyrfalcon;
- Black-headed gull; and
- Barn owl.

BTO Code	Common name *Avian sensitivity* (Percival, 2003)	Occurrence in relation to the proposed development
Red listed species are those which are of highest conservation concern where the population is rapidly declining in abundance or range, has experienced a historic rapid decline (without recovery) or are globally threatened.		
•BO	Barn owl *Medium*	Recorded occasionally out of the breeding season, once within the 500 m turbine buffer in Sep. 2020 (during a bat survey) and once commuting across the bog just south of the buffer during a VP watch in Mar. 2020. The long-established woodland west of the site and buildings associated with Bracklyn House have the potential to support nesting barn owls. However, the availability of suitable nesting cavities within the 500 m turbine buffer was considered limited. Breeding site located c. 1.4 km from closest turbine
•GL	Grey wagtail *Medium*	Only occasionally recorded utilising the stream/drain around T1 during the winter and was not found breeding within the 500 m turbine buffer. A possible breeding territory was located along the grid connection route.
GP*	Golden plover *Medium*	Typically, small numbers (< 100 birds) and occasionally medium sized flocks (up to 500 birds) were recorded utilising the 500 m turbine over the winter and passage periods. The majority of flight line observations were of < 100 birds, which was the same for the third winter season (2020-21). Records were often associated with birds utilising foraging opportunities in the arable fields in the western part of the buffer; however, birds were not always present in the area. Wider area surveys did not locate alternative foraging/roosting sites within 2-5 km of the site and it is considered that usage of the areas is largely opportunistic by over wintering flocks that utilise a wide geographic area in a highly dispersed manner.
•K	Kestrel *Medium*	Kestrel were regularly recorded foraging through the 500 m turbine buffer. No breeding was detected within the buffer. At least one pair is thought to breed within the 2 km turbine buffer and the home range of these birds falls within the 500 m turbine buffer. Based on observations of inter-specific aggression, a possible kestrel breeding site was identified in the long-established woodland c. 1km NW from T5. This species was upgraded from the Amber to Red list in the latest BoCCI (2020-2026) assessments
•MP	Meadow pipit *Medium*	Commonly recorded breeding species on the periphery of the 500 m turbine buffer and strongly associated with areas of bog habitat. No breeding detected in the areas adjacent to the works corridor as cover is unsuitable for this ground nesting species within the plantations and intensively managed farmland. The agricultural habitats are utilised more by over wintering birds.
•L	Lapwing *Medium*	Apart from two commuting flight records, which involved a flock of 16 birds and 3 birds; all lapwing activity within the 500 m turbine buffer was associated with breeding display behaviour recorded in the arable field

BTO Code	Common name *Avian sensitivity* (Percival, 2003)	Occurrence in relation to the proposed development
		around T3 and was observed over Mar/Apr-2019. Birds did not go on to breed as the field was ploughed and the behaviour was not observed in Year 2 or Year 3. In the wider area small flocks (< 50 birds) were occasionally recorded at Lough Analla.
●/●SN	Snipe *Medium*	Snipe were recorded breeding along the boundary of the 500 m turbine buffer. No breeding activity was detected in the areas adjacent to the works corridor and was limited to a small number of pairs on the southern bog. All breeding activity was recorded > 400 m from the closest turbine. The southern bog also supported most of the birds wintering in the area.
RE	Redwing *Medium*	Common and widespread wintering species, with foraging flocks often roosting in the area. Largest numbers recorded during spring and autumn passage. This species was upgraded from the Green to Red list in the latest BoCCI (2020-2026) assessments
SI	Swift *Medium*	Regularly recorded foraging through the 500 m turbine buffer during the breeding season, with a max count of 12 birds. The proposed development site does not hold any suitable nesting habitat for this species and is unlikely to breed within 2 km of the site. This species was upgraded from the Amber to Red list in the latest BoCCI (2020-2026) assessments
●Y	Yellowhammer *Medium*	Only one breeding territory detected over the two-year study, which was located just beyond the 500 m turbine buffer in hedge near Bracklyn House. Unfavourable rotation of arable crops, more treelines/woodland edges rather than hedgerows and poor structure of hedges are thought to be factors limiting the occurrence of this species, which can become relatively abundant in association with tillage. Occasionally birds were recorded over the winter.
●WK	Woodcock *Medium (breeding)*	Dusk surveys recorded roding behaviour around the periphery of the 500 m turbine buffer, associated with woodland and bog. Woodland within the buffer provides nesting cover for this species and foraging birds are likely to utilise agricultural fields to feed at night. Birds also overwinter in the area.
Amber listed species are those with unfavourable European status, occur in internationally important numbers or are moderately declining in abundance or range. May also be Amber listed if population occurs in very small numbers or at limited number of sites		
BH	Black-headed gull *Low*	Over the two-year study only two single birds were observed, with one bird recorded landing to forage in a recently cut silage field. Larger flocks (20-50 birds) were record on one survey day in the wider area (c. 1.8 km from the site). There are no breeding colonies within the zone of influence, the closest being a small breeding colony c. 6 km south of proposed development at the quarry loughs associated with Shag Murtagh Precast Ltd. This species was downgraded from the Red to Amber list in the latest BoCCI (2020-2026) assessments
CA	Cormorant *Low*	Over the two-year study only two commuting flights were recorded within the 500 m turbine buffer, with a third recorded just beyond the buffer. There is no suitable foraging habitat for this species within the buffer and the closest breeding colonies are on Lough Ree, more than 50 km from proposed development.
●GC	Goldcrest *Low*	Common and widespread species breeding in conifer plantations within the wind farm site, with birds also recorded during the winter surveys
GI	Goshawk *Low*	Recorded twice during winter 2018-19, with a female mobbing a raven on one occasion.
●GR	Greenfinch *Low*	Relatively common breeding species, often associated with mature trees/woodland. Recorded foraging in the area over the winter

BTO Code	Common name *Avian sensitivity* (Percival, 2003)	Occurrence in relation to the proposed development
HH*	Hen harrier *High*	No birds were recorded over the first 2-years of the study, within either the 500 m or 2 km turbine buffers. Interestingly, birds were observed three time during the third winter on 26-Nov-2020, 16 & 23-Dec-2020. This remains exceptionally low usage of the area and no roosts or breeding sites were detected within the 2 km turbine buffer.
●HM	House martin *Low*	Recorded foraging within the 500 m turbine buffer during the breeding season. The closest breeding sites were beyond the 500 m turbine buffer and were associated with Bracklyn House.
●HS	House sparrow *Low*	Regularly recorded around VP3 & VP4, with breeding associated with Bracklyn House – beyond the 500 m turbine buffer. Recorded foraging in the area throughout the winter
LB	Lesser black-backed gull *Low*	Occasionally recorded (9 observations) in small numbers (1 to 15 birds) flying/commuting through the 500 m turbine buffer mostly over the breeding season, with a single juvenile bird recorded over the winter.
●LI	Linnet *Low*	Most commonly recorded over the winter, with only a small number of breeding territories located on the periphery of the 500 m turbine buffer and the grid connection route. The open scrubby conditions (e.g. patches of gorse within semi-improved pastural grasslands) that is typically favoured by this species is not widely available in the buffer.
●MA	Mallard *Low*	Commonly recorded in small numbers (up to 4 birds) over the study period. Likely to be breeding along the southern bog, with activity centred on the bog pool. Small numbers also recorded in the wider area. The majority of flight activity was recorded beyond the 500 m turbine buffer over the southern bog. This species was upgraded from the Green to Amber list in the latest BoCCI (2020-2026) assessments
ML*	Merlin *Medium*	Single merlins were recorded on five dates over the winter 2018-19 and 2019-20, with only four observations involving flight lines within the 500 m turbine buffer. No merlins were recorded over the third winter (2020-21). The tillage fields within the 500 m turbine buffer attract relatively high concentrations of passerines over the winter, which in turn provides potential foraging opportunities for birds of prey like merlin. The bog land extending out from the 500 m turbine buffer along the southern and eastern boundary holds the only potential breeding habitat for this species within the 2 km turbine buffer. No breeding activity was recorded during wider area raptor surveys.
●MS	Mute swan *Low*	Only a single flight line of one bird was recorded during the two-year study. In the wider area a single bird was recorded in Mar-2020, foraging in a flooded field adjacent to the 500 m turbine buffer. During wider area waterbird surveys 1-4 birds were regularly recorded at Lough Allala, c. 3 km northwest of Bracklyn
●S	Skylark *Low*	Only one breeding skylark territory was recorded in the 500 m turbine buffer and was located in the cereal fields between VP3 and VP4. Higher numbers occurred over the winter and up to 40 birds were recorded foraging in the arable field in the buffer.
●SF	Spotted flycatcher *Low*	One breeding territory was identified within the 500 m turbine buffer and was associated with woodland habitat along the southern periphery of the buffer.
●SG	Starling *Low*	Common and widespread species breeding within the 500 m turbine buffer, recorded nesting in hole in trees, as well as buildings associated with Bracklyn House. Out of the breeding season flocks of up to 120 birds were regularly recorded foraging through the buffer. At the end of one VP watch

BTO Code	Common name *Avian sensitivity* (Percival, 2003)	Occurrence in relation to the proposed development
		(VP2, 21-Feb-2021) 5,000 plus birds were recorded in a large murmuration over the southern bog, heading west away from the site.
●SM	Sand martin *Low*	Regularly recorded foraging through the 500 m turbine buffer over the breeding season. Most of the observations were recorded from VP1 and VP2, associated with birds utilising the southern bog. No breeding colonies were located in the buffer and no suitable banks were identified. It is possible that there were small colonies in the wider area and sand martin often nest in turf banks
●SL	Swallow *Low*	Regularly recorded foraging through the 500 m turbine buffer over the breeding season. The closest breeding sites were beyond the 500 m turbine buffer and were associated with Bracklyn House.
●T	Teal *Low*	Teal were regularly recorded on the bog pool within the 500 m turbine buffer over the winter, with a max count of 65 birds; however, numbers were usually much lower (< 10 birds) and birds were not always present. The Nationally Important threshold for this species is > 360 birds. Over the two-year study a small number of flight lines (n = 4) were recorded within the buffer (1 to 4 birds). Considered to be potentially breeding within the southern periphery of the buffer
W	Wheatear *Low*	Recorded in spring, not recorded breeding in the 500 m turbine buffer – considered to be birds on passage
WG*	Greenland white-fronted goose *Medium*	There was only one observation of birds flying through the 500 m turbine buffer with 42 birds recorded on autumn passage (02-Oct-2020). Another commuting flight was tracked just beyond the 500 m turbine buffer (15-Nov-2019) and involved a single bird travelling north. No geese were recorded over the next two winter seasons (2019-20 and 2020-21). No foraging or roosting sites were located during wider area surveys. The closest known sites for white-fronts are the Midlands loughs complex and propose development is considered beyond the core foraging range.
WS*	Whooper swan *Medium*	Infrequently recorded over the two-year study, with only two flight lines involving small flocks (2 to 7 birds) recorded commuting through the 500 m turbine buffer. There were three other flight lines (1 to 4 birds) recorded adjacent to the buffer and one observation of a single bird foraging just west of the turbine buffer in a flood field. Similar flight behaviour was recorded during the third winter season (2020-21), with five flight lines recorded (2 to 11 birds). There are no flock foraging areas or roosts associated with the proposed development. The closest consistently used foraging and roosting site was > 500 m from Bracklyn at Lough Analla where up to 56 birds were recorded.
●WW	Willow warbler *Low*	Common and widespread breeding species throughout the 500 m turbine buffer, especially within the plantation. This species was upgraded from the Green to Amber list in the latest BoCCI (2020-2026) assessments
Green List birds are not considered threatened		
●B	Blackbird *Not sensitive*	Common and widespread breeding species within the 500 m turbine buffer, woodland/scrub providing ample nesting cover, as well as foraging opportunities during the winter.
●BC	Blackcap *Not sensitive*	Relatively common breeding species, particularly in areas with dense scrub associated with wet ground conditions
●BF	Bullfinch *Not sensitive*	Relatively common breeding species, utilising scrub and woodland – recorded over the winter

BTO Code	Common name *Avian sensitivity* (Percival, 2003)	Occurrence in relation to the proposed development
●BT	Blue tit *Not sensitive*	Relatively common breeding species, utilising hedgerows/treeline and woodland – recorded over the winter - regularly recorded through the winter foraging in mixed flocks of tits and goldcrests
●BZ	Buzzard *Not sensitive*	Most common target species recorded during VP watches. Typically, birds recorded foraging or commuting along the site. Breeding behaviour recorded within the 500 m turbine buffer, at the substation and also over the woodland/treelines along the site access.
•CD	Collard dove *Not sensitive*	Breeding in the grounds of Bracklyn House and regularly foraging within the 500 m turbine buffer around VP3/VP4 in winter and summer
●CC	Chiffchaff *Not sensitive*	Relatively common breeding species, tending to favour more mature trees/woodland for nesting
●CH	Chaffinch *Not sensitive*	Common and widespread breeding species within the 500 m turbine buffer, with woodland/scrub/hedgerows/treelines providing ample nesting cover. Cereal stubbles, root crops and farmyards support wintering birds.
●CK	Cuckoo *Not sensitive*	Regularly heard calling during the breeding season, particularly from VP1/VP2. The highest breeding densities of meadow pipits, the main host species for cuckoos, were found in the re-vegetated bog just beyond the southern edge of the 500 m turbine buffer.
●CT	Coal tit *Not sensitive*	Common and widespread breeding species within the 500 m turbine buffer, with woodland providing ample nesting cover, as well as foraging opportunities during the winter.
●CR	Crossbill *Not sensitive*	Possibly breeding in site – birds picked up in Mar-2019 during walkover; however only occasionally recorded over the survey period. Dominance of relatively young plantations may not provide the resources of pine cones required by this species.
●D	Dunnock *Not sensitive*	Common and widespread breeding species within the 500 m turbine buffer, nesting in a range of scrubby habitats including hedgerows – recorded over the winter
•DV	Feral pigeon *Not sensitive*	Recorded around Bracklyn House – breeding and wintering
ET*	Little egret *Medium*	Only one observation of a single bird was recorded commuting through the turbine buffer (07-Dec-2018). The arterial drains within the 500 m turbine buffer provide some potentially suitable foraging habitat for this species; however, usage by foraging birds was not detected and no birds were recorded during wider area surveys
FF	Fieldfare *Not sensitive*	Common and widespread wintering species, with foraging flocks often roosting in the area. Largest numbers recorded during spring and autumn passage.
GE	Green sandpiper *Not sensitive*	Recorded twice, with birds flushed from bog drains adjacent to VP2 on 29-Jul-2020 & 07-Aug-2020. Small numbers are recorded on passage in Ireland, with some birds occasionally overwintering
●GO	Goldfinch *Not sensitive*	Several nesting territories recorded within the 500 m turbine buffer, utilising hedgerows. Occasionally recorded during the winter
●GS	Great spotted woodpecker *Not sensitive*	Only recorded in Mar-2021, with bird heard drumming from woodland within 500 m turbine buffer (near T5) suggesting that birds may be setting up a breeding territory. This species was downgraded from the Amber to Green list in the latest BoCCI (2020-2026) assessments
●GT	Great tit *Not sensitive*	Breeding activity (singing/calling birds) identified at several locations within the 500 m turbine buffer, with possible territories associated with patches of older trees. Older trees are more likely to provide the nest holes utilised by this species.

BTO Code	Common name *Avian sensitivity* (Percival, 2003)	Occurrence in relation to the proposed development
H	Grey heron *Not sensitive*	Not observed foraging within the 500 m turbine buffer and observations involved birds commuting through the area. More regularly recorded foraging along streams and drains during wider area surveys. There are no known heronries in the environs
●HC	Hooded crow *Not sensitive*	Commonly recorded species over both the winter and breeding season. Recorded breeding within 500 m turbine buffer.
●J	Jay *Not sensitive*	Commonly recorded species over both the winter and breeding season. Woodland habitats provided ideal breeding habitat within 500 m turbine buffer and family groups of jays were recorded
•JD	Jackdaw *Not sensitive*	Common species within the 500 m turbine buffer, with breeding associated with Bracklyn House.
JS	Jack snipe *Not sensitive*	Small numbers of wintering/passage birds recorded on the bog south of the site, most just beyond the 50 m turbine buffer. This species was downgraded from the Amber to Green list in the latest BoCCI (2020-2026) assessments
•LG	Little grebe *Not sensitive*	Not observed within the 500 m turbine buffer and was only recorded during wider area surveys. This species was downgraded from the Amber to Green list in the latest BoCCI (2020-2026) assessments
●LR	Lesser redpoll *Not sensitive* l	Several breeding territories located in the birch/bog woodland along the southern and eastern boundary of the 500 m turbine buffer and grid connection route. Recorded over the winter and occasionally larger flocks (up to 35 birds) were record foraging in the southern bog.
●LT	Long-tailed tit *Not sensitive*	Although secretive during the during the breeding season, this species was considered a relatively common breeding species, utilising scrub and woodland, with birds foraging through the area over the winter.
•LE	Long-eared owl *Not sensitive*	Although the woodland habitats within the 500 m buffer look ideal for this species, no calling birds were detected during dusk surveys. A possible breeding territory was identified within the 2 km turbine buffer
●MG	Magpie *Not sensitive*	Foraging birds regularly recorded within the 500 m turbine buffer over both the winter and breeding season. No nest sites were identified; however, several pairs are considered to be breeding in the 500 m turbine buffer.
●M	Mistle thrush *Not sensitive*	Several breeding pairs were recorded within the 500 m turbine buffer nesting in conifer plantations and broadleaved woodland, with birds often observed foraging in the adjacent open habitat. Small flocks were recorded during autumn passage and regularly recorded foraging in the area over the winter. This species was downgraded from the Amber to Green list in the latest BoCCI (2020-2026) assessments.
●MH	Moorhen *Not sensitive*	Often recorded around the bog pool (Bracklin Lough) on the southern edge of the 500 m turbine buffer, and likely to be breeding. Also commonly recorded during winter wider area waterbird surveys.
PE*	Peregrine falcon *Medium*	Only recorded four times during the two-year study, with single hunting or commuting birds recorded twice within and twice just beyond the 500 m turbine buffer. No breeding sites were identified within the 2 km turbine buffer and availability of good quality nesting habitat (cliffs > 10 m) was considered limited (non-existent).
●PH	Pheasant *Not sensitive*	An introduced game bird to Ireland and restocked on an annual basis. Several birds often escaped the shoots and were recorded breeding within the 500 m turbine buffer.
•PW	Pied wagtail *Not sensitive*	Regularly recorded within the 500 m turbine buffer, especially around VP3; due to the close proximity to Bracklyn House and grounds, which

BTO Code	Common name *Avian sensitivity* (Percival, 2003)	Occurrence in relation to the proposed development
		appeared to attract this species and was found to be breeding in this area beyond the 500 m turbine buffer
●R	Robin *Not sensitive*	Common and widely distributed breeding species recorded in areas with a scrubby component, such as the edges of plantations and hedgerows. Birds were also regularly recorded during the winter. This species was downgraded from the Amber to Green list in the latest BoCCI (2020-2026) assessments
●RB	Reed bunting *Not sensitive*	Relatively common breeding species within the 500 m turbine buffer with territories identified along drains with longer vegetation. Recorded foraging in larger numbers over the winter, with flocks attracted to the turnip field around VP3
●RN	Raven *Not sensitive*	Regularly recorded commuting through the 500 m turbine buffer. A nest site was identified in the small woodland between VP3 and VP4, near the piggery unit.
●RO	Rook *Not sensitive*	One of the most commonly recorded and numerous species within the 500 m turbine buffer.
●SC	Stonechat *Not sensitive*	Several pairs recorded along the southern and eastern bogs on the periphery of the 500 m turbine buffer. The commercial plantations and intensively farm fields lack the combination of sparse scrub cover and semi-natural habitats generally favoured by this species. Birds were recorded in the area over the winter
●SK	Siskin *Not sensitive*	Several territories identified within the plantations and occasionally small flock recorded during VP watches over the winter
●SH	Sparrowhawk *Not sensitive*	Two breeding territories were identified within the 500 m turbine buffer, one in the small woodland between VP3 and VP4, near the piggery unit and the other in the mature plantation at T10, which was subsequently felled during the 2020 breeding season. Several other territories were identified in the wider area. This species was downgraded from the Amber to Green list in the latest BoCCI (2020-2026) assessments
●ST	Song thrush *Not sensitive*	Common and widespread breeding species within the 500 m turbine buffer, with woodland providing ample nesting cover. Recorded in small numbers over the winter with occasional flocks passing through the area on passage
●TC	Treecreeper *Not sensitive*	Relatively common breeding species, utilising woodland and the mixed nature of the woodland appears to be favoured by this species – occasionally recorded over the winter foraging along treelines with tit flocks.
●WH	Common whitethroat *Not sensitive*	Breeding recorded within scrub on the periphery of the 500 m turbine buffer and grid connection route, with the improved agricultural land appearing to be less suitable for this species
●WP	Woodpigeon *Not sensitive*	Large flocks (up to 450 birds) were recorded over the winter, attracted to foraging opportunities in the crop lands within the 500 m turbine buffer. Common and widespread breeding species utilising woodland and treelines.
●WR	Wren *Not sensitive*	Common and widespread throughout the 500 m turbine buffer, wintering and breeding species occurring where suitable cover exists.
YF*	Gyrfalcon *Medium*	Very scarce visitor to Ireland – this was a white phase gyrfalcon recorded in spring 2020. It is possible that this was an escaped or released falconry bird, rather than a genuine Greenland falcon

Table 5.22: Annotated species list for the two-year bird study for the proposed development

Note: Species are listed alphabetically by BTO code and categorized by conservation status, red, amber and green, as listed in BoCCI 2020 to 2026 (Gilbert et al. 2021). Any species listed on Annex 1 of the EC Bird's Directive is indicated by * following the BTO code. ● or ● indicates that species was recorded exhibiting breeding behaviour within the 500 m or 2 km turbine buffer, respectively.

		Flight seconds recorded in height bands									
Species	Observations (number of birds)	A. < 15m	B. 16-24m	C. 25-30m	D. 31-40m	E. 41-99m	F. 100-150m	G. 151-185 m	H. >185m	Percentage flight secs. in max. CRZ (15 to 185m)	Total flight secs. in turbine buffer
Cormorant	3 observations (1 to 2 birds)				50	131				100	181
Little egret*	1 observation (1 bird)					55				100	55
Grey heron	7 observations (Single birds)			150	43	280	20			100	493
Mute swan	1 observation (1 bird)					75				100	75
Whooper swan*	2 observations (2 or 7 birds)	406		82	110					32	598
Greenland white-fronted goose*	1 observation (42 birds)							18,900		100	18,900
Teal	4 observations (1 to 4 birds)			352		15				100	367
Mallard	23 observations (1 to 4 birds)	77	9	292	150	1,160	170			96	1,858
Golden plover*	29 observations (1 to 200 birds, Ave: 40 birds)			430	3,672	227,295	1,094,030	15,650		100	1,341,077
Lapwing	9 observations (br. season1 to 2 birds, flock of 16 once in winter)	101	194	705		8,743				99	9,743
Jack snipe	2 observations (Single birds - flushed)	3								0	3
Snipe	16 observations (1 to 9 birds, Ave: 2.5 birds)	49	64	570	56	324	655			97	1,718
Green sandpiper	2 observations (Single birds - flushed)									0	0
Black-headed gull	2 observations (Single birds)	35	120							77	155
Lesser black-backed gull	8 observations (1 to 15 birds, Ave: 4 birds)					4,610	90	1,280		100	5,980
Unidentified gull species	1 observation (3 birds, juv. prob. LB)					120				100	120
Goshawk	2 observations (Single birds)	23				373				94	396

		Flight seconds recorded in height bands									
Species	**Observations (number of birds)**	**A. < 15m**	**B. 16-24m**	**C. 25-30m**	**D. 31-40m**	**E. 41-99m**	**F. 100-150m**	**G. 151-185 m**	**H. >185m**	**Percentage flight secs. in max. CRZ (15 to 185m)**	**Total flight secs. in turbine buffer**
Sparrowhawk	45 observations (mostly single birds, occ. 2 birds)	388	356	157	178	880	705	95		86	2,759
Buzzard	319 observations (mostly single birds, occ. 2 to 3 birds, rarely 4 to 5 birds)	1,177	2,433	3,771	4,439	22,579	16,233	2,700	1,462	95	54,794
Kestrel	111 observations (mostly single birds, occ. 2 birds)	1,033	1,061	3,345	910	6,639	2,396	735		94	16,119
Merlin*	5 observations (Single birds)	144								0	144
Peregrine*	2 observations (Single birds)			139	81					100	220
Barn owl	1 observation (1 bird - beyond 500m)									0	0

Table 5.23: Flight seconds for target species recorded in turbine buffer during VP watches (Oct-2018 to Aug-2020)

- Data for third winter of surveying (Oct-2020 to Mar-2021) have not been included
- Colours in cells listing the target species recorded during VP watches indicates conservation status in Ireland **Red**, **Amber** or **Green** as listed on BoCCI 2021-2026 (Gilbert *et al.*, 2021). Species marks with a * are listed on Annex I of the EU Birds Directive
- Max. CRZ = maximum collision risk zone, i.e. the maximum diameter of the rotor swept area based on blade diameter of 170 m and hub height of 100 m would result in a rotor swept area of 15 to 185 m. The Vestas V162 specified for the proposed development, with rotor diameter of 162 m and hub height of 104 m have rotor swept area of 23 to 185 m. Taking a precautionary approach, all flight seconds classed in Column B (16-24 m) are considered as being within the collision risk zone for the Vestas V162 that are specified for the proposed development; as the majority of the flights categorised in Column B were assigned height range that exceed 20 m, therefore bringing birds within or very close to the rotor swept area.

5.3.8.2 Target Species Accounts: EU Birds Directive Annex I Species

During VP watches flight lines for seven species listed on Annex I of the Birds Directive were recorded. Apart from an *ad hoc* record of gyrfalcon, no additional Annex I species were detected during site walkovers or wider area surveys. The desktop study did return a nineth Annex I species occurring within 2 km of the proposed development site – kingfisher. However, this species was not detected during any of the ecological surveys. Breeding kingfisher are associated the River Deel and Stoneyford River, flowing to the west and east of the proposed development site respectively; and forming part of the River Boyne and River Blackwater SPA, which is designated for this species. In terms of Nature Conservation Importance based on Percival (2003), kingfisher as a cited interest of an SPA would be classified as having *Very High* sensitivity.

As outlined in the NIS (Woodrow 2021), there is hydrological connectivity between the proposed development site and the SPA via arterial drainage running through the main area of the proposed development site. It is considered likely that kingfishers commute along the network of streams and drains flowing into the SPA and could travel as far as the proposed development site. The larger drains were assessed as providing some potential to support prey for this species (invertebrates, small fish and frogs); however, these watercourses do not provide suitable banks for nesting kingfishers. Likewise, the bog pool (Bracklin Lough) has the potential to support prey items. Bracklyn Farm is at the 'headwater' of the arterial drainage system flowing into the SPA; and therefore, considering the limited habitat suitability within the 500 m turbine buffer, the predicted usage of the area by kingfisher would be anticipated to be periodic and relatively low. This is supported by the lack of kingfisher records during the study period. As such, the proposed development site is not considered important for kingfisher and there is no requirement to consider this species further within the assessment, beyond potential downstream impact on designated Natura 2000 sites.

Little Egret - BoCCI 2020-2026 Green Listed

A single bird was recorded commuting through the turbine buffer within the collision risk zone (CRZ) during VP watches on 07-Dec-2018 - see **Annex 5.4 – Figure A5.4.5**. The arterial drains within the 500 m turbine buffer provide some potentially suitable foraging habitat for this species; however, usage of the proposed development site was not detected and this is likely to be a function of better foraging conditions occurring in the wider area. The watercourses (highly channelised streams) associated with the proposed development site were predominately steep banked, backed by plantations and overhung with scrub and trees, and these enclosed conditions are likely to make them less attractive to foraging little egret. This species was not recorded during wider area surveys; however, little egret can be under recorded, as birds tend to occur in low densities and are often obscured from view below the banks of rivers and drainage lines.

Overall, based on low recorded usage of the area, the proposed development site is not considered important for this species.

Whooper Swan - BoCCI 2020-2026 Amber Listed

As shown in **Annex 5.4 – Figure A5.4.3**, during VP watches whooper swans were only recorded five times, with just two flights recorded within the 500 m turbine buffer, one of which was a flock of 7 birds commuting through the area at c. 10 m (below the collision risk zone) on 19-Mar-2020. The other in-site observation was of 4 birds

commuting at 30 to 40 m on 25-Oct-2020. The three observations just beyond the turbine buffer were records of a small number of whooper swans (1 to 4 birds), one of which included a single bird foraging/loafing in a flooded field of improved grassland west of the turbine buffer and Bracklyn House. A mute swan was recorded in the same location the previous day. Similar flight behaviour was recorded during the third winter season (2020-21), with six flight lines recorded (2 to 11 birds) and only four with birds commuting through the buffer.

Wider area surveys have detected whooper swan flocks at three locations along the River Deel and one along the Stonyford River, including:-

- Caddagh, north of N52 near Lough Analla, > 2.5 km NNW of the 500 m turbine buffer: up to 60 birds regularly recorded foraging in improved pasture on the eastern bank of the River Deel and associated with Lough Analla;
- Killagh (2 birds) and Priesttown (2 birds), in improved pasture on the western bank of the River Deel within c. 2.5 to 3 km of the proposed development site - not regularly recorded in the area;
- Cereal stubble field along the Stonyford River (N of Ballivor), c. 5.5 km E of the 500 m turbine buffer: flock of c. 270 birds recorded once on 11-Dec-2020 (area not always covered on wider area surveys); and
- South of Raharney, approx. 6.5 km south of the 500 m turbine buffer: 80 to 100 birds associated with the ponds/lagoons of Shay Murtagh Precast Ltd. This is a well-known roost site and foraging area.

Aside from the record from the Stonyford River flock (c. 270 birds) numbers recorded have not exceeded Nationally Important thresholds (150 birds) over three winters.

Habitat suitability within the 500 m turbine buffer would be considered superficially good for whooper swans, with relatively large fields of improved grassland, cereal stubbles and root crops. However, a combination of the distance from potential roost sites and the efficiency with which fields are harvested (e.g. limited spilt grain and rapid re-seeding of stubble with turnip crops over the winter), are likely to be factors limiting usage of the site by whooper swans.

Overall, the proposed development site is not considered an important foraging or roosting area for whooper swans. Locations utilised in the wider area are considered to be beyond the zone of influence for this species. There is no regularly used flight paths between roosts and foraging through the 500 m turbine buffer. Small flocks (up to 11 birds) sporadically commute through the 500 m turbine buffer.

Greenland White-Fronted Goose - BoCCI 2020-2026 Amber Listed

There was only one observation of white-fronted geese flying through the 500 m turbine buffer on 02-Oct-2020 - see **Annex 5.4 – Figure A5.4.3**. This observation involved a flock of 42 birds recorded as being on autumn passage (migrating) and flew northeast through the proposed development site at heights of > 175 m, which is just within the collision risk zone (CRZ); although at times during the flight the flock, or birds within the flock, were judged to be slightly higher than the maximum proposed tip height (185 m). As a precaution the cumulative flight seconds for the flock were all assigned to the CRZ, because it was considered that accurately judging flight heights at higher altitudes with precisions of ± 10 m is challenging, due to the flatness of the site and reference features that were ground based (no meteorological mast had been erected at time). There was another relatively high (c. 100 m) commuting flight

that was tracked just beyond the 500 m turbine buffer on 15-Nov-2019 and involved a single bird travelling north.

The lack of records over the following autumn passage window (2019), as well as no records for the return spring passage periods in 2019 and 2020, would suggest that the proposed development is not located on a well-established or heavily utilised migration route. The additional winter surveys 2020-21 did not record any geese flights.

It should also be acknowledged that birds travelling overnight would go undetected using standard VP methodology, which only samples day light hours. Studies using satellite tags to track species during spring migration (Glahder *et al*., 1999[96] & Fox *et al*. 2003[97]) indicate that a relatively wide migration corridor may be used, possibly extending over 100 km wide and birds were found to travel up the eastern part of country in early to mid-April, potentially covering area that could overfly the proposed development site. Therefore, the proposed development site can be considered as occurring on a dispersed migration route for Greenland white-fronted geese; however, during migration flights birds tend to fly high (up to 3 km) and are therefore likely to avoid the collision risk zone of the proposed turbines.

The wider area wintering water bird surveys did not record any Greenland white-fronted geese in the environs of the proposed development site. The closest significant flock is associated with Lough Derravarragh, Lough Owel, Lough Ennell and Lough Iron, which supported maximum counts of 217 birds over winter 2018-19 and 280 birds over winter 2019/20 (Fox *et al*., 2019[98] & Fox *et al*., 2020[99]). This complex of loughs (Midlands loughs) is located between *c*. 14 km and *c*. 26 km from the 500 m turbine buffer for proposed development. As outlined in the NIS (Woodrow 2020), Lough Iron SPA and Garriskil Bog SPA are designated for Greenland white-fronted geese; however, distances between the Midlands loughs complex and the proposed development site were considered beyond the core foraging range (from night roosts) during winter season assigned to this species by SNH (2016)[100] as 5 to 8 km.

In summary, the proposed development site is not important for any over wintering flocks of foraging or roosting Greenland white-fronted geese and is beyond the zone of influence for any known sites utilised by this species. The proposed development site can be considered as occurring on a diffuse migration route for Greenland white-fronts, with relatively small flocks likely to pass through the area sporadically, as birds disperse to wintering grounds over the autumn and possibly during the spring on return passage. Therefore, the proposed development site is considered of limited importance for this species.

Golden Plover - BoCCI 2020-2026 Red Listed

96 Glahder, C.M., Fox, A.D. & Walsh, A.J. (1999). Satellite tracking of Greenland White-fronted Geese. *Dansk Ornitologisk Forenings Tidsskrift* 93: 271-276.

97 Fox, A.D., Glahder, C.M. & Walsh, A.J. (2003) Spring migration routes and timing of Greenland white-fronted geese – results from satellite telemetry. *Oikos* 103:2 414-425

98 Fox, T., Francis, I., Norriss, D. & Walsh, A. (2019). *Report of the 2018/19 International census of Greenland white-fronted geese*. Greenland White-fronted Goose Study, Rønde, Denmark and Wexford, Ireland.

99 Fox, T., Francis, I., Norriss, D. & Walsh, A. (2020). *Report of the 2019/20 International census of Greenland white-fronted geese*. Greenland White-fronted Goose Study, Rønde, Denmark and Wexford, Ireland.

100 Scottish Natural Heritage (2016). Avoidance rates for the onshore SNH wind farm collision risk model. SNH.

Typically, small numbers (< 100 birds) and occasionally medium sized flocks (up to 500 birds) were recorded utilising the 500 m turbine buffer over the winter, see **Annex 5.4 – Figures A5.4.1 & A5.4.2**. The majority of flight line observations were of < 100 birds. Records were often associated with birds utilising foraging opportunities in the arable fields in the western part of the buffer, however, birds were not always present in the area. Wider area surveys did not locate alternative foraging/roosting sites within 2-5 km of the site; and it is considered that usage of the areas is largely opportunistic by over wintering flocks that utilise a wide geographic area in a highly dispersed manner. The highest count of 520 birds was a flock recorded on a breeding season walkover (17 Apr 2019) and birds on passage may swell numbers marginally. Numbers recorded over three winters have not exceeded Nationally Important thresholds (920 birds).

The closest areas supporting Nationally Important numbers are all beyond the zone of influence, being more than 20 km from the proposed development, including Lough Iron (c. 24 km W), Tara Mines (26 km NE) and Lough Ramor (25 km north). Other important golden plover sites, along the east coast (Dublin Bay, Baldoyle Bay, Dundalk Bay, Nany Estuary), Lough Ree and at the Curagh in Co. Kildare are more than c. 50 km from the proposed development.

Overall, the proposed development site was considered to have local importance for this species over the winter, occasionally providing foraging opportunities in tillage fields for a relatively small number of golden plovers. Usage of the area is related to occurrence of foraging opportunities on exposed soil provided by arable farmland.

Hen Harrier - BoCCI 2020-2026 Amber Listed

Hen harriers are an important Annex I species to consider in relation to wind farm developments. No hen harriers were recorded within or surrounding the 500 m turbine buffer during the two-year study. Interestingly, birds were observed on three dates during the third winter, including: 26 Nov 2020 & 16/23 Dec 2020. Observations on 26 Nov 2020 and 16 Dec 2020 were recorded as an adult female and involved a bird hunting over the southern bog, spending some time in the 500 m turbine buffer. The bird observed on 23 Dec 2020 was different and was judged to be a juvenile female. It was recorded hunting over the cereal fields between VP3 and VP4.

- 26 Nov 20 08:48 Ad. Female @ 5-15m Hunting over south bog
- 26 Nov 20 09:30 Ad. Female @ 20-50m Hunting over south bog
- 16 Nov 20 14:02 Ad. Female @ 15-35m Hunting over south bog
- 16 Nov 20 14:25 Ad. Female @ 30-60m Hunting over south bog
- 23 Dec 20 09:49 Juv. Female @ 20-35m Hunting over arable land

A hen harrier habitat suitability assessment was conducted as part of this study and covered the area extending 2 km from the proposed turbine locations. The 500 m turbine buffer was considered to be largely unsuitable for breeding hen harrier, being dominated by tillage, improved grassland and closed thicket plantation, while the periphery of the buffer extending onto the raised bogs to the south and east did provide some cover that had the potential to be utilised by roosting birds. Within the wider area there were some suitable nesting and roosting cover located within re-

vegetating raised bog to the south and east of the buffer. However, this was considered limited, especially for breeding as the habitat surrounding the bogs was dominated by improved grassland and unlikely to support the densities of ground nesting birds, such as meadow pipits, typically associated with breeding hen harriers. Wider area breeding raptor surveys and hen harrier winter roost searches covering suitable patches of habitat out to 2 km from the proposed turbine locations did not record any hen harriers, breeding or wintering.

The last National breeding hen harrier survey conducted in 2015 (Ruddock *et al*., 2016)[101] did not cover the 10-km square encompassing the proposed development site, as the habitat was considered largely unsuitable for the species. Based on the 2015 census, the closest confirmed breeding site to the proposed development was a single pair located c. 30 km away on the Westmeath-Longford border.

Considering the winter 2020-21 observations, usage of the 500 m turbine buffer remains exceptionally low and no roosts or breeding sites were detected within the 2 km turbine buffer. Therefore, beyond providing habitat for the occasional foraging bird over the winter, the proposed development site and surrounding area was not found to be important for hen harriers.

Merlin - BoCCI 2020-2026 Amber Listed

Single merlins were recorded on five dates over the winter 2018-19 and 2019-20, with only four observations involving flight lines within the 500 m turbine buffer - see **Annex 5.4 – Figure A5.4.6**. No merlins were recorded over the third winter (2020-21). As is typical for this species all flight lines were below 15 m (i.e. below the rotor swept zone). The combination of woodland and tillage fields within the 500 m turbine buffer attract relatively high concentrations of passerines over the winter, which in turn provides potential foraging opportunities for birds of prey like merlin. The bog land extending out from the 500 m turbine buffer along the southern and eastern boundary holds the only potential breeding habitat for this species within the 2 km turbine buffer. No breeding activity was recorded during wider area raptor surveys. During a hen harrier roost search on the evening of 30 Oct 2019, three merlin were recorded in the bog opposite the proposed site entrance. These birds disbanded and did not roost and no further activity was recorded in the area on subsequent visits.

Usage of the 500 m turbine buffer was found to be low and limited to over wintering birds. No roosts or breeding sites were detected within the 2 km turbine buffer. Therefore, beyond providing habitat for the occasional foraging bird over the winter, the proposed development site and surrounding area was not found to be important for merlin.

Peregrine - BoCCI 2020-2026 Green Listed

Peregrine falcons were only recorded four times during the two-year study, with single hunting or commuting birds recorded twice within and twice just beyond the 500 m turbine buffer - see **Annex 5.4 – Figure A5.4.6**. The flat topography surrounding the proposed development site means there are no natural cliff breeding sites within 2 km and there are also no artificial breeding sites on quarry cliffs or high buildings in the

101 Ruddock, M., Mee, A., Lusby, J., Nagle, A., O'Neill, S. & O'Toole, L. (2016). The 2015 National Survey of Breeding Hen Harrier in Ireland. *Irish Wildlife Manuals*, No. 93. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland

vicinity. In fact, nesting opportunities even within 10 km of the proposed development site were considered limited, which probably explains the relatively low levels of peregrine activity recorded in the general area. Peregrines were not recorded breeding within the 10 km square covering the proposed development site during the Bird Atlas 2007-11 (Balmer *et al*., 2013)[102] and were only recorded as possibly breeding in some of the adjacent squares.

Given the low-level usage recorded and lack of suitable nesting habitat the proposed development site and its environs were not considered important for peregrine falcons.

Gyrfalcon - BoCCI 2020-2026 Not Assessed

A white phase gyrfalcon was recorded during the ecological scoping exercise in spring 2020 - see **Annex 5.4 – Figure A5.4.6**. Gyrfalcons are very scarce visitors to Ireland, occasionally arriving from Greenland and are most regularly encountered in coastal counties. Given the inland location it is possible that this was an escaped or released falconry bird, rather than a genuine Greenland falcon.

The status of this species as a scarce visitor to Ireland means the proposed development site was not considered important – not included as an important ecological receptor.

5.3.8.3 Target Species Accounts: Red Listed Bird Species (BoCCI 2020-2026)

Lapwing

Over the two-year study there were nine lapwing flight lines recorded within the 500 m turbine buffer. Apart from two commuting flight records, which involved a flock of 16 birds and 3 birds, all lapwing activity within the 500 m turbine buffer was associated with breeding display behaviour recorded in the arable field around T3 - - see **Annex 5.4 – Figure A5.4.4**. This behaviour was observed over Mar/Apr-2019 site visits; however, birds did not go on to breed successfully as the field was ploughed. Breeding behaviour was not observed in Year 2. Over the third winter (2020-21) there was only one flight line observation for lapwing involving 3 birds. Numbers recorded over three winters have not exceeded Nationally Important thresholds (850 birds).

The pair observed at the proposed development site attempted to breed in a turnip crop in 2019, which was harvested in the spring and likely caused the breeding attempt to fail. The selection of this breeding site is considered in the context of unfavourable management of tillage land. Ongoing unfavourable management practice means it is unlikely that breeding lapwing will persist in the area, as evidenced by no breeding attempt being recorded in Year 2. Arable fields, including tilled land, fields of under-sown cereal and fodder crop are often occupied by breeding lapwing early in the season. However, agricultural activity, e.g. ploughing, harrowing, sowing of seeds, spraying and spreading of slurry generally result in nest failure in this intensely managed habitat type. The breeding site was not occupied in 2021, based on VP watches conducted into Mar-2021 and site visits in May-2021.

102 Balmer, D. Gillings, S. Caffrey, B. Swann, B. Downie, I. & Fuller, R. (2013). *Bird Atlas 2007-11: The Breeding and Wintering Birds of Britain and Ireland*. British Trust for Ornithology

During wider area wintering waterbird surveys the only area found to occasionally support small flocks (< 50 birds) was Lough Analla, which is *c.* 3 km north from Bracklyn. The Midlands loughs complex, including Lough Iron, are the closest sites historically supporting Nationally Important numbers and are all beyond the zone of influence, being more than 14 to 20 km from Bracklyn. Other important lapwing sites, along the east coast (Dublin Bay, Baldoyle Bay, Dundalk Bay, Nany Estuary) and Lough Ree are more than *c.* 50 km from proposed development. Smaller wintering flocks occur *c.* 6.5 km south of the proposed development site and are associated with the ponds/lagoons of Shay Murtagh Precast Ltd – see **Annex 5.3 – Figure A5.3.3**

Given the low-level usage recorded over the winter the proposed development site and its environs were not considered important for wintering lapwing. In terms of breeding lapwing, unless the timings of ongoing intensive tillage management practices change, it is considered unlikely that the area will support any successful breeding attempts into the future.

Snipe

Snipe were recorded breeding along the boundary of the 500 m turbine buffer. No breeding activity was detected in the areas within or adjacent to the proposed works corridor. As shown in **Annex 5.3 – Figure A5.3.4**, breeding was limited to a small number of pairs distributed within the southern bog. All breeding activity was recorded > 400 m from the closest turbine and therefore considered beyond the zone of influence for disturbance from construction activities and operational turbines. The southern bog also supported most of the birds wintering in the area, as shown in **Annex 5.3 – Figure A5.3.5**. Flight line activity recorded during VP watches was also concentrated over the southern bog, mirroring the distribution of breeding and wintering records - see **Annex 5.4 – Figure A5.3.12**.

In summary, the southern bog on the periphery of the 500 m turbine buffer is assessed as the most important area for breeding and wintering snipe at Bracklyn. The proposed wind farm infrastructure has been designed to avoid the habitats of highest value to breeding and winter snipe.

Woodcock

Both wintering and breeding populations of woodcock utilise woodland at Bracklyn for day roosts and breeding cover. Birds are likely to forage nocturnally on improved grassland and tillage within the 500 m turbine buffer and on bogland on the periphery of the buffer. The wintering and breeding populations are considered to be different, with only the declining breeding population being BoCCI Red listed.

As shown in **Annex 5.3 – Figure A5.3.6**, dusk surveys recorded roding behaviour around the periphery of the 500 m turbine buffer along the edge of the southern and eastern bog, which was associated with woodland within the 500 m turbine buffer. Ground cover within woodland and scrub within the buffer provided nesting cover for this species.

In summary woodland habitats within the 500 m turbine buffer are important for this species, especially during the breeding season.

Kestrel

After buzzards, kestrels were the most regularly recorded target species within the 500 m turbine buffer with 15,086 flight seconds recorded within the collision risk zone

over the two-year study. As shown in **Annex 5.4 – Figures A5.4.7 to A5.4.10**, kestrels regularly foraged through the 500 m turbine buffer over both the winter and breeding seasons. The fields of arable crops are likely to support rodent population, as well as birds that provide prey for kestrels. Although there is potential nesting habitat in the site (e.g. old crows nests in trees), no breeding was detected within the 500 m turbine buffer. At least one pair is thought to have bred within the 2 km turbine buffer and the breeding season home range of these birds falls within the 500 m turbine buffer. Based on observations of inter-specific aggression, a possible kestrel breeding site was identified in the long-established woodland *c.* 1 km NW from T5.

Based on flight activity within the 500 m turbine buffer this site is important to at least one pair of breeding kestrel and is also utilised over the winter.

Barn Owl

Barn owls were recorded occasionally out of the breeding season, once within the 500 m turbine buffer in Sep-2020 hunting over the field NNW of T4 (during a bat survey) and once commuting across the bog just south of the buffer during a VP watch in Mar-2020 – see **Annex 5.4 – Figure A5.4.6**. The fields of arable crops are likely to support rodent populations that provide prey for barn owls. The availability of suitable nesting cavities (e.g. hollows in mature trees) within the 500 m turbine buffer was assessed as limited, based on features surveyed for bat roost/nesting owl potential and no evidence of breeding was identified. Veteran trees with suitable nest holes occurring in the long-established woodland west of the buffer have the potential to support nesting barn owls.

There is a known breeding site within the 2 km turbine buffer (location confidential), which was located within *c.* 1.4 km of the closest proposed turbine. In Ireland, foraging distances from a nest site can extend up to 6 km and even as far as 9 km; however, the core breeding season home range is documented to be 4 to 5 km from the nest (Lusby & Cleary, 2014[103], TII 2021[104]). This is further than the 1 km search area recommended by the SNH (2017) survey guidelines for breeding barn owls (owls other than short-eared owls). Likewise, the documented extent for breeding season home ranges for Irish barn owls exceeds the *zone of sensitivity* given for barn owls in relation to wind farm developments in Mc Guinness *et al*. (2015)[105], which is 2 km

In summary, there was a known barn owl site within 1.5 km of the proposed development. The arable fields and woodland within the proposed development site provide foraging opportunities for this species, which are within the range of the known breeding site. The proposed development site is also at the edge of the reported range of the non-native greater white-toothed shrew (Biodiversity maps), which has featured highly in the diet of some regional barn owl populations (Tosh *et al*., 2008)[106].

103 Lusby, J. & O'Cleary, M. (2014) Barn Owls in Ireland: Information on the ecology of Barn Owls and their conservation in Ireland. BirdWatch Ireland

104 TII – Transport Infrastructure Ireland (2021). Survey and Mitigation Standards for Barn Owls to inform the Planning, Construction and Operation of National Road Projects. TII Publications, April 2021

105 Mc Guinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015*). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland*. BirdWatch Ireland, Kilcoole, Wicklow

106 Tosh D.G., Lusby J., Montgomery W.I., O'Halloran J. (2008). First record of greater white-toothed shrew in

Swift

Small foraging parties of swifts were regularly recorded foraging through the 500 m turbine buffer during breeding season VP watches, with a max count of 12 birds. Most of the foraging activity was recorded over the southern bog. With the possible exception of Bracklyn House, the area does not hold any suitable nesting habitat for this species and they are unlikely to breed within the 2 km of the turbine buffer. Birds are known to travel considerable distances from breeding sites to forage (up to 20 km). The closest reported colonies are in Clonmellon and Killucan/Rathwire between 6.5 and 10 km from proposed development (Krastev *et al*., 2018)[107]

Red Listed Passerines

Four red listed passerines were recorded within the 500 m turbine buffer, including: wintering redwing, grey wagtail, meadow pipit and yellowhammer.

Redwing

Flocks (up to 70 birds) were regularly recorded foraging and roosting over the winter. The largest numbers were recorded during the spring and autumn passage periods. Fruit bearing shrubs provide foraging opportunities, including hawthorn, rowan, holly as well as possibly those off the non-native cherry laurel which were plentiful though the plantations. Redwings were upgraded from the Green to Red list in the latest BoCCI (2020-2026) assessments, due to recent consideration as a European species of global conservation concern (SPEC 1).

*Grey **W**agtail*

Grey wagtail were only occasionally recorded during the winter season where they were observed utilising the stream/drain along the proposed access track between the turn to T1 and the substation. Birds were also often recorded around Bracklyn House during the winter. No breeding sites were found within the 500 m turbine buffer. The steep sided drains, without rapids that occurred within buffer were considered largely unsuitable for this species. It is considered likely that there is one pair in the local area and a possible breeding territory was identified along the channel adjacent to the grid connection route. Although red listed, grey wagtails are relatively widespread and common on waterways and other waterbodies across Ireland. Severe winters during the last Bird Atlas (Balmer *et al*., 2013)[108] were thought to contribute to the observed population decline in this species, which although still registering declines appears to be stabilising (Crowe *et al*. 2014[109] and Lewis *et al*., 2019a)[110]. In relation to development projects, grey wagtails regularly utilise holes/cervices in man-made nest sites, including bridges and rock armouring around culverts.

*Meadow **P**ipit*

Ireland. *Mammal Review* 38: 321-326

107 Krastev, A., Whelan, R. & Caffrey, B. (2018). Westmeath Swift Survey 2018. Report by BirdWatchIreland

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

109 Crowe, O., Musgrove, A.J. & O'Halloran, J. (2014). Generating population estimates for common and widespread breeding birds in Ireland. *Bird Study* 61(1): 82-92

110 Lewis, L. J., Coombes, D., Burke, B., O'Halloran, J., Walsh, A., Tierney, T. D. & Cummins, S. (2019a) Countryside Bird Survey: Status and trends of common and widespread breeding birds 1998-2016. *Irish Wildlife Manuals*, No. 115. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland.

Commonly recorded breeding species on the periphery of the 500 m turbine buffer and strongly associated with areas of bog habitat. No breeding was detected in the areas adjacent to the works corridor as cover is unsuitable for this ground nesting species within the plantations and intensively managed farmland – see **Annex 5.3 – Figure A5.3.12**. These habitats are utilised more by over wintering birds – see **Annex 5.3 – Figure A5.3.11**. The most recent population estimates give a figure of 1,007,407–1,726,880 birds, and as for grey wagtail, meadow pipit numbers registered a crash, thought to be linked with consecutive cold winters in 2009/10 and 2010/11, with more recent data indicating the species is staging a recovery. (Lewis *et al*., 2019a). These declines contributed to meadow pipit being assigned to the Red list.

Yellowhammer

Only one breeding territory was detected over two-year study, which was located just beyond the 500 m turbine buffer in hedge near Bracklyn House – see **Annex 5.3 – Figure A5.3.10**. Unfavourable rotation of arable crops, more treelines/woodland edge rather than hedgerows and poor structure of hedges are thought to be factors limiting the occurrence of this species, which can become relatively abundant in association with tillage. Small numbers of birds were occasionally recorded over the winter.

5.3.8.4 Target Species Accounts: Amber Listed Bird Species (BoCCI 2020-2026)

Cormorant

Over the two-year study only two commuting flights were recorded within the 500 m turbine buffer, with a third recorded just beyond the buffer – see **Annex 5.4 – Figure A5.4.10**. Aside from the small bog pool south of T4 there is no suitable foraging habitat for this species within the buffer and the closest breeding colonies are on Lough Ree, more than 50 km from proposed development. Small numbers (1-2 birds) were occasionally recorded at Lough Analla and on the Deel and Stonyford Rivers. The largest congregation in the vicinity of Bracklyn, was *c*. 6.5 km south at the ponds/lagoons of Shay Murtagh Precast Ltd, where up to 30 birds were recorded over the winter.

Given the low-level usage recorded (occasional commuting flight) and lack of suitable foraging/roosting/breeding habitat the proposed development site and its environs were not assessed as important for cormorant.

Mute Swan

Only a single flight line of one bird was recorded during the two-year study – see **Annex 5.4 – Figure A5.4.10**. In the wider area a single bird was recorded in March-2020, foraging in a flooded field west of Bracklyn House, adjacent to the 500 m turbine buffer. During wider area waterbird surveys 1-4 birds were recorded at Lough Allala, *c*. 3 km north of proposed development, with small numbers (1 to 2 birds) also occasionally recorded along the Deel and Stonyford Rivers.

Given the low-level usage recorded (occasional commuting flight and low wider area counts) the proposed development site and its environs were not assessed as important for mute swan.

Mallard

Over the study period mallard were commonly recorded in the 500 m turbine buffer in small numbers (up to 4 birds), in both winter and over the breeding season. Based on spring flight behaviour it is considered likely that several birds nest (up to 3 nests)

along the southern bog, with activity centred on the bog pool south of T4. The majority of flight activity recorded during VP watches was recorded beyond the 500 m turbine buffer over the southern bog – see **Annex 5.4 – Figure A5.4.12**. Small numbers were also recorded during wider area winter waterbirds surveys, typically < 5 birds at all point count locations, which is below thresholds for National Importance (280 birds). The largest winter flock was recorded at Reynella Lough (75 birds), which c. 4 km from the proposed development site and beyond the zone of influence.

In summary, the southern bog on the periphery of the 500 m turbine buffer is considered to be the most important area for wintering and possibly breeding mallard at the proposed development site. The proposed development has been designed to avoid the habitats of highest value to wintering and possible breeding mallard.

Teal

Over the winter teal were regularly recorded on the bog pool within the 500 m turbine buffer, with a max count 65 birds; however, numbers were usually lower (< 10 birds) and birds were not always present. Over the two-year study a small number of flight lines (n = 4) were recorded within the buffer (1 to 4 birds), with flight lines occurring over the southern bog – see **Annex 5.4 – Figure A5.4.12**. Although not confirmed, based on habitat availability and spring flight behaviour, it is considered likely that teal potentially breed within the buffer in small numbers (1 to 2 nests)

The Nationally Important threshold for this species is counts above 360 birds and the Midlands loughs complex, including Lough Iron, are the closest sites historically supporting Nationally Import numbers. These sites are all beyond the zone of influence, being more than 14 to 20 km from the proposed development. Wider area winter waterbird surveys around the proposed development only recorded small numbers of teal (< 10 birds).

In summary, the southern bog on the periphery of the 500 m turbine buffer is considered to be the most important area for wintering and possibly breeding teal at the proposed development. The proposed development has been designed to avoid the habitats of highest value to wintering and possible breeding teal.

Goshawk

Goshawks were only recorded twice during winter 2018-19, with a female mobbing a raven on one occasion - see **Annex 5.4 – Figures A5.4.18**. The goshawk population in Ireland is thought to have originated from escaped falconry birds rather than natural immigration. Based on *ad hoc* reports, numbers appear to be increasing across the country. This expansion is likely to be linked to the proliferation of maturing commercial forestry plantations across the Irish landscape, which provides nesting and hunting habitat for this woodland species. The combination of woodland and open habitat at proposed development site does offer some potential habitat for breeding goshawk. However, the relatively young (unstructured) age of the plantations and isolated nature of the older woodland habitats within the wider agricultural landscape (dominated by improved pasture, some cereal production and areas of raised bog) may not provide the overall area of woodland required to support sustained usage by this species.

Given the low-level usage recorded, the proposed development site and its environs were not considered important for goshawk – not included as an important ecological receptor.

Black-head Gulls

Over the two-year study only two single birds were observed, with one bird recorded landing to forage in a recently cut silage field – see **Annex 5.4 – Figure A5.4.13**. Larger flocks (20-50 birds) were record on one survey day in the wider area (c. 1.8 km from the site). There were no breeding colonies within the zone of influence, the closest being a small breeding colony c. 6 km south of the proposed development at the quarry loughs associated with Shag Murtagh Precast Ltd.

Given the low-level usage recorded, the proposed development site and its environs were not considered important for black-headed gulls – not included as an important ecological receptor.

Lesser Black-backed Gulls

Occasionally recorded (9 observations) in small numbers (1 to 15 birds) flying/commuting through the 500 m turbine buffer – see **Annex 5.4 – Figure A5.4.13**. Aggregated flight seconds within the buffer amount to 5,980 seconds and the majority of the flights were observed over the breeding season, with a single juvenile bird recorded over the winter. Although some lesser black-backs (mainly sub-adults) over-winter in Ireland, most birds leave the country, explaining the lack of records out of the breeding season. No birds were recorded foraging in the area and there were no breeding colonies within the zone of influence, with the closest being on Lough Ree (c. 50 km from the proposed development).

Given the low-level usage recorded, the proposed development site and its environs were not considered important for lesser black-backed gulls.

Amber Listed Passerines

Amber listed passerines recorded breeding in the 500 m turbine buffer included: goldcrest, willow warbler, skylark, spotted flycatcher, starling, linnet, greenfinch. For linnet and skylark (see **Annex 5.3 – Figure A5.3.11**) nesting locations identified and/or available habitat are removed from the proposed works corridor. This is notably the case for linnet, as the patches of scrub in open habitat typically favoured by this species are only available around the eastern and southern periphery of the 500 m turbine buffer. Similarly, the nesting sites of other Amber listed passerines are beyond the 500 m turbine buffer, including house martin, sand martin, swallow and house sparrow. Wheatear was recorded on passage and is not considered to be breeding in the vicinity of the proposed development.

Overall, it is considered that inappropriately timed removal of vegetation has the potential to result in direct/indirect disturbance to Amber listed breeding passerines that nest in scrub, hedgerow, treelines and woodland habitats, within or directly adjacent to the works corridor. This includes: goldcrest, willow warbler, spotted flycatcher, starling and greenfinch.

5.3.8.5 General Avian Assemblage

In addition to Amber listed breeding passerine species, it is important to consider potential impacts on the general assemblage of woodland/farmland birds and the annotated species list in **Table 5.22** provides details on the occurrence of all Green listed species in relation to the proposed development. This includes Green listed raptors breeding within the 500 m turbine buffer (buzzard and sparrowhawk) and new arrivals into the area – great spotted woodpeckers (first recorded in March 2021).

Overall, it is considered that inappropriately timed removal of vegetation has the potential to result in direct/indirect disturbance to Green listed breeding species that nest in scrub, hedgerow, treelines and woodland habitats, within or directly adjacent to the works corridor. Of the Green listed species recorded breeding within the 500 m turbine buffer this includes approximately 29 species: blackbird, blackcap, bullfinch, blue tit, buzzard, chaffinch, chiffchaff, coal tit, crossbill, dunnock, goldfinch, great spotted woodpecker, great tit, hooded crow, lesser redpoll, long tailed tit, magpie, mistle thrush, pheasant, robin, reed bunting, raven, siskin, sparrowhawk, song thrush, treecreeper, woodpigeon and wren.

5.3.8.6 Green Listed Target Species (BoCCI 2020-2026)

In terms of Annex I Green list species, baseline notes have been provided for little egret, peregrine and gyrfalcon - see **Section 5.3.8.2**. The other Green listed target species recorded within the 500 m turbine buffer included: grey heron, sparrowhawk and buzzard.

Two passage migrants: green sandpiper and Jack snipe (possibly overwintering) occurred on the periphery of the 500 m turbine buffer in low numbers and are not given any further consideration in this assessment, i.e. are not included as an important ecological receptors. Similarly, little grebe and long-eared owl were recorded in the wider area and are not considered further.

Grey heron

Herons were not observed foraging within the 500 m turbine buffer and observations involved birds commuting through the area - see **Annex 5.4 – Figure A5.4.5**. Over the two-year study seven flight observations were recorded during VP watches, totalling 493 seconds within the buffer. Birds were more regularly recorded foraging along streams and drains during wider area surveys; and the watercourses (highly channelised streams) within the buffer were predominately steep banked, backed by plantations and overhung with scrub and trees, and these enclosed conditions are likely to make them less attractive to foraging herons. Although there no known heronries in the environs of the proposed development, birds were recorded flying through the 500 m turbine buffer during the breeding season.

Given the low-level usage recorded (occasional commuting flight) and lack of foraging records within the 500 m turbine buffer, the proposed development site is not considered important for grey herons and this Green listed target species is not included as an important ecological receptor.

Sparrowhawk

Sparrowhawks were recorded hunting through the area over both the breeding season and non-breeding season – see **Annex 5.4 – Figure A5.4.18** & **A5.4.19**. A total of 2,759 seconds recorded within the 500 m turbine buffer, of which 2,371 seconds was determined to be at collision risk height (15-185m). On balance this species tends to fly relatively low (below rotor swept height), especially when hunting; however, display flights and when commuting long distances results in flight time within the collision risk zone. Two sparrowhawk breeding territories were identified within the 500 m turbine buffer – see **Annex 5.3 – Figures A5.3.17**. The flights associated with the breeding sites contributed to more display flights being recorded and long flight times spent within the collision zone. During the 2020 breeding season the breeding site at T10 became unavailable due to felling operations in the area. It is understood that this species,

which often nests in commercial forestry plantation, will be relatively tolerant of felling operations and should be able to readily relocate in the remaining woodland adjacent to the felled areas.

Woodland habitats within the proposed development site are important for this wide spread and commonly occurring species of raptor.

Buzzard

Buzzards were the most commonly recorded target species over the baseline study, with 319 observations recorded within the 500 m turbine buffer during VP watches – see **Annex 5.4 – Figure A5.4.14** to **A5.4.17**. After golden plovers, buzzard observations generated the second highest number of flight seconds (54,794 seconds) over the two-year study. Typically, single birds were recorded regularly foraging or commuting through the buffer, with occasionally up to 5 birds observed simultaneously flying in the buffer. It was not usual to see up to 10 birds distributed across the wider area. As shown in **Annex 5.3 – Figures A5.3.17** a buzzard territory was located in the woodland adjacent the proposed substation location, with another two territories identified in the wider area. Territorial behaviour was also noted along the proposed access tracks and was associated with the forestry/treelines near the turn to T1. This was area was identified as possible alternative location used by the pair nesting in the woodland at the proposed substation. As with sparrowhawk, buzzards are considered to be relatively tolerant of felling operations and it is reported that a single pair of buzzards can have up to 11 alternative nest sites within its breeding season home range.

Woodland habitats within the proposed development site are important for this widespread and commonly occurring species of raptor.

Other Green Listed Waterbird Species

As summarised in **Table 5.22**, green sandpiper and Jack snipe were recorded in low numbers in the cutover bog occurring on the southern periphery of the proposed development site. Given the low-level of usage recorded within the 500 m turbine buffer and lack of foraging records, it is considered that the proposed development site is not important for these species.

5.3.8.7 Identifying key ornithological receptors

The desk-based study and two years of ornithological surveys, with an additional winter, have identified the following species as key ornithological receptors. Based on the criteria listed in **Table 5.9** (Percival, 2003) for assessing sensitivity of avian populations the key ornithological receptors are as follows:

Very high sensitivity

- Species included in this category are those cited as Qualifying Interests (QIs) for Special Protection Areas (SPAs). A potential source-receptor pathway (hydrological link) was identified between the proposed development site and downstream SPAs, notably kingfisher the sole QI of the River Boyne and River Blackwater SPA. Kingfishers were not recorded in the study area and watercourses (drainage channels) in the proposed development site were assessed as largely unsuitable nesting banks for this species. Potential impacts to kingfisher are related to deterioration in water quality and this is assessed in the sections covering designated sites (see **Section 5.4.2.1** & **Section 5.4.3.1**).

High sensitivity

- Hen harrier – non-breeding, very occasional observations (3 dates in 3 winters).

Medium sensitivity

- Woodcock – breeding territories/nest sites in woodland/scrub;
- Kestrel – high levels of foraging activity recorded;
- Golden plover – wintering flocks (100-200 birds) foraging;
- Lapwing – one pair attempting to breed;
- Snipe – breeding and wintering in small numbers;
- Swift – small foraging parties (up to 12 birds); and
- Red listed passerines: redwing (wintering), grey wagtail (non-breeding), meadow pipit (breeding/wintering) and yellowhammer (one pair).

The following medium sensitivity species are included as populations/individuals listed as Annex I species, occasionally occurring (as non-breeding birds) within and/or adjacent to the proposed development:-

- Whooper swan – low number of commuting flights involving small numbers;
- Greenland white-fronted geese – very low number of commuting flights involving relatively small numbers (< 50 birds);
- Merlin – low level of site usage by foraging birds over the winter; and
- Peregrine – low level of site usage by foraging birds over the winter.

Low sensitivity

- Assemblage of Amber listed breeding passerines, particularly those breeding woodland, treelines, hedgerows and scrub, including: goldcrest, willow warbler, spotted flycatcher, starling, greenfinch;
- Mallard – small numbers (< 10 birds) wintering and probably breeding;
- Teal – small numbers (up to 65 birds) wintering and probably breeding; and
- Lesser black-backed gulls – low number of commuting flights involving small numbers (up to 15 birds).

The following low sensitivity species are included as populations/individuals that are Amber listed, occasionally occurring (as non-breeding birds) within and/or adjacent to the proposed development:-

- Cormorant – very low number of commuting flights involving small numbers;
- Mute swan – very low number of commuting flights involving small numbers;
- Goshawk - very low number of flights; and
- Black-headed gull – very low number of commuting flights involving small numbers.

Green Listed Target Species – Local (Higher) Importance

- Buzzard – one territory identified within proposed development site, high usage of proposed development site; and
- Sparrowhawk – two territories identified within proposed development site, high usage of proposed development site.

5.3.9 Terrestrial (Non-volant) Mammals

A map showing the proposed infrastructure in relation to the location of resting places for protected mammal species (considered as important ecological features) is provided is **Annex 5.8**. Several native species of mammals afforded protection under Section 23 of the Wildlife Act (1976) as amended 2000 and listed on the Fifth Schedule

were recorded within the proposed development site, including otter *Lutra lutra*, badger *Meles meles*, pine marten *Martes martes* and Irish hare *Lepus timidus hibernicus*. Otter is also listed in Annex II of the Habitats Directive and there is a downstream SAC (River Boyne and River Blackwater SAC), where otter is listed as a Qualifying Interest (QI). No evidence of red squirrel *Sciurus vulgaris* was recorded within the proposed development site, although the older growth woodlands on the periphery of the proposed development site were noted as suitable.

The following sections provide species accounts for these five mammals; otter, badger, pine marten, Irish hare and red squirrel. These mammals were considered important ecological features occurring within or adjacent the proposed development site and are carried through for further assessment.

Other mammal species recorded included pygmy shrews *Sorex minutus*, which were commonly heard in the spring and occasionally found dead. No evidence of the non-native greater white-toothed shrew *Crocidura russula* was observed (often found dead in spring), although it has been recorded in the wider area. Other protected mammal species not recorded that have the potential to occur include Irish stoat *Mustela erminea hibernica* and hedgehog *Erinaceus europaeus*.

Foxes *Vulpes vulpes*, as well as non-native rabbits *Oryctolagus cuniculus*, were common throughout the area. These species are not listed as protected mammals on the Fifth Schedule.

Fallow deer *Dama dama* and evidence of rats (almost certainly brown rats *Rattus norvegicus*) were the only invasive alien mammal species, as listed on Third Schedule [under Regulations 49 & 50* (*not enacted) in the EC (Birds and Natural Habitats) Regulations 2011] that were recorded within the proposed development site. The area was considered suitable for other non-native mammal species, including mink *Neovision vision* and grey squirrel *Sciurus carolinensis*, which have been recorded in the wider area – see **Table 5.15**.

Otter

Otters are a Qualifying Interest (QI) of the downstream River Boyne and River Blackwater SAC. Otters are reported as occurring throughout the SAC (NPWS, 2014)[111]. As shown in **Annex 5.8**, otter signs (spraints) were recorded in several locations along drainage channels within the proposed development site. No otter holts or layups were located within the proposed development site. It is considered that otter utilise the network of drains to commute through the area and Bracklin Lough, which lies just outside the proposed development site, is likely to offer the only substantial foraging opportunities for otter. The lough is reported to have been stocked with fish.

Badger

Two large main setts (5-10 entrances) were identified within the Lands-Made-Available for the project, with evidence of well-worn trails leading between the two areas. The setts were located c. 700 m apart, with one main sett located within the copse surrounding the crypt, north of T2. This sett is located > 30 m from the proposed

111 NPWS (2014). Site Synopsis: River Boyne and River Blackwater SAC [Site Code: 00229]. National Park & Wildlife Service

development site and > 150 m from the closest proposed infrastructure and therefore, was considered beyond the zone of influence of the project.

The other main sett was located adjacent to the proposed substation. This sett had multiple sett entrances dug into a bank on the opposite side a drain from the proposed substation. The substation was re-designed to avoid directly impacting upon this sett. In spring 2021 the sett near the substation was noted as being very active and likely to be in use as a maternity sett. The drain runs NNW-SSE along the edge of a long-established beech treeline and this ditch forms a natural barrier between the substation and sett. Given the depth of the drain and height of the water table it is considered highly unlikely that badgers will burrow east under the wet drain. Therefore, the risk of directly disturbing a badger tunnel on the east side of the drain is considered low. Heavily used badger trails track away from the setts, heading north - south along the western edge of the drain/embankment; and there was no evidence of regular through flow of animals into the plantation to the east, which is the location of the proposed substation.

Several more isolated setts were located between the crypt and the substation wood, including an outlier sett in the earth bank adjacent to the existing track that will be upgraded to facilitate access to T2. The track layout was designed to ensure a 30 m standoff from this outlier sett was achieved. Other outliers or small subsidiary setts were located in treelined earth banks north of T4 and there was an inactive burrow recorded along the treeline NE of T5.

Along the proposed grid connection route badger activity was commonly recorded, including trails and forging signs. The only setts encountered was along the stream section, where a freshly dug single entrance sett was located on the north side of the stream, i.e. on the opposite side of the stream to the proposed works and therefore beyond the zone of influence.

Pine Marten

There was evidence of pine marten activity (scats) throughout the wooded parts of the proposed development site, and several animals were spotted during VP watches or when driving between survey locations. The old growth woodland on the periphery of the proposed development site has the potential to provide natural tree cavities for dens; however, none were located in the areas surveyed. No suitable den sites were identified within proposed works corridor for the proposed development, which largely avoids the old growth woodland with veteran trees capable of supporting pine marten dens. Increasingly, pine martens are being recorded as utilising man-made structures such as dens (e.g. attic and roof spaces) and the abandoned cottage near the proposed site entrance was noted has having potential in this regard.

Irish Hare

Irish hares were commonly recorded within the proposed development site, especially during VP watched and were considered likely to be breeding in the area. While hares are protected under the Wildlife Act (1976) as amended (2000), it is also cited in this Act as a quarry species that may be hunted in season.

Red Squirrel

Red squirrels are an arboreal species reliant on woodland habitats. Existing records for red squirrel in the vicinity of the proposed development are limited and were recorded from relatively distant blocks of woodland. The distribution of woodland

across much of Co. Westmeath and Co. Meath is relatively patchy and fragmented, although a level of connectivity is provided by hedgerows and treelines. During multi-disciplinary surveys woodlands within the proposed development site were searched for signs for red squirrel, e.g. gnawed pine cones and dreys, however no evidence of this species was detected.

The old growth woodland on the periphery of the proposed development site was assessed as suitable for red squirrel, providing a diversity of seed/fruit producing species for food. However, the extent of old growth woodland was somewhat limited, compared to the relatively recently planted plantations of spruce and ash (< 20-25 years). These immature monocrop plantations within the proposed development site were considered sub-optimal for red squirrel, as they were only just starting to attain seed-bearing age; and therefore, were unlikely to provide suitable foraging habitat for this species (Gurnell *et al*., 2009)[112]

5.3.10 Bats

The bat surveys at the proposed development site, were carried out using a range of survey methods and techniques including; investigations for potential roost features (PRFs), surveys at potential roosts, walked transects and the use of static bat detectors between May and September. This survey effort provided robust information to facilitate an understanding of how bat populations utilise the study area. This section summarises the main findings of bat surveys conducted in 2020 and 2021. The full breakdown of the baseline conditions (relative to bats) on the proposed development site are provided, in detail, within the Bat Report at **Annex 5.5** (**Section 3 & 4**) of this Report.

5.3.10.1 Baseline Value to Bat Populations

Based on the baseline survey data collected during the 2020 field surveys and included at **Annex 5.5**, and using the criteria set out in **Table 5.8,** it is considered that the study area scored:-

- 4 for roosts/potential roosts nearby;
- 5 for foraging habitat characteristics;
- The following for number of bats:-
    - 20 for number of bats for common pipistrelle and soprano pipistrelle;
    - 10 to 20 for number of bats for Leisler's bat; and
    - 10 for number of bats for Myotis species, Nathusius' pipistrelle and brown long-eared bat.

This equates to species specific scores of:-

- 31 for common pipistrelles and soprano pipistrelles. This ranks the proposed development site as holding foraging populations of these species that are of Regional Importance;
- 24 to 34 for Leisler's bat. This ranks the proposed development site as holding foraging populations of this species of County to Regional Importance;
- 24 for Myotis species (Daubenton's bat and Natterer's bat), Nathusius' pipistrelle and brown long-eared bats. This ranks the proposed development site as being of County Importance; and

112 Gurnell, J., Lurz, P., McDonald, R. & Pepper, H., (2009). *Practical techniques for surveying and monitoring squirrels. Practice Note*. Forestry Commission. Available at: https://www.rfs.org.uk/media/53625/squirrel-surveys.pdf

- 39 for Myotis species (Whiskered bat if occurring*). This ranks the proposed development site as being of Regional Importance.

*Note: Whiskered bats are considered to occur locally in small numbers across Ireland and it is acknowledged that it is a species that can go undetected during surveys (McAney, 2006)[113]. There were no records received from BCI within 10 km of the proposed development site and there are no records for Co. Westmeath/Co. Meath published on NBDC Biodiversity Maps. The closest locations of Whiskered bat occurrence are over 20 km from the proposed development. The species could potentially occur on a site with similar characteristics to that of the proposed development; however, expected occurrence would be considered unlikely, and as the risk of collision for *Myotis* species is considered low further consideration is only given to this species within its Genus (i.e. as *Myotis* species).

With the exception of Nathusius' pipistrelle (and whiskered bat if it occurred), the bat species recorded utilising the proposed development site are generally considered common and widespread in an Irish context (Marnell *et al*., 2009 & Roche *et al*., 2014[114]). Taking into account the EU Annex IV protected status of bats, the bat assemblage is considered to represent a feature of *Regional Importance*.

5.3.10.2 Bat Risk Assessment

The results from bat surveys conducted over the active season of 2020 show a level of activity that would be expected at a site with connecting patches of scrub, small plantations, bog woodland, defunct hedgerows, broadleaf woodlands and treelines. An initial (Stage 1) potential risk assessment for the proposed development site was carried out using the risk assessment matrix provided in SNH *et al*. (2019) – Table 3a. For habitat risk, *Moderate* was entered into the matrix as the proposed development site was assessed to have:-

- Buildings trees or other structures with moderate-high potential as roost sites on or near the site;
- Habitat could be used extensively by foraging bats; and
- Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.

For project size the Medium category was selected, as this is the best fits the proposed development. These two parameters returned a site risk score of 3, which is considered a medium site risk.

The next of step of the risk assessment (Stage 2) uses a second matrix (Table 3b in SNH *et al*., 2019) to derive an overall risk assessment based on the activity level of high collision risk species, which in this instance are Leisler's bat, common pipistrelle, soprano pipistrelle, and Nathusius' pipistrelle. The Stage 2 - risk assessment matrix is reproduced in **Table 5.24** and for each of the four high collision risk species the activity score is multiplied by the site risk score, which as stated above was determined to be 3 – medium risk site. Activity levels are derived from Ecobat; however, consideration is

113 McAney, K. (2006) A conservation plan for Irish vesper bats. Irish Wildlife Manuals, No. 20. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

114 Roche, N., Aughney, T., Marnell, F. & Lundy, M. (2014). Irish Bats in the 21st Century. Bat Conservation Ireland. Cavan, Ireland

also given to activity levels derived from Kepel *et al*. (2011) and both are summarised in the following bullet points:-

- Based on Kepel *et al*. (2011), activity record by the majority of static deployments was high on a site wide basis for common pipistrelle and soprano pipistrelle activity. Activity for Leisler's bat was low with occasional high activity at specific deployment locations during spring and summer – notably at deployment location D.09, which was a location where the turbine initially proposed for this location was omitted from the final design. Activity for *Myotis* species, brown long-eared bats and Nathusius' bats was assessed low throughout the survey; and
- Based on the SNH *et al*. (2019) activity categories used to describe the percentile outputs generated by Ecobat, the overall levels of bat activity for the turbine location surveyed and across all three seasonal deployments in 2020 found *high* levels of activity for common pipistrelles, *moderate/high* levels of activity for soprano pipistrelles, *moderate* levels of activity for Leisler's bats and ***moderate/low*** levels for *Myotis species*, brown long-eared bats and Nathusius' pipistrelles. As detailed in **Annex 5.5** (see **Table 10** and **Table 11**) specific deployment locations in specific seasons and specific nights were flagged as generating high or moderate high levels of bat activity.

Potential site risk level	**Ecobat activity category** (or equivalent justified categorisation)					
	0 Nil	**1 Low**	**2 Low-moderate**	**3 Moderate**	**4 Moderate-high**	**5 High**
1 Lowest	0	1	2	3	4	5
2 Low	0	2	4	6	8	10
3 Medium	0	3	6	9	12	15
4 High	0	4	8	12	15	18
5 Highest	0	5	10	15	20	25

Table 5.24: Stage 2 – Overall risk assessment matrix

Source: SNH *et al*. (2019)

For common pipistrelles, categorised by Ecobat as having high activity levels, the Stage 2 risk assessment matrix returns a score of 15 – high risk.

For soprano pipistrelles, categorised by Ecobat as having moderate/high activity levels, the Stage 2 risk assessment matrix returns a score of 12 – medium risk.

For Leisler's bat, categorised by Ecobat as having moderate activity levels, the Stage 2 risk assessment returns a score of 9 – medium risk.

For Nathusius' pipistrelles, categorised by Ecobat as having moderate/low activity levels, the Stage 2 risk assessment returns a score of 6 – medium risk.

To account for seasonal or localised peaks in activity SNH et al. (2019) note the importance of also assessing the highest levels of activity recorded for each of the high collision risk species within the proposed development site.

Common pipistrelles, soprano pipistrelles and Leisler's bat were all scored as having local and seasonal high activity levels, which returns a Stage 2 risk assessment matrix maximum score of 15 – high risk.

The outputs of the overall risk assessment are then considered in the context of any potential impacts at the population level for species assessed having high population vulnerability (see **Table 5.7**), which in Irish context are Leisler's bat and Nathusius' pipistrelle.

Annex 5.5 (see **Table 20**) provides a summary of bat population vulnerability to wind farm impacts (see **Table 5.7**), species activity recorded at the proposed development site (low, medium, high based on Kepel *et al*., 2011 and high, moderate-high based on SNH *et al*., 2019) and the regional importance attached to bat populations found to occur at the proposed development site (locally to internationally important based on Wray *et al*, 2010 – see **Table 5.8**).

5.4 Description of Likely Effects

This section assesses the like significant effects of the proposed development on the important ecological features, as outlined in **Table 5.25**. Direct and secondary (indirect) effects are considered in turn under the following headings:

- 'Do Nothing' Scenario;
- Construction Phase;
- Operational Phase;
- Decommissioning Phase; and
- Cumulative Effects

The potential for cumulative effects during the construction and operatorial phases of the proposal are assessed at the end of each relevant section. No potential for transboundary effects were identified.

5.4.1 'Do Nothing' Scenario

The proposed development site encompasses agricultural land, farmland and commercial forestry plantation that are currently managed through a combination of intensively managed pasture, tillage regimes and agroforestry practices. If the proposed development does not proceed, the area is considered likely to remain in use for agriculture/forestry purposes.

Ecological Feature	Important Ecological Features Identified	Highest Geographic Evaluation
Designated sites Downstream hydrological connection with two Natura 2000 sites. No source-receptor pathways with NHAs/pNHAs	River Boyne & River Blackwater SAC Qualifying Interest • River lamprey • Salmon • Otter NIS determined that there were no source-receptor pathways with QI habitats: Alkaline fen or Alluvial forests River Boyne & River Blackwater SPA Qualifying Interest • Kingfisher	International importance International importance
Habitats	[FW4] Drainage ditch [WD1] Mixed broadleaved woodland Mosaic of [WN1] Oak-birch-holly woodland and [WN7] Bog woodland [WN7] Annex I *Bog woodland [WL1] Hedgerows [WL2] Treeline	Local importance (Higher Value) Local importance (Higher Value) Local importance (Higher Value) to County (Regional) Importance (BAP) County (Regional) Importance Local importance (Higher Value) Local importance (Higher Value)
Freshwater ecology Hydrological connection with fish & crayfish populations	Salmon Lamprey Otter/kingfisher – see above designated sites White-clawed crayfish	International importance International importance International importance County (Regional) Importance
Invertebrates	No protect terrestrial species identified White-clawed crayfish – see above	N/A
Amphibians & reptiles	None identified	N/A
Birds	Hen harrier (wintering)	High sensitivity (Percival, 2003)
	Woodcock (breeding) Golden plover (wintering) Lapwing (breeding) Snipe (breeding & wintering) Kestrel (breeding & wintering) Barn owl (breeding & wintering) Swift (foraging) Red listed passerines (breeding/wintering) Limited usage: whooper swan, Greenland white-fronted geese, merlin, peregrine	Medium sensitivity (Percival, 2003)
	Amber listed breeding passerines Mallard (wintering & breeding) Teal (wintering & breeding) Lesser black-backed gull (commuting) Limited usage: Cormorant, mute swan, goshawk, black-headed gull	Low sensitivity (Percival, 2003)
	General avian assemblage Buzzard (breeding & wintering) Sparrowhawk (breeding & wintering) Limited usage: grey heron, jack snipe, green sandpiper, gyrfalcon	Overall avian assemblage including Green listed breeding species and target species exhibiting high usage, considered as having local importance (higher value).
Terrestrial mammals	Otter Badger Pine marten Irish hare Red squirrel	International importance Local importance (Higher Value) Local importance (Higher Value) Local importance (Higher Value) Local importance (Higher Value)
Bats	Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Leisler's bat *Myotis* species Brown long-eared bat	Regional Importance (Wray *et al.* 2010) Regional Importance (Wray *et al.* 2010) County Importance (Wray *et al.* 2010) Regional Importance (Wray *et al.* 2010) County Importance (Wray *et al.* 2010) County Importance (Wray *et al.* 2010)

Table 5.25: Summary of Important Ecological Features Identified

5.4.2 Construction Phase

The construction phase will result in a certain amount of inevitable impact, largely in the form of habitat loss/alteration and disturbance to facilitate construction of site access tracks, turbine bases, hardstand areas, substation and excavation for the cabling trenches to facilitate grid connection, which is underground. During the construction phase tree felling operations will be undertaken to implement turbulence buffers around turbines and for mitigation to maintain 50 m standoffs between rotor swept areas and features utilised by bats (50 m bat feature buffer).

The likelihood of significant effects upon ecological features along the haul route, where modifications to areas may be required to facilitate the passage of large vehicles and components, was assessed. There is no potential for significant effects, which will be avoided by utilising the existing road network for the transportation of turbines to the site. Any works associated with haul route relate to modification of existing infrastructure, e.g. temporary removal of road signage, temporary hard surface of roundabouts.

Timing of the construction works will have an effect on the level and type of impact, since a number of species are known to be seasonally sensitive or seasonally located within and adjacent to the proposed construction corridor, such as breeding birds and breeding badgers. In terms of the zone of influence for construction works, potential for direct effects to occur were assessed within 20m of the proposed site infrastructure, including temporary features (site compound, deposition areas) and for the grid connection route this was reduced to 5m. This assessment area is referred to as the works/construction corridor. Indirect effect on ecological receptors to works occurring with the construction corridor are assessed with regard to types of works proposed and the sensitives of the receptor, as published.

Typically, the construction phase for wind farm development is less than two years, therefore for ornithological receptors temporal magnitude of disturbance effects emanating from the construction phase of the project will be *Temporary – short term* (Percival, 2003) or for other important ecological features *short-term effects* (EPA, 2017).

Likely significant effects during the construction phase encompass both direct and secondary effects, which are summarised as follows:

Likely Sources of Direct Effects During the Construction Phase

- Clearance of vegetation, soil and rock for access road, hardstands and turbine bases;
- Clearance of woodland around turbines to facilitate proposed development infrastructure and reduce turbulence;
- Clearance of woodland around turbines to implement 50 m bat feature buffers;
- Creation of temporary infrastructure such as site compound, blade set-down areas and crane pads;
- Excavation trenches for cable ducting; and
- Placement of material arising from infrastructure works.

Note: The removal of vegetation around turbines to create 50 m separation distance between rotor swept areas and potential bat features is a mitigation measure and should technically be considered under the section on likely operational phase effects of the project. However, to avoid duplication in

assessment of likely significant effects and because there is considerable overlap between felling required for both bat feature buffers and site infrastructure/ turbulence reduction buffers, the areas to be targeted for felling have been combined and are assessed together as construction phase effects, unless otherwise stated.

Likely Sources of Secondary Effects During the Construction Phase

- Stockpiling of materials on-site (run-off, erosion etc.);
- Collection/drainage of surface water runoff;
- Spreading of non-native plant species; and
- Construction activity/noise resulting in avoidance by birds and mammals due to disturbance.

5.4.2.1 Likely Construction Phase Effects on Designated Sites

As detailed in the NIS (Woodrow, 2021) and summarised in **Section 5.3.3.1** of this Chapter, only two internationally-designated sites were identified as falling within the potential zone of influence of the proposed development. For both the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA there is a degree of biological connectivity with the proposed development site via a downstream hydrological connection.

No other source-receptor pathways between the proposed development site and sites designated for conservation were identified, including nationally designed sites (NHAs) or proposed conservation sites (pNHAs).

Likely Direct Effects During the Construction Phase

As detailed in **Section 5.3.3.1**, the proposed development is not located within or directly adjacent to any Natura 2000 site (SAC/SPA), nationally designed site (NHA) or proposed conservation site (pNHA). Therefore, construction works will not directly impact on any sites designated for nature conservation.

Likely Secondary Effects During the Construction Phase

A bird study investigating bird usage of the proposed development site and its environs (as detailed in **Section 5.3.8**) has ruled out any source-receptor pathways between the proposed development and any SPA supporting wintering waterbirds, specifically the Lough Derravaragh SPA which falls within 15 km from the proposed development.

As detailed in the NIS (Woodrow, 2021), in the absence of mitigation, the proposed development has the potential to have indirect impacts upon designated features of two downstream internationally-protected Natura 2000 sites, specifically the River Boyne and River Blackwater SAC and SPA. This is through the potential for deterioration in water quality caused by entry of pollutants or suspended solids into drains flowing adjacent to the proposed works corridor. Construction works are not anticipated to affect water levels downstream of the proposed development site.

The potential impact on Natura 2000 sites has been assessed within the NIS (Woodrow, 2021). Potential for significant effects were identified for the following Qualifying Interests (QIs):

- [1099] River lamprey *Lampetra fluviatilis*;
- [1106] Atlantic salmon *Salmo salar*;

- [1355] Otter *Lutra lutra*;
- [91E0] Alluvial forests with *Alnus glutinosa* & *Fraxinus excelsior**; and
- [A229] Kingfisher *Alcedo athis*

Kingfisher (listed as QI for the SPA) and Annex II species (listed as QI of the SAC), specifically salmon, lamprey and otter are sensitive to water pollution. Reduction in water quality through sedimentation can result in inhibition of respiration in aquatic organisms, particularly salmonids. Siltation can result in smothering of fish eggs and affecting suitability of spawning locations. The accidental release of toxic chemicals (hydrocarbons) and materials (cement & concrete) into surface waters can poison fish and other aquatic organisms. Prolonged deterioration in water quality would impact on food sources for otters and kingfishers, as well as salmon and lamprey – see further discussion of likely effects on aquatic ecology in **Section 5.4.2.3**.

In the absence of mitigation and without consideration given to dilution effects, regularly occurring diffuse levels of pollution and/or worst-case scenario pollution incidents during construction could result in a significant detrimental change in water quality in the stream/drain located adjacent to the construction corridor; and either alone or in combination with other projects or plans could result in indirect pollution mediated effects on QI species that are considered *significant* at the *International* scale.

Alluvial forests are generally removed from the water environment, except in times of flooding and while surface waters are noted as having an impact on alluvial woodland in Ireland, the occurrence is low; and this instance this habitat is not considered to be at risk from water pollution. The main threats to alluvial forests include fragmented nature, abundance of alien invasive species and sub-optimal grazing regimes and drainage (O'Neill *et al*. 2013)[115]. Therefore, it is considered that there is no reasonable link, as there is no link to land use within SAC; and therefore, no likelihood for influence of grazing regimes or drainage. Any effects are considered *Not Significant*.

5.4.2.2 Likely Significant Effects on Habitats - Construction Phase

Likely Direct Effects During the Construction Phase

Construction of wind farm infrastructure will result in direct habitat loss that is considered permanent (30-year life span of the project).

As given in **Habitats that** are identified as being Important Ecological Features for the purposes of this impact assessment are marked with a *

Table 5.26, the infrastructural footprint of the project was designed to avoid the most sensitive habitats within the lands-made-available, including bog woodland [WN7] and oak-birch-holly woodland [WN1]. Direct habitat loss due to the footprint of the proposed development will result in the loss of 0.45ha of mixed broadleaved woodland (not classified as commercial broadleaf plantation), 459m of treelines [WL2] and 67m of hedgerow [WL1], which is considered to have the potential to be *Significant* at the *Local (higher)* scale.

115 O'Neill, F.H. & Barron, S.J. (2013). Results of monitoring survey of old sessile oak woods and alluvial forests. *Irish Wildlife Manuals*, No. 71. NPWS, DoAHG, Dublin, Ireland

An ephemeral scrape of 0.19ha (0.06ha ephemeral) was classed as [FL8] Artificial lakes and ponds. Typically, ponds are assigned an importance rating of Local (higher value), as they support a range of biodiversity, such as dragonflies and amphibians. However as described in the ecological baseline the scrape is considered to be largely ephemeral and highly eutrophic, with limited value for wildlife due its isolation and the dominance of filamentous algae in the small central area holding water. Therefore, the scrape was not considered an important ecological feature and has been rated as being of local (lower value) importance. The area of the scrape is proposed as a peat storage area and will be permanently infilled and brought back into agriculture production. The permanent effect is considered *Significant* on an ecological feature of *Local (Lower value)* importance.

All the watercourses within the proposed development site are either drains or modified (channelised) streams and have been classified as [FW4] drainage ditches, including the main channel flowing through the proposed development site. Despite the modified nature of these linear features, they are likely to provide connectivity and foraging opportunity for aquatic species, including otter. Therefore, these habitat features are classed as being of *Local (higher)* Importance. At several points the proposed access track crosses the main channel and construction works will involve the installation of culverts. In addition, construction works along sections of the proposed track will involve upgrading existing farm and forestry tracks that run directly adjacent to these watercourses. While construction works will directly impact the banks of these drains and channels, especially at crossing points; it is considered that any direct impacts on stream ecology will be localised in effect ranging from *neutral* to *imperceptible*. The overall functioning of the drainage channels in terms of flow will remain unchanged. Taking these points into account, the potential for direct effects on watercourses resulting from the construction phase is considered to be *Not Significant.* Likely effects on ecology relating to water quality within water courses are covered in **Section 5.4.2.1** and **Section 5.4.2.3**.

Implementation of turbulence reduction buffers and bat feature buffers around proposed turbines (T4, T5, T6, T7, T10 and T11), predominately commercial forestry plantations. However, these habitats will be converted to agricultural grasslands and therefore the likely significant effects are considered as habitat alteration, as opposed to permanent loss under site infrastructure. Likewise, tree felling is required to facilitate access along parts of the tracks, including the site entrance, the turn to T1 and around the proposed substation to satisfy infrastructural standoffs to damage from falling trees.

The clearance of vegetation for turbulence reduction buffers and bat feature buffer comprises the loss of 1.54ha of non-Annex I bog woodland [WN7] at T10 and a total of 1.37km of treelines considered to have the potential to be *Significant* at the *Local (higher)* scale. The proposed felling also has the potential (unless avoided) to impact on 0.18ha of Annex I priority habitat Bog woodland [WN7] adjacent to T10 considered to have the potential to be *Significant* at the *County* scale. Likewise, felling around T11 has the potential (unless avoided) to impact on 0.19 ha of oak-birch-holly woodland [WN1].

The proposed infrastructural footprint for the wind farm requires the removal of commercial forestry plantations, which including turbulence reduction buffers/bat feature buffers/substation buffer equates to 16.3ha of conifer plantation [WD4] and 4.41ha of relatively young broadleaved (mostly ash) plantations [WD1]. While the

wildlife value of commercial plantations is considered of lower local value due to the dominance of single crop blocks (mostly Sitka spruce or ash), they can provide shelter, connectivity and edge effect for certain woodland species. These impacts are assessed on a species-by-species basis in the following sections; and it is considered that where removal of plantations is required there will be no overall loss of features benefiting wildlife, such as forestry rides and edge effects. In addition, the outbreak of ash dieback in Ireland may require the pre-mature removal of these ash plantation to control the spread of the fungus. Therefore, the potential effects due to loss of commercial plantations are assessed as *Imperceptible* at the *Local (lower)* scale.

The inherently low wildlife value of arable crop [BC1] and improved grassland [GA1], as well as the relative abundance of these habitats in the environs, means that direct habitat loss due to construction is assessed as *Not significant*.

It is anticipated that the part of the trench for the grid connection to be excavated along the existing road will have no direct impact on sensitive habitats. The section exiting the proposed development site at T10 will involve excavation of a trench through bog woodland (non-Annex I), including clearance of vegetation to facilitate access of machinery (5 m wide strip) over a length of c. 140 m. This area (0.09ha) of woodland is heavily infested with cherry laurel and after clearance works the native tree species that occur, including birch and willow are capable of relatively quick regeneration (pioneering species). Over ten years the area will have recovered. Therefore, it is assessed that clearance of a thin strip of vegetation is unlikely to have any lasting negative effects on the poor-quality woodland habitats in this area, i.e. *slight*, *short to medium-term* effects at the *Local (higher)* scale. The two sections of the proposed grid connection route that deviate from the local road will both involve excavation of improved grassland, with one short length (c. 220 m) passing through an area of cutaway bog that appeared to be in the process of being converted to improved grassland (parts currently under wild-bird cover). Once cabling is installed the trench will be backfilled and the grassland allowed to recover. Therefore, any of the *slight* effects will be *temporary* at the *Local (lower) scale* and given the inherently low wildlife value the impact is assessed to be *Not significant*. At a number of points along the route, short sections (<1 m wide) of vegetation forming linear features will need to be removed to facilitate ducting works. This includes sections from four hedges and one treeline (small wood). Even in the absence of mitigation, it is anticipated that the small gaps created within these hedgerows would fill in naturally over time. Therefore, any effects are assessed as being highly localised, *imperceptible* and *short-term* at the *Local (higher) scale*. Similarly, the of excavation of a trench through the treeline/thin woodland (c. 10 m wide) would result in *slight* effects at the *Local (higher) scale* that would recover over the *medium term*.

Habitat types Fossitt (2000) code	Linear features (m)			Areas of habitats (ha)													Footprint Area (ha)
	FW4*	WL1*	WL2*	BC1	BL3	FL8	GA1	GS2*	PB4	WD1 - plantation	WD1 - older*	WD4	WN1*	WN7 – Non-Annex*	WN7 – Annex I*	WS5	
Total lengths/areas within redline boundary	3,057 10,703	1,065	7,772	82.98	4.33	0.19	68.89	1.65	0.48	21.78	4.72	57.68	6.99	5.21	0.199	3.45	258.52 **(269.43)**
Infrastructural elements – areas of habitat loss For FW4 lengths given reflect locations directly affected by proposed development For access tracks 5m allowance for track with 10m taken for WL1/2 intersections & 5m for watercourse crossing points For grid route & cabling not associated with other infrastructure a 5m work corridor was applied																	Area without linear habitat **(Overall area)**
Site compound				0.393													0.393 **(0.39)**
Spoil storage areas (x2)				3.391		0.192											3.583 **(3.58)**
Access track	190	31	124	0.533	0.921		0.676	0.160		0.174	0.066	0.893				0.029	3.425 **(3.60)**
Grid route (from T10)	10	5			2,153m on road		1.180	0.004	0.020				0.009	0.104		0.037	**4,660m**
Cabling (not associated with other infrastructure)	409				0.083		0.205					0.090					**755m**
Substation											0.380	1.175					1.555 **(1.56)**
T01 - hardstand							1.032										1.032 **(1.32)**
T02 - hardstand			21	0.720	0.013												0.733 **(0.74)**
T03 - hardstand	30	31		0.950	0.034					0.013							0.997 **(1.00)**
T04 - hardstand	78		69	0.302						0.403							0.705 **(0.77)**
T05 - hardstand	32		104				0.510					0.522					1.032 **(1.03)**
T06 - hardstand					0.035					0.249		0.744					1.029 **(1.03)**
T07 - hardstand	85		141		0.009					0.033		0.708					0.750 **(1.00)**
T10 - hardstand																0.699	0.775 **(0.78)**
T11 - hardstand							0.077					0.923					1.000 **(1.00)**
Met. mast				0.024													0.024 **(0.02)**
Met. mast hardstand				0.122	0.003												0.125 **(0.13)**
MV switchgear room							0.037										0.037 **(0.04)**
Total habitat affected by infrastructural elements	834m	67m	459m	6.435	2.078	0.192	3.717	0.164	0.020	0.872	0.446	5.055	0.009	0.114	0.000	0.765	19.652ha
% Habitat affected	6	6	6	8	48	100	5	10	4	4	9	9	0	2	0	22	7.5

Felling areas for substation, turbulence reduction buffers and bat feature buffers																Area without linear habitat **(Overall area)**
Habitat types Fossitt (2000) code	**Linear features (m)**			**Areas of habitats (ha)**												**Footprint Area (ha)**
	FW4*	WL1*	WL2*	BC1	BL3	FL8	GA1	GS2*	PB4	WD1 - plantation	WD1 - older*	WD4	WN1*	WN7 – Non-Annex*	WN7 – Annex I*	WS5	
Site entrance	66		56									0.117					0.117 **(0.18)**
Turn to T1	138		73									0.129					0.129 **(0.17)**
Grid route from T10														0.089			0.089 **(0.09)**
Substation felling											0.700	2.106					2.806 **(2.81)**
T04	383		383							2.189		0.030					2.219 **(2.46)**
T05	273		512									2.875					2.875 **(3.55)**
T06										1.189		4.593					5.782 **(5.85)**
T07	529		347							1.03		3.972					5.002 **(5.33)**
T10														1.445		2.447	3.892 **(3.92)**
T11	143											2.492					2.492 **(2.49)**
Total habitat alteration for felling	1,532		1,371							4.408	0.700	16.314		1.534		2.447	25.401 **(26.87)** Turbine buffers = 23.62
% Habitat affect by alteration	11		17							20	15	28.3		30		71	10

Habitats that are identified as being Important Ecological Features for the purposes of this impact assessment are marked with a *

Table 5.26: Habitats associated with the proposed infrastructure and felling around turbines to limit turbulence/bat feature buffers

Likely secondary effects during the Construction Phase

Likely secondary effects on habitats during the construction phase can be caused by smothering due to sediment wash-out from cleared areas, deposition areas or dewatering of excavations. The nature of such effects is usually localised and some habitats are more sensitive than others, in particular aquatic habitats or more specifically aquatic ecosystems. **Section 5.4.2.3** assesses potential impacts on watercourses and downstream ecology further. Without control measures the impact of sedimentation on habitats within local drainage channels has the potential for *Significant* effects at the *Local (Higher)* scale.

In terms of effects on terrestrial habitats extended periods of heavy rain in association with extensive areas of cleared ground, for example, could result in significant washout of sediment onto surrounding areas, if uncontrolled. The majority of the habitats within the proposed development site would not be considered sensitive to this effect, including areas of commercial forestry and agricultural improved habitats. In the absence of mitigation, the effects of sediment smothering the understorey of native/semi-native woodlands occurring adjacent to works corridor has the potential for localised effects on Annex I bog woodland in particular, which would be considered *Significant* at the *County (Regional)* scale.

Compaction and excavation of soil adjacent to hedgerows/treelines has the potential cause damage and disease of plants. Dust due to construction activities has the potential to suppress plant growth by smothering photosynthetic activity. However, it is considered unlikely that dust will consistently reach levels that will have a measurable impact on woodland/hedgerow vegetation. In the absence of mitigation (root protection areas), compaction and excavation have the potential for *Significant* effects at the *Local (Higher)* scale.

In the absence of appropriate on biosecurity measures there is risk of spreading non-native species within the proposed development site, which if invasive can impact negatively on sensitive habitats. As indicated in **Table 5.19**, of the non-native species recorded within or adjacent to the proposed development site cherry laurel, snowberry, evergreen *Lonicera* shrubs, yellow archangel and montbretia were the species considered to be most at risk of being spread during the construction phase of the project. These species, and cherry laurel in particular, have the potentially for negative impacts on native plants and habitats.

No invasive aquatic plant species were recorded during surveys. No plant species listed under the Third Schedule of the European Communities (Birds and Habitats) Regulations 2011 as 'non-native species subject to restrictions under Regulations 49'[116] were recorded.

Cherry laurel was the most abundant and widely disturbed non-native species recorded. It is considered a high impact invasive species, especially in woodland

116 Regulation 49(2) of the European Communities (Birds and Habitats) Regulations 2011 states that any person who plants, disperses, allows or causes to disperse, spreads or otherwise causes to grow in any place specified in relation to such plant in the third column of Part 1 of the Third Schedule, any plant which is included in Part 1 of the Third Schedule, shall be guilty of an offence. Regulation 49(3) states that it shall be a defence to a charge of committing an offence under paragraph (2) to prove that the accused took all reasonable steps and exercised all due diligence to avoid committing the offence.

habitats, where it crowds out other native species (O'Flynn *et al*., 2014[117] and Kelly *et al*., 2013[118]). The stands of cherry laurel at Bracklyn were noted as prolifically fruiting and this is likely to have facilitated the proliferation of this species throughout the woodland in the area. The occurrence of dense stands already negatively impacts on the integrity of some older growth semi-natural woodland in the area. Unlike rhododendron which has a similar crowding out effect in woodland habitats; cherry laurel is not listed as a Third Schedule non-native species. Without mitigation spoil infected with seed and viable roots has the potential to result in the spread of this species.

As indicated in **Table 5.19**, snowberry is assessed as a low-risk invasive species and the invasive nature of evergreen *Lonicera* shrubs has not been assessed in Ireland. Although considered low risk in terms of invasiveness, in woodland and hedgerow habitats snowberry can form dense thickets of cover, which exclude native species and the same localised impact occurs where evergreen *Lonicera* shrubs have been introduced. These species occurred locally in wooded areas of the site and formed hedgerow sections along the proposed grid connection route. Without mitigation spoil infected with viable roots has the potential to result in the spread this species.

As indicated in **Table 5.19**, the invasiveness risk posed by montbretia has not been assessed. However, this non-native plant is included within the TII guidance document detailing management of non-native invasive plant species (NRA, 2010)[119]; and it is considered appropriate, in the interests of good practice and due diligence, to take steps to avoid spreading this species during works, either within the site or to other locations. Only two small clumps of montbretia were noted along the grid connection route; however, without mitigation spoil infected with corms has the potential to result in the spread of this species.

As indicated in **Table 5.19**, the only other non-native species considered as having the potential to result in negative effects was a patch of variegated yellow archangel along the grid connection route. Although the invasiveness risk posed by this species has not been assessed in Ireland, it is listed on Schedule 9 of the Wildlife and Countryside Act in England and Wales, which is the equivalent of the Ireland's Schedule III. Yellow archangel spreads easily and once it has escaped from gardens it can spread rapidly in the wild forming carpets in shaded areas at the edge of woodland, treeline and hedgerows. These carpets smother other vegetation forming dense patches of growth. Only one small patch of archangel was noted along the grid connection route; however, without mitigation spoil infected with parts of this plant has the potential to result in the spread of this species.

The impact of accidentally spreading invasive species into areas of native/semi-native woodlands occurring within and adjacent to the proposed development site has the potential for *Significant* effects at the *County (Regional)* scale for Annex I bog

117 O'Flynn, C., Kelly, J. & Lysaght, L. (2014). Ireland's invasive and non-native species – trends in introduction. *National Biodiversity Data Centre Series* No.2, Ireland. Available online at: http://www.biodiversityireland.ie/wordpress/wp-content/uploads/Trends-Report-2013.pdf

118 Kelly, J., O'Flynn, C. & Maguire, C. (2013). *Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland*. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland. Available online at: https://invasivespeciesireland.com/wp-content/uploads/2013/03/Risk-analysis-and-prioritization-29032012-FINAL.pdf

119 National Roads Authority (2010). *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads*. NRA. Dublin. Available online via: http://www.tii.ie/technical-services/environment/construction/

woodland and the mosaic of non-Annex I Oak-birch-holly woodland/Bog woodland in Bracklin Wood. Negative effects for mixed broadleaved woodland (non-plantation), treeline and hedgerows are assessed as *Significant* at the *Local (Higher)* scale.

5.4.2.3 Watercourses & Downstream Ecology – Likely Construction Phase Effects

The nature of the proposal means that likely significant effects may arise at both construction and operational phases. The most pertinent sources of impact and potential pathways for such proposals are considered to be:-

- The loss of natural watercourses due to stream/rivers crossings and the placement of culverts;
- Water quality degradation (both construction and operational phases) with pathways including surface water and groundwater;
- The diversion of natural streams to bypass construction zones;
- Increased suspended solids in streams within the proposed development site boundary during the construction phase; and
- The loss of freshwater habitats due to the removal or blockage of watercourse.

Likely Direct Effects During the Construction Phase

There is limited potential for direct impact on watercourses within the proposed development site as no viable natural streams or rivers exist within the proposed development site boundary. Additionally, downstream watercourses which are potentially viable (with salmon, lamprey and crayfish potential) are outside of the proposed development site boundary; and therefore, direct effects are not foreseen. Taking this into account, the potential for direct effects on watercourses resulting from the construction phase is assessed as being *Not Significant*.

Likely Secondary Effects During the Construction Phase

Likely secondary effects on downstream ecological receptors such as salmonids, lamprey and crayfish include the release of suspended solids, hydrocarbons or cement leachate into rivers such as the Deel, Stonyford and the Boyne to the west and east of the proposed development during the construction phase indirectly through hydrological connectivity.

Salmonid species require very high levels of water quality in order to complete their life cycles. High levels of suspended solid concentrations in waterbodies can affect the feeding and health of individual species through increased turbidity (inhibiting respiration through gills) and increased siltation affecting composition of riverbed substrate (reducing fry survival) and affecting spawning beds. Suspended solids often hold nutrients such as phosphorus or hydrocarbons that can result in eutrophication and reduced oxygen levels (with high oxygen levels being important for all life stages of Atlantic salmon, for example).

Densities of different life stages of salmon, particularly fry and parr, vary within a river catchment, limited often by the availability of suitable substrates. Young parr are territorial and defend small sections of the river channel used for intercepting edible particles within the current (Kalleberg, 1958)[120]. Habitat availability and quality are

120 Kalleberg H (1958). Observations in a stream tank of territoriality and competition in juvenile salmon and trout (Salmo salar L and S. trutta). Report of the Institute of Freshwater Research, Drottningholm 39, 55–98

intrinsically linked with survival rates and recruitment to smolt stages. Therefore, small amounts of debris entering a section of river important for vulnerable life stages of salmon and lamprey can have deleterious impacts, even in the short-term, on juvenile survival and habitat utility.

Release of hydrocarbons as a result of such events as fuel spills have the potential to impact on water quality as a result of reduced oxygen, thereby affecting the salmon and lamprey populations that required good oxygen supplies. Hydrocarbons are known to bioaccumulate in salmonids (e.g. McCain *et al*., 1990)[121], with Atlantic salmon known to be physically affected by short term exposure leading to loss of condition, and also known to avoid areas containing hydrocarbons (e.g. Maynard & Weber 1981)[122] leading to the effective loss of habitat or migration routes for the species.

The release of even small amounts of hydrocarbons into the watercourses adjacent to the site, has the potential to result in a significant impact on the downstream populations of Atlantic salmon. Hydrocarbons released due to inappropriate storage or dispensing of fuel could have detrimental effects on the habitats and species of interest.

There is potential hydrological connectivity from surface waters exiting the proposed turbine locations and downstream watercourses. The creation of temporary drainage during the construction phase may create connectivity from surface water drainage. Groundwater pathways is another vector for the transportation of contaminants downstream. The surrounding area of the site, under the Ground Waterbody WFD status 2013-2018 is classified as overall 'Good' status. As detailed in **Chapter 7**, due to the hydrogeological setting of the site (i.e. low permeability peat, silts and clays overlying a poor bedrock aquifer) and the near surface nature of construction activities, impacts effecting groundwater quality or water quantity arising from the proposed development are assessed as not likely.

Secondary effects upon watercourses and downstream ecology during the construction phase are assessed as having the potential to be *Significant* at the *International* scale for salmon, lamprey, otter and kingfisher, as discussed under impacts on designated sites (**Section 5.4.2.1**). For other downstream aquatic fauna, including white-clawed crayfish secondary effects during construction are assessed as having the potential to be *Significant* at the *Local (higher)* scale.

5.4.2.4 Amphibians & reptiles – Likely construction phase effects

Due to the lack of suitable habitat within the proposed development site smooth newt and common lizard were not included as important ecological features. Similarly, the works corridor largely avoids wetter parts of lands-made-available for the project with the potential to support spawning frog and this species was ruled out as an important ecological feature.

121 McCain, B.B., Malins, D.C., Krahn, M.M., Brown, D.W., Gronlund, W.D., Moore, L.K., Chan, S.L. (1990). Uptake of aromatic and chlorinated hydrocarbons by juvenile chinook salmon (Oncorhynchus tshawytscha) in an urban estuary. *Arch Environ Contam Toxicol*. 19:10–16. [PubMed]

122 Maynard, D.J. & Weber, D.D. (1981). Avoidance Reactions of Juvenile Coho Salmon (Oncorhynchus kisutch) to Monocyclic Aromatics. *Can. J. Fish. Aquat. Sci*. 38:772-778.

5.4.2.5 Avi-fauna – Likely Construction Phase Effects

In relation to ornithological impacts the timing of the construction works will have an effect on the level and type of impact, since a number of species are known to breed within and adjacent to the proposed construction corridor.

Hen harrier – Likely Construction Phase Effects

As described in the ornithological baseline, the habitat within and adjacent to the works corridor is considered unsuitable for breeding hen harrier. The closest confirmed breeding site to the proposed development was a single pair located c. 30 km away on the Westmeath-Longford border (Ruddock *et al*., 2016)[123]. No hen harrier roosts were located within or adjacent to the 500 m turbine buffer during roost searches. Hen harriers were only occasionally recorded foraging through the proposed development site on three dates over three non-breeding seasons.

As evidenced by the lack of breeding season records during the baseline study, the current distribution of breeding hen harriers is beyond the core breeding season foraging range of 2 km considered in SNH (2016)[124]. Based on the lack of historical occupancy and sub-optimal habitat availability (close thicket plantations), the possibility of hen harriers populating new breeding territories within 1-2 km of the works corridor was assessed as unlikely.

Therefore, taking account of the species' *high* population sensitivity (Percival, 2003), and based on the species' current distribution it is assessed that the potential direct impact of construction disturbance on breeding hen harriers is highly unlikely and therefore *not significant*. It is important to note that depending on ongoing forestry operations in the area, suitability could change over the next 5-10 years, leading to areas of clearfell/second rotation becoming occupied prior to or during construction.

In terms of indirect impact, as reviewed in Ruddock & Whitfield (2007)[125], hen harrier breeding activity in relation to the proposed development site is well beyond the maximum '*safe working distance buffer*' of 1 km from any known breeding sites. Nevertheless, based on the sporadic utilisation over the non-breeding season it can be assumed that there is potential for a level of one-off disturbance events during construction works that may result in the displacement of intermittently foraging birds to another area. However, the size of the works corridor relative to foraging habitat available in the wider area, combined with low bird usage, means that any potential displacement effects on foraging birds caused by disturbance during construction is considered to be *negligible*. Therefore, taking account of the species' *high* population sensitivity (Percival, 2003), it is considered that the potential effect of construction disturbance on foraging hen harriers would be of *negligible* magnitude and therefore *not significant*.

Golden plover – Likely Significant Construction Phase Effects

123 Ruddock, M., Mee, A., Lusby, J., Nagle, A., O'Neill, S. & O'Toole, L. (2016). The 2015 National Survey of Breeding Hen Harrier in Ireland. *Irish Wildlife Manuals*, No. 93. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland

124 Scottish Natural Heritage (2016). *Assessing Connectivity with Special Protection Areas* (*SPAs*) Guidance (Version 3). SNH

125 Ruddock, M. & Whitfield, D. (2007). *A review of disturbance distances in selected bird species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

Golden plover breeding distribution is limited to the north and west of Ireland (Balmer *et al*., 2013)[126]; and therefore, there is no risk of direct impacts to nesting birds during construction. As detailed in the ornithological baseline, relatively small flocks occasionally forage in the tillage fields in the western part of the 500 m turbine buffer. Numbers utilising the area never exceeded thresholds for consideration as Nationally Important (920 birds). Typically, flocks of less than 100 birds were recorded; however, 100-200 birds were sometimes recorded, with numbers occasionally reaching 400 birds. During the spring passage a maximum count of 520 birds was recorded utilising the tillage fields just west of the 500 m turbine buffer. This flock disbanded and one of the smaller flocks (up to 210 birds) moved into the buffer to forage/loaf.

Construction related disturbance events have the potential to displace this foraging flock. At an Irish population level (80,707 birds)[127], and taking the maximum flock size recorded (520 birds) the magnitude of the potential displacement effect is *negligible* (< 1% population effect).

Consideration at a regional or county population level, is problematic as an accurate population estimate for this part of Westmeath/Meath is not available; and several thousand birds may periodically move into the region depending on weather and ground conditions. In this respect, given the highly mobile nature of inland flocks, it may not be appropriate to apply a regional population estimate to an area where birds are not particularly sedentary over the winter. Taking a regional population estimate of 1,400 to 2,000 birds (loosely based on counts for IWeBS site in the region), then the magnitude of the displacement effect on the local population ranges from low to the lower end of high (5 to 26% population effect depending on the size of the foraging flock:100 to 520 birds). On balance, it is reasonable to assume a moderate displacement effect on the local population. However, the fact that birds are not consistently recorded in the area, indicates that they are not exclusively reliant on this resource and it is likely that birds are attracted to the area by certain field conditions, such as exposed soil in winter cereal crops.

Taking account of the species' *medium* population sensitivity (Percival, 2003), it is considered that the potential impact of construction disturbance on foraging golden plover is of *negligible* magnitude at the national population level and therefore *not significant*. At the local/regional population level, with consideration given to the ample availability of similar habitat in the general area, the potential impact of displacement is considered as a low to moderate magnitude effect of *low significance*.

Woodcock – Likely Significant Construction Phase Effects

As described in the ornithological baseline, woodcock utilise ground cover in woodland and scrub within the 500 m turbine buffer for nesting during the breeding season and for day roosting during the winter. Areas of woodland and scrub potentially utilised by woodcock will be cleared to facilitate construction of the wind farm and associated infrastructure.

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

127 Lewis, L. J., Burke, B., Fitzgerald, N., Tierney, T. D. & Kelly, S. (2019b). Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16. *Irish Wildlife Manuals*, No. 106. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland

As outlined in **Section 5.4.2.2** (**Habitats that** are identified as being Important Ecological Features for the purposes of this impact assessment are marked with a *

Table 5.26) covering habitat loss, the works corridor largely targets existing forestry and farm tracks; and were woodland will be removed this is small areas of commercial conifer and broadleaf plantations. Note: The potential impacts on woodcock from loss of woodland habitat in relation to the establishment of 50 m standoffs between operational turbine and potential bat habitat features is assessed under potential operational impacts.

The wintering population is not listed as being of conservation concern. Therefore, although disturbance resulting from construction activities has the potential to displace wintering birds, it is considered that there are ample alternative areas of roosting habitats in the vicinity and the magnitude of effect on the wintering population is considered negligible and therefore *not significant*.

There is potential for inappropriately monitored/phased construction works occurring during the breeding season, specifically clearance of woodland and scrub, to result in direct disturbance to woodcock nests and precocious young (mobile, but flightless young). Construction activities in close proximity to nesting birds also has the potential to result in displacement and contribute to nest failure. The magnitude of effect is difficult to judge as there are currently no Irish population estimate for woodcock. Consideration, also needs to be given to the *temporary -short term* nature of construction works and that there is a requirement for an equivalent area to be planted to replace the area of commercial plantations that will be felled to facilitate construction of the proposed development.

Overall, taking account of the species' *medium* population sensitivity (Percival, 2003), it is considered that the magnitude of effect will be low, and therefore potential direct/indirect impacts to breeding woodcock due to construction disturbance is assessed as *low significance*.

Lapwing – Likely significant Construction Phase Effects

As described in the ornithological baseline, a single pair of lapwings attempted to breed in the field surrounding the proposed location for T3. The breeding attempt failed in 2019 and no birds were recorded the following breeding season (2020). No breeding activity was noted from VP watches in March 2021 or site visits in May 2021. There is potential for this site to be re-occupied during construction. If this is the case, there is potential for inappropriately monitored/phased construction works occurring during the breeding season, specifically in the vicinity of T3, (or similar open habitats at T1 and T2 if occupied) to result in direct disturbance to nesting lapwing nests and precocious young. Construction activities in close proximity to nesting birds also have the potential to result in displacement and contribute to nest failure.

There is no up to date population estimate for breeding lapwing in Ireland and Lauder & Donaghy (2008) in BWI (2011)[128]/Mc Guinness *et al*. (2015)[129] give an estimate 2,000

128 BWI – BirdWatch Ireland (2011). Action Plan for Lowland Farmland Birds in Ireland 2011-2020. *BirdWatch Ireland's Group Action Plans for Irish Birds*. BWI, Kilcoole, Co. Wicklow

129 Mc Guinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015*). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland*. BirdWatch Ireland, Kilcoole, Wicklow

pairs. While acknowledging the sub-optimal habitat conditions at the proposed development site, in terms of crop rotation; it is considered advisable to take a precautionary approach in the context of declining wader populations across Ireland (Balmer *et al*., 2013[130], Donaghy, 2016[131], O'Donoghue *et al*., 2019[132], Suddaby *et al*., 2020[133]). In this respect, taking account of the species' *medium* population sensitivity (Percival, 2003), and upping the assessment for the magnitude of effect from negligible to low, potential direct/indirect impacts to breeding lapwing due to construction disturbance is classed as *low significance*. Mc Guinness *et al*. (2015) suggest that an 800 m precautionary *zone of sensitivity* is maintained around known lapwing breeding sites.

Snipe – Likely Significant Construction Phase Effects

As detailed in the ornithological baseline snipe breed and winter in the 500 m turbine buffer. Construction activities have the potential for direct/indirect disturbance to breeding snipe and indirect disturbance to winter snipe. Displaced wintering birds are able to re-locate to alternative areas, which are widely available beyond the proposed work corridor; and the magnitude of effect on the wintering snipe is considered negligible and therefore *not significant*.

In relation to direct disturbance to breeding snipe, the turbine locations and construction corridor avoid the wetter areas within the 500 m turbine buffer, which have been highlighted as snipe breeding habitat (i.e. the southern bog). Therefore, there will be no direct impacts on breeding snipe, as suitable areas of breeding habitat are being avoided.

There is potential for secondary impacts on breeding/wintering snipe during construction, with disturbance factors potentially resulting in the temporary displacement of small numbers of breeding/wintering birds. Pearce-Higgins *et al*. (2009, 2012)[134, 135] suggest snipe may be displaced up to 400 m from turbines and that construction may reduce snipe densities by up to 53%. All breeding activity was recorded > 400 m from the construction corridor and therefore was beyond the zone of influence for disturbance from construction activities.

Given the *Medium* conservation sensitivity of snipe, the fact that construction activity avoids sensitive areas for this species, as well as the *temporary – short term* nature of the construction works, it is considered that the potential indirect impact of

130 Balmer, D., Gillings, S., Caffrey, B., Swan, B., Downie, I. & Fuller, R. (2013) *Bird Atlas 2007–11. The breeding and wintering birds of Britain and Ireland*. British Trust for Ornithology.

131 Donaghy, A. (2016). Breeding Curlew Survey 2016: Results from Sligo, Leitrim, Cavan and Monaghan & East Galway, Roscommon, Offaly and Longford (Excluding the Shannon Callows). Unpublished report to National Parks and Wildlife Service. BirdWatch Ireland 2016

132 Lauder A. & O'Donohue, B. (Eds) (2019) *Action for Curlew in Ireland. Recommendations of the Curlew Task Force*. DoCHG, Ireland. Available at: https:// www.chg.gov.ie/app/uploads/2019/09/curlewtask-force-recommendations.pdf.

133 Suddaby, D., O'Brien, I., Breen, D. & Kelly, S. (2020) A survey of breeding waders on machair and other coastal grasslands in Counties Mayo and Galway. *Irish Wildlife Manuals*, No. 119. NPWS, DoCHG, Ireland.

134 Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46, 1323–1331.

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

construction disturbance on breeding/wintering snipe is of *negligible* magnitude and therefore of *not significant*.

Kestrel – Likely Significant Construction Phase Effects

While the nest locations utilised during the 2019 and 2020 breeding seasons were beyond the 500 m turbine buffer, based on the current turbine layout, there is potential nesting habitat within the works corridor; and therefore, if birds shifted nest site during the build, inappropriately monitored/phased construction works could result in direct disturbance of breeding kestrel.

In 2020 the nest site was thought to be located within the long-established woodland c. 1 km NW of T5, which would be considered beyond the zone of sensitivity for most similar raptor species. For example, Ruddock & Whitfield (2007)[136] provide a review of exclusion zone buffers around nest sites for Merlin, designed to limit the impacts of human disturbance, which suggests that disturbance effects from construction are unlikely to extend beyond 400 m, with 500 m given as the highest estimate. Kestrel exhibit a level of tolerance to human related disturbance and for example regularly nest in active quarries. Therefore, unless the existing nest site shifts significantly closer to the works corridor, it is considered unlikely that there will be indirect disturbance to breeding kestrels during construction.

Kestrels were regularly recorded foraging and flying through the 500 m turbine buffer during baseline surveys and it is considered that construction activities may have a localised effect, displacing individuals foraging though the area. However, in consideration of kestrels being relatively tolerant to certain kinds of human disturbance, the discreet nature of the proposed construction works within the wider landscape and the availability of alternative foraging areas, as well as the temporary – short term nature of the proposed construction works, potential secondary impacts on foraging kestrels are assessed as being of *negligible* magnitude and therefore *not significant*.

Swift – Likely Significant Construction Phase Effects

Swifts do not breed locally and up to 12 birds were periodically recorded foraging over the proposed development site, taking airborne insect prey. It considered highly unlikely that any disturbance factors due to construction activities will negatively affect this species; as swifts typically nest in buildings in busy urban settings and are therefore habituated to high levels human activity. It is possible that construction activities, such as excavation works may have a highly localised impact on the emerging insect prey taken by swifts. However, given the relatively constrained nature of the works corridor any impact on hatching invertebrates is considered imperceptible. Overall, any potential indirect effects on foraging swifts during construction are assessed as *not significant*.

Barn owl – Likely Significant Construction Phase Effects

There were only two observations during the study period. This included birds recorded foraging out of the breeding season. No barn breeding sites were identified within construction corridor or 500 m turbine buffer. No potentially suitable old growth woodland or tress with cavities are earmarked for removal. The only potential

136 Ruddock, M. & Whitfield, D. (2007). *A review of disturbance distances in selected bird species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

breeding site identified within the proposed development site was the abandoned cottage adjacent to the access track at the site entrance. No evidence of occupation by barn owls was reported during licenced building inspections for bats. There are no plans to alter the cottage as part of this proposal. Therefore, *no direct impacts* on barn owl breeding sites are anticipated.

Reported disturbance thresholds for barn owls are highly variable and as reviewed in Ruddock & Whitfield (2007)[137] the majority of expert opinion is within the range of 30 to 100 m from breeding sites, although values as low as 10 m and as high 250 m were also cited. The reasons for this variability have been recognised as being a function of the nest site characteristics (e.g. building in an active farmyard vs a more isolated site), behavioural traits of breeding pair (e.g. habituation to human activity) and the type of disturbance activities involved. Barn owls are report as successfully breeding at a large wind farm in Scotland (Crystal Rig), with the number of pairs increasing after the provision of nest boxes. In 2018 four pairs attempted to breed, with three site successfully hatching 12 owlets (8 surviving to the point of fledgling) and the fourth site producing sterile eggs[138].

As noted above no potential breeding sites were identified within the 500 m turbine buffer, therefore there will be no indirect impact to breeding barns owls during the construction phase of the project.

Usage of the proposed development site by foraging birds was assessed as periodic and the nocturnal nature of this species means that potential disturbance events due to construction activities are considered unlikely. In addition, barn owls are often reported as foraging along roads. Therefore, potential direct/indirect impacts to breeding and foraging barn owls during the construction phase are considered negligible and therefore *not significant*.

Non-breeding Medium Sensitivity Target Species Occurring at Low Densities

Six of the medium sensitivity target species recorded during VP watches were only observed commuting or foraging through the 500 m turbine buffer on a limited number of occasions (see **Table 5.23**). No breeding, roosting or foraging sites were recorded within or adjacent to the works corridor. This included: little egret, whooper swan, Greenland white-fronted geese, merlin, peregrine and barn owl (as covered in the previous section).

For these species, based on the sporadic utilisation of the area over the non-breeding season, it can be assumed that there is potential for a level of one-off disturbance events during construction works that may result in the displacement of intermittently commuting/foraging birds to another area. However, the size of the works corridor relative to foraging habitat available in the wider area, combined with low bird usage, means that any potential displacement effects on commuting/foraging birds caused by disturbance during construction is considered to be *negligible*.

Taking account of the *medium* population sensitivity (Percival, 2003) for these species, it is considered that the potential direct/indirect impact of construction disturbance

137 Ruddock, M. & Whitfield, D. (2007). *A review of disturbance distances in selected bird species*. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage

138 As reported at: http://www.pes.eu.com/wind/ornithological-plan-leads-to-barn-owl-success/

on whooper swan, Greenland white-fronts, merlin peregrine and barn owl (as covered in a preceding section) is of *negligible* magnitude and therefore ***not significant***.

Red listed passerines – Likely Significant Construction Phase Effects

Four species of red listed passerine were recorded within the 500 m turbine buffer, including redwing (wintering), grey wagtail (occasional non-breeding), meadow pipit (breeding/wintering) and yellowhammer (one pair).

The low recorded usage of the 500 m turbine buffer by non-breeding grey wagtail means that potential for direct construction phase impacts can be discounted within the 500 m turbine buffer. A possible breeding territory was identified along the grid connection route and inappropriately timed/monitored construction works have the potential to directly/indirectly impact on nesting birds. This species is reliant on aquatic invertebrates (Snow & Perrins, 1998)[139] and can be negatively impacted by deterioration in water quality (e.g. see Rushton *et al*., 1994[140] and Larsen *et al*. 2010[141]). Therefore, in the absence of mitigation there is potential for a pollution event or prolonged sedimentation affecting the invertebrate populations in the local network of drainage channels to have a negative impact on the grey wagtails utilising the area. At the population level, isolated/localised impacts on a small number of birds (probably a single pair) is unlikely to result in any impact above an effect of *negligible* magnitude; as the populations is estimated at 36,949 to 66,035 birds (Lewis *et al*., 2019a)[142]. Therefore, the potential impact would be classed as *not significant*. Fortunately, stringent mitigation will be in place during construction to protect water quality.

Wintering redwing may be displaced by construction activities; however, it is considered that there are ample alternative foraging/roosting habitats in the vicinity of the proposed development and the magnitude of effect on the wintering population is assessed as negligible and therefore *not significant*.

Inappropriately timed removal of vegetation within the works corridor has the potential to result in direct/indirect disturbance to breeding meadow pipit and yellowhammer. As detailed in the ornithological baseline, the breeding distribution of these two species was found to be beyond the works corridor, therefore the potential for direct impact to nesting birds was assessed as unlikely and therefore *not significant*.

Amber Listed Breeding Passerines – Likely Construction Phase Effects

Given the dominance of highly improved agricultural habitats and woodland within the proposed development site, habitat availability for ground nesting passerines, such as Amber listed skylark was limited; and it was considered unlikely that ground nesting species would occur within the works corridor. Therefore, potential for direct disturbance to ground nesting birds was assessed as *not significant*.

139 Snow, D.W. & Perrins, C.M. (1998). *The Birds of the Western Palearctic*. Concise Edition.

140 Rushton, S. P., Hill D. & Carter, S. P. (1994). The Abundance of River Corridor Birds in Relation to Their Habitats: A Modelling Approach. *Journal of Applied Ecology* 31(2): 313-328

141 Larsen, S., Sorace, A. & Mancini, L. (2010). Riparian Bird Communities as Indicators of Human Impacts Along Mediterranean Streams. *Environmental Management* 45(2): 261-273

142 Lewis, L. J., Coombes, D., Burke, B., O'Halloran, J., Walsh, A., Tierney, T. D. & Cummins, S. (2019a) Countryside Bird Survey: Status and trends of common and widespread breeding birds 1998-2016. *Irish Wildlife Manuals*, No. 115. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland.

Inappropriately timed removal of vegetation within the works corridor has the potential to result in direct/indirect disturbance to Amber listed breeding passerines that nest in scrub, hedgerow, treelines and woodland habitats, within or directly adjacent to the works corridor. This includes: goldcrest, willow warbler, spotted flycatcher, starling, greenfinch. In terms of population dynamics these species, which although Amber listed are generally considered as common and wide spread. A precautionary assessment of *low* magnitude of effects (1-5%) for potential direct/indirect impacts due to construction related disturbance on *low* sensitivity receptors returns an impact of *very low significance*.

Mallard and Teal – Likely Construction Phase Effects

Potential direct/indirect impacts during the construction phase for mallard and teal can be examined in the same section, as these species occupy the same parts of the 500 m turbine buffer and behave in a similar manner. Although not confirmed, based on spring flight behaviour it thought that several birds of both species were likely to be nesting within the buffer. Breeding activity was considered to be centred around Bracklin Lough south of T4, with females likely to seek cover in the area; and female teal also likely to nest along some of the densely vegetated drains in the site. Areas where possible nesting activity was observed (along the southern bog) was sufficiently removed from the works corridor and therefore potential direct/indirect impacts on nest sites could be excluded. Likewise, areas utilised during the winter, essentially the bog pool (Bracklin Lough), were considered sufficiently removed and screened by woodland to avoid any indirect disturbance from construction activities. Therefore, for these low sensitivity species (Percival, 2003), any magnitude of effect was negligible and therefore *not significant*.

Non-breeding Low Sensitivity Target Species Occurring at Low Densities

Five of the low sensitivity target species recorded during VP watches were only observed commuting or foraging through the 500 m turbine buffer on a limited number of occasions. No breeding, roosting or foraging sites were recorded in the within or adjacent to the works corridor. This included: cormorant, mute swan goshawk, black-headed gull, lesser black-backed gulls

For these species based on the sporadically utilisation of the area over the non-breeding season, it can be assumed that there is potential for a level of one-off disturbance events during construction works that may result in the displacement of intermittently commuting/foraging birds to another area. However, the size of the works corridor relative to foraging habitat available in the wider area, combined with low bird usage, means that any potential displacement effects on commuting/foraging birds caused by disturbance during construction is considered to be *negligible*.

Taking account of the *low* population sensitivity (Percival, 2003) for these species, it is assessed that the potential impact of construction disturbance on cormorant, mute swan goshawk, black-headed gull and lesser black-backed gulls is of *negligible* magnitude and therefore *not significant*.

Green Listed Secondary Avian Target Species with High Recorded Usage

Based on usage of the site the impacts on two Green listed raptors are considered, including: sparrowhawk and buzzard.

Sparrowhawk

Sparrowhawk breed within the proposed development site and a nest site was identified in the small woodland between T2 and T3. The location of this breeding site will not be directly impacted by construction activities and is 150 m from the proposed works corridor. Another territory (possibly utilised by the same pair) was identified in the plantation around T10; however, this was displaced by commercial felling operations in 2019/2020. Sparrowhawks regularly alternate between breeding sites and it is possibly that a pair establishes a nest site within or adjacent to the proposed works corridor during construction. Therefore, inappropriately timed/phased construction works have the potential to result in direct and indirect disturbance to nesting sparrowhawk. This species regularly utilises commercial forestry plantation as breeding sites and are considered relatively tolerant of displacement effects from commercial felling operations.

Sparrowhawk are common and widespread raptor in Ireland (8,746 – 14,252 pairs in Lewis *et al*. 2019)[143] and on a country wide population basis the magnitude of effect on 1 or 2 pairs would be considered *negligible*. In addition, the conservation status for sparrowhawks has recently been downgraded from Amber (Colhoun & Cummins, 2013)[144] to Green (Gilbert *et al*., 2021)[145] listed, meaning this species is no longer rated as having *Low* sensitivity to wind farm development (Percival, 2003). Therefore, technically construction related direct/indirect impacts are considered *not significant*. However, in this instance, the effect of inappropriately timed construction works is considered to have the potential for short-term, significant direct/indirect impacts on the local sparrowhawk population. This potential impact will be minimised through project design to ensure removal of vegetation at appropriate times of the year, i.e. out of the breeding season.

Buzzards

Buzzards were routinely recorded forage through the proposed development site; therefore, it can be assumed that there will be a level of disturbance from certain operations during construction works and it is possible that this will result in the displacement of foraging birds to another area. However, the constrained nature of the proposed works corridor in relations to the terrain and size of the proposed development site means that the effects of disturbance to foraging birds are unlikely to be far ranging during the construction phase of the project.

Several breeding sites were identified in the proposed development site, with a territory located in the woodland adjacent the location of the proposed substation and territorial behaviour was also noted along the proposed access tracked, associated with the forestry/treelines near the turn to T1. As with sparrowhawk, buzzards are considered to be relatively tolerant of felling operations and it is reported that a single pair of buzzards can have up to 14 alternative nest sites within their breeding season home range. Taking account of this, and the unrated conservation importance of buzzard in Percival (2003), it is assessed that the potential impact of construction disturbance on buzzard is *negligible* and therefore *not significant*. Nevertheless, as is the case with sparrowhawk and breeding birds in general, best

143 Lewis, L. J., Coombes, D., Burke, B., O'Halloran, J., Walsh, A., Tierney, T. D. & Cummins, S. (2019a) Countryside Bird Survey: Status and trends of common and widespread breeding birds 1998-2016. *Irish Wildlife Manuals*, No. 115. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland.

144 Colhoun, K., & Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014-2019. *Irish Birds*. 9: 523-544.

145 Gilbert, G., Stanbury, A. & Lewis, L. (2021). Birds of Conservation Concern in Ireland 2020 –2026. *Irish Birds* 43: 1–22

practice dictates that this potential impact will be minimised through project design to ensure removal of vegetation at appropriate times of the year, i.e. out of the breeding season.

5.4.2.6 Terrestrial (non-volant) Mammals – Likely Construction Phase Effects

Based on habitat availability and/or occurrence within the proposed development site five species of protected mammal were considered as important ecological features; including: otter, badger, pine marten and hare. Potential habitat suitability for red squirrel was identified within the older growth woodland on the periphery of the proposed development site; however, no evidence of squirrels was recorded.

Likely Direct Effects During the Construction Phase

Direct effects on mammals during construction relate to impacts on resting sites, where young or resting animals can be killed or injured; although in some instance construction activities may only result in the destruction of the resting site itself. Tree/vegetation removal impacts arboreal species and ground works such excavation or pile driving impacts on burrowing species (otters, badgers). As detailed in **Section 5.3.9**, the only mammal species identified as an important ecological feature where resting sites were identified within the zone of influence of the proposed works corridor were badger. A main sett was located adjacent to the substation and an outlier was located near the track to T2 – see **Annex 5.8**. In the absence of mitigation potential direct impacts on badger setts are considered to be *Significant* at the *Local* (*higher*) scale.

No otter holts/layups, pine marten dens or red squirrel dreys were identified within the proposed works corridor and the relatively young commercial plantations associated with the proposed development site/proposed works corridor were considered sub-optimal habitat for pine marten dens and red squirrel dreys. Therefore, no likely direct effects were identified for these species.

Hares do not occupy a single den but instead rest in 'forms', a flattened area in long grass. This, coupled, with the characteristics of young hare and the habits of nursing females, means that potential direct impacts resulting from construction phase of the proposed development are likely to be very limited. Young hares are born fully furred and are able to run soon after birth. During daylight, they hide in long grass and are fed only once a day, at dusk. As construction will be undertaken during daylight hours, the risk of disturbance is limited to physical disturbance of young rather than disturbance and displacement of the mother. As young hares are able to move freely, mortality is unlikely to result from construction activities. Overall, direct impacts upon hare resulting from the construction phase are assesses as *Not significant*.

Likely Secondary Effects During the Construction Phase

Construction of the infrastructural footprint will result in the loss of potential foraging, commuting and sheltering habitat utilised by mammals. In this instance removal of trees, is likely to reduce habitat availability for arboreal species like pine martin and red squirrel; however, may 'open up' new foraging opportunities to badgers and hares. In the absence of mitigation, potential deterioration in water quality within the drainage channels associated with the proposed development site may result in reduced prey availability for otter.

Disturbance from noise, vibration and movement of machinery and operatives has the potential to displace foraging individuals or typically of more concern causing

breeding mammals to abandon natal sites. Disturbance from construction activities is considered unlikely to impact on foraging pine marten; as this species hunts over a large area and the surrounding area contains a large amount of similar foraging habitat that may be used, if construction noise causes certain areas to be avoided. Likewise, foraging red squirrel if occurring will be able to disperse freely into surrounding woodland and to avoid disturbance in the vicinity of construction corridor. No pine marten dens or red squirrel dreys were located during surveys and neither species were considered to have breeding sites within the zone of influence where disturbance would have the potential for significant effects (50 m for red squirrel[146] and 100 m for pine marten[147]). As explained in the previous section under direct impacts, hares are considered unlikely to suffer any significant effects due to disturbance from construction activities.

Foraging badgers and otters to a lesser extent are nocturnal; and therefore, are unlikely to be affected by construction activities which occur during the day. No otter resting sites were located within the zone of influence where disturbance would have potential for significant effects (30 m for a holt/couch and for a natal den 150 m as per NRA (2008)[148]/NIEA[149], which is inline the 100-200 m for a breeding site as per NatureScot[150]). In terms of secondary impacts to mammals during construction the main cause for concern at this site is disturbance to breeding badgers, which were judged to have a principal breeding sett adjacent to the substation. NatureScot[151] advises employing a minimum exclusion zone of 30 m from sett entrances to construction works, which is in line with NRA (2006)[152] for out of the breeding season, although under these guidelines this increases to 50m of active setts during the breeding season (December to June inclusive), with no blasting or pile driving within 150m of active setts.

For pine marten and red squirrel, any secondary impacts resulting from habitat alteration and associated disturbance during construction are assessed as having the potential for *Slight effects* at the *Local (higher)* level.

In the absence of mitigation, secondary impacts resulting from deterioration in water quality during construction are assessed as having the potential for *Significant effects* at the *International* level for otter; as there is potential overlap between foraging otters utilising the proposed development site and populations inhabiting the River Boyne and River Blackwater SAC. Although evidence of otters recorded during surveys was suggestive of low usage in the environs of the proposed development site, animals

146 As recommended in: NatureScot. Standing advice for planning consultations - Red Squirrels. Available at: https://www.nature.scot/doc/standing-advice-planning-consultations-red-squirrels

147 As recommended in: VWT (2015). Managing forest and woodlands for pine martens. Practical measures to protect and benefit the pine marten The Vincent Wildlife Trust & SelectFor Ltd.

148 NRA (2008). *Guidelines for the treatment of otters prior to the construction of national road schemes*. National Roads Authority - Environment Series on Construction Impacts

149 As recommended in: NIEA. Otters & Development. Northern Ireland Environment Agency. Available at: https://cieem.net/wp-content/uploads/2019/07/natural-information-otters-and-development-2011.pdf

150 As recommended in: NatureScot. Protected species advice for developers: Otter. Available at: https://www.nature.scot/sites/default/files/2018-09/Species%20Planning%20Advice%20-%20otter.pdf

151 As recommended in: NatureScot. Protected species advice for developers: Badger. Available at: https://www.nature.scot/sites/default/files/2017-10/A2293028%20-%20Species%20Planning%20Advice%20Project%20-%20Badger.pdf

152 NRA (2008). *Guidelines for the treatment of badger prior to the construction of national road schemes*. National Roads Authority - Environment Series on Construction Impacts

potentially displaced from the proposed development site could relocate foraging activities to the SAC and compete for resources with otter populations utilising the SAC.

Secondary impacts, in the absence of mitigation, resulting from potential disturbance to a badger maternity sett during construction of the substation are considered *Significant* at the *Local (higher)* level.

For Irish hare in the context of the surrounding landscape, which provides abundant suitable habitat, the likely secondary effects resulting from the proposal are assessed as *Not Significant*.

5.4.2.7 Likely Construction Phase Effects on Bats

Likely Direct Effects During the Construction Phase

Direct effects on bats during construction include vegetation removal, resulting in a loss of potential roost sites in mature trees or the removal/modification to existing buildings.

Along the grid connection route, there were several structures (bridges) and trees assessed as having moderate or moderate to high bat roost potential. These features were identified as being within a 30 m buffer of the proposed development site, including several veteran beech trees and one oak with a range of holes assessed as providing moderate PFRs with the occasional high PRF noted, and a bridge noted as having moderate to high PRF. However, given the limited scope of the works proposed for laying cable (trench excavation and fill along existing roads and agricultural fields), no direct impacts to potential bat roosts are anticipated during construction works for installation of the grid connection.

The potential for impacts upon ecological features along the haul route where modifications to areas may be required to facilitate the passage of large vehicles and components was assessed. There is no potential for significant effects, which will be avoided by utilising the existing road network for the transportation of turbines to the site. Any works associated with haul route relate to modification of existing infrastructure, e.g. temporary removal of road signage, temporary hard surface of roundabouts or widening works to an existing roadside verge. Therefore, there will be no direct impacts to any features potentially utilised by bats for roosting.

No demolition or modification of existing buildings has been proposed as part this project, notably the derelict building adjacent to the proposed access track into the site will remain in situ. Throughout the construction corridor vegetation clearance will be required to facilitate access and construction activities, including creating gaps through treelines/hedgerows. In addition, felling required to implement proposed turbulence reduction buffers/bat feature buffers and substation standoffs will be encompassed within the felling areas required to implement bat feature buffers has the potential to directly impact on roosting bats. The areas which are scheduled to be felled for these purposes are shown in **Annex 5.5** – **Appendix 2** and **Appendix 3**. Felling is proposed for the following areas:-

- Only minor scrub clearance along edge of conifer plantation is required to upgrade latter section of forestry track running from site entrance to turn to T1, where conifer plantation will be cleared to facilitate access to T1 – No PRFs identified, except for ruined cottage, which will remain unaltered;

- A section of hedgerow/open treeline and earth bank on the track/hardstand for T2 – No PRFs identified;
- Create of gap through treeline to facilitate access from site compound to substation, crossing main channel – Trees with occasional moderate PRFs identified in T-shape treeline. Soprano pipistrelle roost location pinned down to this area, exact location not determined;
- Commercial forestry plantations, mature broadleaved woodland/treelines to facilitate construction of the substation and implement required standoffs – Only low PRFs identified within felling area. Treeline on the southwestern edge of the felling area supports the occasional moderate PRF. The closest significant bat roost identified was in the area of the T-shape treeline;
- Minor clearance of scrub/plantation to facilitate track widening along existing forestry tracks adjacent to substation and on to T6/T7 and toward southern part of site (T3/T4) – Only low PRFs identified;
- Creation of gaps through two treelines to facilitate access to T5 from T4, including area for T5 hardstand – Only low PRFs identified;
- Broadleaf treelines and commercial plantation around T4, T5 and T7;
  - Only low PRFs identified in treelines around T4, with no roost identified in treeline with moderate PRFs adjacent to felling area;
  - Broadleaf treeline directly adjacent to T5 felling area has two trees with moderate PRFs – no roost identified;
  - Treeline with occasional moderate PRFs along northern edge of T7 felling area;
- Conifer and broadleaved plantations surrounding the proposed location of T6 – No PRFs identified;
- Creation of gap through treeline to facilitate access from T6/T7 to T10/T11over main channel – Treeline with occasional moderate PRFs;
- Conifer plantation to facilitate access to T10 and T11 – No PRFs identified;
- Bog woodland south of T10 and to facilitate grid connection from T10 to local road (Annex I bog woodland to be retained) – No PRFs identified; and
- Removal of conifer plantation at T11, with oak-birch-hazel on edge of felling to be retained – Moderate PRFs identified in this woodland.

Some tree surgery to broadleaf treelines for the construction of the turbine access track is anticipated.

Roost suitability surveys classed commercial conifer and broadleaf plantations as having negligible roost potential, and although Ecobat emergence time analysis suggests that there are potential roosts in the wider area, these are removed from the felling areas (see results for D.04, D.05, D.06, D.07 in **Annex 5.5**). The results of the roost surveys conducted on the area affected by felling concluded that roosting is limited to semi-mature to mature broadleaf trees. Therefore, the felling conducted on conifer plantation and broadleaf plantation is considered unlikely to have any direct effects on bat roosts.

Proposed felling areas around T4, T5 and T7, as well as the substation do hold broadleaf treelines, with some moderate PRFs identified within and adjacent to felling areas. Emergence/re-entry and roost inspection surveys did not identify any occupied roosts in these areas. Treelines with moderate PRFs adjacent to the substation and T11 are not within the felling areas

It is acknowledged that the existence of PRFs within the proposed felling areas means that although no roosting activity was recorded during the baseline surveys, these sites may be occupied prior to commencement of construction. Given the understanding of species composition within the site, and particularly the areas affected by felling, in the event that treelines become occupied; they are likely to be used by the two most common species, common and soprano pipistrelles. Using Wray *et* al. (2010) to assess the value of roost types, the presence of any potential roosts within the felling areas are of *Local* importance. Therefore, the removal of these treelines in the absence of mitigation are assessed as being *Significant* at the *Local* level.

Likely Secondary Effects During the Construction Phase

The likelihood of secondary effects on bats resulting from construction works are limited to the loss of foraging and commuting habitats/features utilised by bats. Disturbance of roosting and foraging bats through lighting impacts was considered; however, it is understood that there will be no night-time working at the site and as such no additional lighting will be required during the construction phase of the works. In addition, the species utilising this site most – Leisler's bat, soprano pipistrelle and common pipistrelle – are less sensitive to light pollution than the less commonly recorded species – brown long-eared bats and *Myotis* species.

The proposed development site holds a number of defunct hedgerows, treelines and small patches of woodland that are known to be used by foraging and commuting bats. The baseline study found that the linear features within conifer plantations are highly active foraging grounds for bats, e.g. as recorded by the static bat detector deployed near T6 (D.06). Vegetation removal as a result of the proposed felling areas, as detailed in the previous section, will alter bat foraging patterns within the site, particularly given the relatively high levels of activity seen in these conifer plantations. However, felling plans were designed to retain connectivity through the site and avoid disruption to linear features used by commuting/foraging bats. The only location in which the removal of treelines is considered to disrupt connectivity within the site is the removal of broadleaf treeline at T4.

The site layout, including a reduction in turbine numbers (by 2 turbines) was designed to avoid the best examples of woodland habitats within the lands-made-available for the project. This ensures that strong connectivity is retained through the site.

Vegetation removal during site construction has the potential for secondary effects upon bats that are considered, in the absence of mitigation, to be *Significant* at the *Regional* scale.

5.4.2.8 Likely Cumulative Effects During the Construction Phase

The likelihood of cumulative effects resulting from the construction phase of the proposed development are limited to water quality changes within the drain/stream flowing through the proposed development site (Bolandstown - EPA code: 07B45). This stream/drain is hydrologically connected to two downstream Natura 2000 sites via the Stonyford River, specifically the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA. The River Boyne flows into the Irish Sea at Laytown, just beyond Drogheda on the border of Co. Louth and Co. Meath, where the estuary is designated as both SAC and SPA, specifically the Boyne Coast and Estuary SAC and Boyne Estuary SPA. It is considered that the construction phase of the proposed development in combination with existing and planned developments has the potential to have *additive/incremental effects* on water quality within these

downstream Natura 2000 sites over the *short-term*; and taking a precautionary approach in the absence of mitigation, effects have the potential to be *significant*. There are several proposed/pre-planning and consented (pre-construction) wind farms within the Boyne catchment (as detailed in **Chapter 7**), which if under construction at the same time as the proposed development and the in the absence of best practice control measure have the potential for cumulative impacts on water quality. This would include the proposed Ballivor Wind Farm, which is a pre-planning proposal for the construction of 26 no. turbines on bogland adjacent to the proposed development. The Yellow River Wind Farm, currently under construction, will be operational by 2023.

As detailed in **Section 5.3.6**, two of the baseline sample points [WQ3 & WQ4] for measuring WFD status were located on the Stonyford River up and downstream of the proposed development. Both sample points returned a Moderate ecological status WFD score.

Locally (in the environs of the proposed development), potential for cumulative impacts on water quality come from diffuse sources including rural housing, the existing road network, forestry operations (track upgrades and felling), agricultural activities and peat extraction. Based on EPA Maps[153], there are no Section 4 discharges to water linked to the stream/drain (EPA code: 07B45); and the only site in the area with an Industrial Emissions (IE) licence is Clondrisse Pig Farm. The pig farm is an IPPC (Integrated Pollution Prevention Control) site and waste water is stored on site, rather than discharged into receiving waters under licence. Based on the National Planning Application Database[154], there are no planning applications or existing planning consents in Co. Westmeath/Co. Meath, with downstream connectivity to the stream/drain (EPA code: 07B45); and therefore, no potential for additive/incremental effects on local water quality in combination with other proposed developments. Overall, considering the existing effects of diffuse water population and in the absence of mitigation, potential secondary cumulative impacts on local freshwater ecology due deterioration in water quality during construction is considered *significant* at the *Local (higher)* level.

5.4.3 Operational Phase

Operational effects of wind farms are considered as those emanating from the footprint of the development, including turbines, hardstands, assess tracks and substation. As the grid connection is underground and avoids any notably sensitivity habitats, once installed it is considered that there will be no operational impacts due to underground cabling/ducting. For some important ecological features, if not previously assessed under construction phase effects, the likely significant effects due to habitat loss/alteration are considered in relation to mitigation measures, specifically the creation of bat feature buffers, which requires the felling of trees and creation of grassland around certain operational turbines.

The proposed operational lifespan for the wind farm is 30 years, therefore for ornithological receptors temporal magnitude of effects over the operational phase of the project can be considered as *Temporary – very long term* or *Permanent* (Percival, 2003). For other important ecological features, effects can be considered

153 EPA Maps Accessed May-2021

154 National Planning Application Map Viewer - My Plan Accessed May-2021

long-term effects if lasting 15 to 60 years (EPA, 2017). As the footprint of the proposed development is within a landscape that has been highly modified by agriculture and agroforestry, it is considered that effects, specifically in relation to habitat loss are fully *reversible* (EPA, 2017).

Sources for effects during the operational phase have the potential to result in both direct effects and secondary effects; as summarised below:

Likely Sources of Direct Operational Phase Effects:

- Collisions or barotrauma risk with turbines for bats; and
- Collisions risk with turbines for birds.

Likely Sources of Secondary Operational Phase Effects:

- Collection/drainage of surface water runoff;
- Operational activities and servicing - though this would be limited to relatively few visits per year and would not be considered to add significantly to existing/background levels of human activity in the area;
- Displacement effect of operating turbines; and
- Displacement effects of lighting for substation.

5.4.3.1 Designated Sites – Likely Operational Phase Effects

As detailed in the NIS (Woodrow, 2021) and summarised in **Section 5.3.3.1** of this Chapter, only two internationally-designated sites were identified as falling within the potential zone of influence of the proposed development. For both the River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA there is a degree of biological connectivity with the proposed development site via a downstream hydrological connection.

No other source-receptor pathways between the proposed development site and sites designated for conservation were identified, including nationally designed sites (NHAs) or proposed conservation sites (pNHAs).

Likely Direct Effects During the Operational Phase

As detailed in **Section 5.3.3.1**, the proposed development is not located within or directly adjacent to any Natura 2000 site (SAC/SPA), nationally designed site (NHA) or proposed conservation site (pNHA). Therefore, once operational the proposed development will not directly impact on any sites designated for nature conservation.

The potential for avian collision risk to impact on bird populations associated with SPAs was assessed. Based on core foraging ranges for QI species, the distance between the proposed development site and SPAs and an ornithological study confirming that there were no source-receptor pathways (e.g. regular whooper swan flight-lines); it can objectively be concluded that there is no potential for direct impacts on birds to adversely affect populations associated with SPAs in the wider area.

Likely Secondary Effects During the Operational Phase

The main source of potential downstream effects on water quality during the operational phase is likely to come from ground exposed by felling operations to create bat feature buffers. The risk of run-off acting on bare ground will act over short-term, as the felled area will revegetate over one or two years. There is also potential for poorly designed, engineered and/or constructed wind farm infrastructure, to result in increased runoff and sedimentation, specifically drainage associated with turbine

hardstands and access tracks. Sub-standard re-instatement works on the grid connection route, especially sections along watercourse are also considered as posing a pollution risk to the aquatic environment. Potential for any accidental hydrocarbon pollution during the operational phase of the project would be limited to rare accidental spillages from small volumes of service vehicles periodically accessing the proposed development site. There is no risk of toxic of materials, namely cement/concrete entering watercourses.

As detailed in **Section 5.4.2.1** in relation to construction impacts on designated sites, in the absence of mitigation deterioration in water quality has the potential to impact on Qualifying Interests (QIs) of the downstream River Boyne and River Blackwater SAC and SPA, including: salmon, lamprey, otter and kingfisher. As noted above, during the operational phase of the project the main pollution risk to the aquatic environment is from suspended solids entering local watercourses. The factors that determine the extent of downstream effects caused by suspended solids are complex and highly dynamic, being depended on a range of interacting factors, such as rainfall, channel flow characteristics and the amount and sizes of particulate matter within surface water runoff. Considering dilution and dispersion effects between source and receptor, any potential significant effects due to sedimentation are likely to be relatively localised. However, applying the precautionary principal in the absence of mitigation it is considered that potential downstream effects on the River Boyne and River Blackwater SAC and SPA is *significant*.

The potential for any displacement effects of QI species, specifically kingfishers and otters, as a result of the operational wind farm were considered unlikely and therefore *Not significant*, due to the low recorded usage of the proposed development site by QI species, limited sensitivity of receptors to operational disturbance factors and relative separation distance between the proposed development and the designated sites.

5.4.3.2 Habitats – Likely Operational Phase Effects

Likely Direct Effects During the Operational Phase

Potential direct effects on habitats during the operational phase are considered to largely relate to habitat lost under the application footprint and clearance of vegetation to mitigate for impacts on bat species. The loss and alteration of habitats under the operational footprint of proposed development, including creation of buffer against turbulence and to implement bat feature buffers have been considered under construction phase impacts in **Section 5.4.2.2** – see **Habitats that** are identified as being Important Ecological Features for the purposes of this impact assessment are marked with a *

Table 5.26.

Therefore, during the operational phase no direct significant effects on habitats within or adjacent to the proposed development are anticipated.

Likely Secondary Effects During the Operational Phase

There is potential for the proposal to impact locally on ground water dependent habitats, namely bog woodland [WN7] during operations, as a result of any ongoing hydrological impacts and/or scouring and erosion. In particular an area supporting a good example of Annex I bog woodland between the proposed location for T10 and

T11 could be significantly affected if water levels are altered. Issues related to ground water and surface waters are considered in more detail by **Chapter 7**.

Without mitigation, there is potential for Significant secondary effects on important habitats, notably bog woodland of Regional (County) Importance and Local (higher) Importance, during the operational phase of the proposed development, depending upon the nature and location of unmitigated impacts e.g. the construction of inappropriate drainage affecting the bog woodland.

5.4.3.3 Watercourses & Downstream Ecology – Likely Operational Phase Effects

As described in **Section 5.4.3.1**, the main sources of potential downstream effects on water quality during the operational phase is likely to come from ground exposed by felling operations to create turbine buffers. In addition, runoff from site infrastructure and the along grid connection were identified as potential sources of sediment laden runoff, which in the absence of mitigation could adversely affect water quality locally and downstream of the proposed development.

Likely Direct Effects During the Operational Phase

There is limited potential for direct effects on watercourses within the proposed development site during the operational phase as no viable natural streams or rivers exist within the site boundary. Additionally, downstream watercourses which are potentially viable with salmon/lamprey/crayfish potential are outside of the proposed operational site boundary and so direct effects are not foreseen. Taking this into account, the potential for direct effects on watercourses resulting from the operational phase is considered to be *Not Significant*.

Likely Secondary Effects During the Operational Phase

Potential secondary impacts on important downstream ecological receptors such as salmonids, lamprey and crayfish include the release of suspended solids or hydrocarbons into rivers such as the Stonyford and the Boyne to the east of the proposed development during the operational phase indirectly through hydrological connectivity. The same secondary effects as described for the construction phase on salmonid/lamprey/crayfish apply for the operational phase.

Taking this into account, in the absence of mitigation the potential for secondary effects on watercourses and downstream ecology resulting from the operational phase are considered to be *Significant* at the *International* scale for salmon, lamprey, otter and kingfisher, as discussed under impacts on designated sites (**Section 5.4.2.1**). For other downstream aquatic fauna, including white-clawed crayfish secondary effects during the operational phase are considered to have the potential to be *Significant* at the *Local (higher)* scale.

5.4.3.4 Amphibians & Reptiles – Likely Operational Phase Effects

The operational wind farm will have no direct or secondary impacts likely to result in significant effects on common frog, smooth newt or common lizard.

5.4.3.5 Avi-fauna – Likely Operational Phase Effects

Operational Phase - Likely Direct Effects on Ornithological Receptors

Potential effects can be due to direct impacts on birds in terms of mortality caused by collision with the turbines and any associated overhead infrastructure. Although there has been little in the way of documented raptor collisions with wind turbines in

Ireland (see - Fennelly, 2015)[155], there are concerns that raptors and large waterfowl (e.g. geese and swans) are some of the more sensitive to collision risk (e.g. Hötker *et al*. 2006[156], Madders & Whitfield 2006[157], Drewitt & Langstone 2008[158]).

A collision risk model has been developed by Scottish Natural Heritage (SNH, 2000[159]). There are a number of assumptions built into this model and results are improved through a data collection approach throughout the survey that best facilitates input into the model (specifically time spent by target species at flight heights that may bring them into contact with turbines). The fieldwork approach for the proposed development was specifically designed to allow the use of this model. The model has since been updated to take account of avoidance action by birds (SNH, 2010[160]).

All models, and the assumptions they are based on, are open to scrutiny. A study by the British Trust for Ornithology (BTO) on the SNH collision risk model (Chamberlain *et al*. 2005[161]) found the model to be statistically robust; but lacking with respect to its consideration of avoidance rates. The issue of avoidance rates has since been addressed (though understanding on these is still developing for certain species). It is considered, therefore, that the use of the SNH collision risk assessment model is appropriate for this study.

Use of the SNH collision risk study, running data from VP watches over 2-years between Oct 2018 and Aug 2020 inclusive, provided calculations relating to predicted collisions for a range of target species recorded within the 500 m turbine buffer. Details of methodology and assumptions are provided in **Annex 5.7**, which outlines the CRM – collision risk model undertaken. **Table A5.7.10** in **Annex 5.7** provides predicted collisions/mortality for target species, representative of a worst-case scenario. A summary of predicted collisions is provided **Table 5.27**, which gives weighted values (adjusted to correct for overlapping viewsheds, turbine downtime and seasonal bird activity), with appropriate species-specific avoidance rates applied.

Species	Occurrence in model	Season (hrs)	Avoidance rate	Predicted collisions per				
				Annum without avoidance	Annum with avoidance	Decade	30 years	1 bird every
Buzzard	Year-round	4,380	0.98	18.03	0.36	3.61	10.8	2.8 years
Golden plover	Wintering, plus April	2,124	0.98	215.01	4.30	43.00	129.0	0.23 years

155Fennelly, R.F. (2015). A Review of Bird Strike Mortality at Irish Onshore Windfarms. *CIEEM in-practice* Issue 88 June 2015

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

157 Madders, M. and Whitfield, D. P. (2006). Upland raptors and the assessment of wind farm impacts. *Ibis* Vol 148 pp 43-56.

158 Drewitt, A. L., Langston, R. H.W. (2008) Collision Effects of Wind-power Generators and Other Obstacles on Birds. *Annals of the New York Academy of Sciences* 1134:1, 233-266, Online publication date: 1-Jun-2008

159 SNH (2000). Windfarms and birds: Calculating a theoretical collision risk assuming no avoiding action. Guidance Note Series. Scottish Natural Heritage.

160 SNH (2010). Use of Avoidance Rates in the SNH Wind Farm Collision Risk Model. Guidance Note Series. Scottish Natural Heritage.

161 Chamberlain, D., Freeman, S., Rehfisch. M. (2005). Appraisal of Scottish Natural Heritage's Wind Farm Collision Risk Model and its Application. BTO Research Report 401. BTO. Thetford.

Species	Occurrence in model	Season (hrs)	Avoidance rate	Predicted collisions per				
				Annum without avoidance	Annum with avoidance	Decade	30 years	1 bird every
Greenland white-front	Wintering	1,704	0.998	2.96	0.01	0.06	0.2	169.0 years
Kestrel	Year-round	4,380	0.95	4.49	0.22	2.24	6.7	4.5 years
Lesser black-backed gull	Breeding	2,400	0.995	1.19	0.01	0.06	0.2	168.0 years
Mallard	Year-round	4,380	0.98	0.72	0.014	0.14	0.4	69.9 years
Snipe	Year-round +25% night	5,475	0.98	0.66	0.013	0.13	0.4	76.3 years
Sparrowhawk	Year-round	4,380	0.98	0.71	0.014	0.14	0.4	70.1 years
Lapwing	Year-round	4,380	0.98	2.85	0.057	0.57	1.7	17.5 years
	Breeding	2,400	0.98	1.05	0.021	0.21	0.6	47.8 years
	Wintering	1,704	0.98	1.48	0.030	0.30	0.9	33.9 years

Table 5.27: Summary of predicted collisions – weighted & avoidance rates applied

Operational Phase - Likely Secondary Effects on Ornithological Receptors

Potential secondary effects on birds during the operational phase can be due to disturbance/displacement from operational activities and servicing. However, disturbance levels would be limited to relatively few visits per year and would not be considered to add significantly to existing/background levels of human activity in the area. There is evidence that for some bird species operational turbines result is a displacement effect, e.g. Pearce-Higgins *et al*. (2009)[162], Wilson et al. (2015)[163].

In the absence of mitigation measure deterioration in water quality due to increased runoff and sedimentation as a result of the development has the potential to impact on birds reliant on aquatic habitats, such as kingfisher and grey wagtail; if occurring in the environs.

Hen Harrier – Likely Operational Phase Effects

There are relatively few documented cases of hen harrier mortality due to turbine collisions in Ireland (e.g. Fennelly, 2015[164] & GreenNews.ie, July 2019[165]), and this holds even if reviewing records from abroad (Whitfield & Madders, 2006[166] & Haworth &

162 Pearce-Higgins, J.W., Stephen, L., Langston, R.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46: 1323-1331.

163 Wilson, M, Fernández-Bellon, D., Irwin, S. & O'Halloran, J. (2015). *The interactions between Hen Harriers and wind turbines*. Windharrier. Final project report, prepared by School of Biological, Earth & Environmental Sciences, University College Cork, Ireland.

164 Fennelly, R.F. (2015). A Review of Bird Strike Mortality at Irish Onshore Windfarms. *CIEEM in-practice* Issue 88 June 2015

165 GREEN NEWS.ie https://greennews.ie/hen-harrier-wind-turbine/ -Accessed Dec-2020

166 Whitfield, D.P. & Madders M. (2006). A review of the impacts of wind farms on hen harriers *Circus cyaneus* and an estimation of collision avoidance rates. Natural Research Information Note 1 (revised). Natural Research Ltd, Banchory,

Fielding, 2012[167]). Official reporting of fatalities at Irish wind farms has been at low frequency between 2007-2018 (O'Donoghue, 2018)[168]; however, it is acknowledged that targeted studies are limited (O'Donoghue *et al*., 2020)[169]. Flight heights typically below rotor swept volumes, combined with high rates of avoidance results in low predicted collision risk for most winds farm sites monitored. Based on studies on observed behavioural avoidance SNH (2018)[170] recommends the application of 99% avoidance rate for hen harriers in collision risk modelling for this species (Whitfield & Madders, 2006).

VP watches conducted at the proposed development site generated 225 seconds of flight line data within the 500 m turbine buffer over three winters, of which 195 seconds was determined to be at collision risk height. This level of activity was notably low and no CRM was run for this species. Based on low recorded usage of the wind farm and therefore very low assumed collision risk, the magnitude of effect due to direct operational impacts are considered *negligible* for hen harrier and therefore *not significant*.

Studies of hen harrier behaviour at operational wind farms suggests a degree of avoidance around active turbines, with Pearce-Higgins *et al*. (2009)[171] finding that birds avoided flying within 250 m of turbines. A review for SNH conducted by Haworth & Fielding (2015) found no evidence of decreases in activity post-construction and reported relatively small scales of displacement from turbines ranging from none to 100/200 m (micro-avoidance). This is supported by an Irish activity study conducted by Madden & Porter (2007)[172], which found that post-construction hen harrier activity around turbines returned to pre-construction levels.

For UK wind farms Haworth & Fielding (2015) found no evidence for negative effects on nesting locations or productivity. However, an Irish study (Fernández-Bellon *et al*. 2015)[173] while not statically significant, found that hen harrier productivity may be negatively impacted by proximity to turbines. Other Irish research on bird densities in relation to turbine arrays (including prey species of hen harrier) reported in Wilson *et al*. (2015)[174] indicated that bird densities were lower at wind farm sites than at control sites (without turbines), as well as lower closer to wind turbines than at distances further away.

UK.

167 Haworth, P. F. & Fielding, A. H. (2012). *A review of the impacts of terrestrial wind farms on breeding and wintering hen harriers*. Report prepared for Scottish Natural Heritage

168 Donoghue, B.G. (2018). *R.A.P.T.O.R. - Recording and Addressing Persecution and Threats to Our Raptors 2018*. Report prepared by NPWS, Regional Veterinary Laboratories and the State Laboratory.

169 O'Donoghue, B.G., Casey, M.J., Malone, E., Carey, J.G.J., Clarke, D. & Conroy, K. (2020). R.A.P.T.O.R. - Recording and Addressing Persecution and Threats to Our Raptors: A review of incidents 2007–2019' *Irish wildlife manuals*, No. 126. NPWS, DoHLGH

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

171 Pearce-Higgins, J.W., Stephen, L., Langston, R.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46: 1323-1331.

172 Madden, B. & Porter, B. (2007). Do wind turbines displace Hen Harriers *Circus cyaneus* from foraging habitat? Preliminary results of a case study at the Derrybrien wind farm, County Galway. *Irish Birds* 8: 231-236.

173 Fernández-Bellon, D., Irwin, S., Wilson, M. & O'Halloran, J. (2015). Reproductive output of Hen Harriers *Circus cyaneus* in relation to wind turbine proximity. *Irish Birds*. 10: 143-150.

174 Wilson, M, Fernández-Bellon, D., Irwin, S. & O'Halloran, J. (2015). *The interactions between Hen Harriers and wind turbines*. Windharrier. Final project report, prepared by School of Biological, Earth & Environmental Sciences, University College Cork, Ireland.

There were no hen harrier breeding sites located within the 2 km turbine buffer and recorded usage of the 500 m turbine buffer by hen harriers over the initial two-year study was nil, with low levels of usage recorded in the third non-breeding survey season undertaken (winter 2020-21). No winter communal roosts were located in the environs of the wind farm site (including for the third winter). Therefore, in term of indirect impacts operational turbines may have a localised effect, displacing the occasional individual foraging around turbines. However, in consideration of the discrete, relatively linear nature of the turbine array within the wider landscape, the availability of alternative foraging areas within the wider area and because the very intermittent level of recorded usage of the area clearly demonstrates that hen harriers are not exclusively reliant on the proposed development site, potential secondary impacts on foraging harriers are assessed as *negligible* magnitude and therefore *not significant*.

Golden plover – Likely Operational Phase Effects

As detailed in the ornithological baseline, relatively small flocks of golden plover periodically utilise the tillage fields at the proposed development site. Typically, flocks numbering < 100 birds were recorded; but up to 520 birds have picked up on passage in April. The attraction of the area appears to be the availability of arable fields on the western side of the proposed development site. Based on the conservation status of golden plover and the relatively low density of use, the area and the numbers of birds involved was considered as locally important. This section assesses the potential operational impacts of the proposed development site, including potential displacement of birds from the area and potential impacts from turbine mediated mortality.

In terms of the displacement effects of wind farm developments on golden plovers, there is a growing body of published studies and reports indicating that this species is relatively tolerant of operational turbines, although there are also studies with conflicting findings. For example, Sansom *et al*. (2016)[175] found that that breeding golden plovers were significantly displaced within 400 m of operational turbines, with a 79% reduction in abundance detected at the study site, which was monitored before and after construction. In contrast, Fielding & Haworth (2010, updated 2015)[176] studying breeding birds at a 40-turbine wind farm in Scotland found that breeding golden plover were not displaced, which is supported by Douglas *et al*. (2011)[177] and Pearce-Higgins *et al*. (2012)[178] that found no evidence for consistent declines within breeding populations at wind farm sites.

Earlier research by Pearce-Higgins *et al*., (2009)[179] noted a reduction in habitat use within 200 m of turbines. This is within the ranges reported in a review of wind farm

175 Sansom, A. Pearce-Higgins, J.W. & Douglas, D.J.T. (2016) Negative impact of wind energy development on a breeding shorebird assessed with a BACI study design. *IBIS* 158, 3: 541-555

176 Fielding & Haworth (2010, updated 2015) Farr windfarm: A review of displacement disturbance on golden plover arising from operational turbines between 2005-2015. Haworth Conservation, Mull.

177 Douglas, D.J.T., Bellamy, P.E. & Pearce-Higgins, J.W. (2011). Changes in the abundance and distribution of upland breeding birds at an operational wind farm. *Bird Study*, 58, 37–43.

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

179 Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46, 1323–1331.

impacts in Germany by Hötker *et al*., (2006)[180] that includes information on minimum disturbance distances for wintering golden plover at 22 wind farms sites. For these wind farms, the following minimum disturbance distances are given: 50 m (six sites), 150 m (nine sites), 250 m (4 sites), 350 m (2 sites) and 850 m (one site). The mean minimal displacement distance was 135 m (median 175 m) and the large variation in range was explained by habitat availability on a site-by-site basis. This indicated that displaced non-breeding birds move to the nearest suitable habitat patch; and therefore, as was the case for the site with the 850 m displacement effect, if the wind farm occupies a significant proposition of the suitable habitat, then birds are likely to be displaced to suitable areas further afield. Hötker *et al*., (2006) also noted that at three out of four study sites, golden plover demonstrated increasing habituation to turbines over time. Woodrow's surveyors have regularly observed wintering golden plover utilising upland blanket bog within 80-150 m of operational turbines at one of the country's oldest wind farms.

At the proposed development site, the habitat utilised by golden plover is tillage. Assuming a maximum displacement effect of 200 m from turbines, there is still a substantial area of tillage (c. 50%) potentially available beyond 200 m of the proposed turbine locations. Therefore, taking into consideration the periodic use of the tillage fields at the proposed development site by golden plover (max. flock size 520 birds), the magnitude of the potential operational displacement effect is *negligible* (<1% population effect) at an Irish population level (80,707 birds)[181] and is assessed as *not significant*. Taking a local population estimate of 1,400 to 2,000 birds, then the magnitude of the displacement effect on the local population ranges from low to the lower end of high (5 to 26% population effect depending on the size of the foraging flock:100 to 520 birds). However, the fact that birds are not consistently recorded in the area, indicates that they are not exclusively reliant on this resource. Therefore, at the local/regional population level, with consideration given to the ample availability of similar habitat in the general area (arable/improved grasslands), the potential impact of displacement is considered as a low to moderate magnitude effect of *low significance*.

To investigate the magnitude of effects of potential for direct impacts through collision with turbines, collision risk modelling was undertaken utilising observed flights for golden plover from two winters. VP watches conducted for the proposed development generated 29 golden plover observations, which cumulatively amounted to 1,341,077 seconds of flight line data within the 500 m turbine buffer, all of which was determined to be at collision risk height. As detailed in **Annex 5.7**, predicted collision risk (weighted and applying avoidance rate of 98%) was 129 collisions over 30 years (see **Table 5.27**).

Applying an annual adult survival rate of 0.73 (Sandercock, 2003; as cited by Robinson, 2005 in BTO BirdFacts)[182], it is estimated that the number of collisions required

180 Hötker, H., Thomsen, K. M., & Köster, H. (2006). *Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats. Facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation*. Michael-Otto-Institut im NABU, Bergenhusen, 65.

181 Lewis, L. J., Burke, B., Fitzgerald, N., Tierney, T. D. & Kelly, S. (2019b). Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16. *Irish Wildlife Manuals*, No. 106. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland

182 Sandercock, B.K. (2003). Estimation of survival rates for wader populations: a review of mark-recapture methods. *Wader Study Group Bulletin* 100:163-173. As published on http://www.bto.org/birdfacts - BTO BirdFacts | Golden

to produce a 1% increase over baseline mortality would be 218 collisions/annum based on the Irish winter wintering population (80,707 birds) or 3.7 to 5.4 collisions/annum based on the estimated regional/local wintering population (1,400 to 2,000 birds). Based on predicted collisions (4.3 collision/annum) the additional annual mortality on the regional/local population is estimated to have a negligible to low effect adding an 0.80 to 1.14% to annual mortality. As the model was run on a highly precautionary avoidance rate, the magnitude of effect on the wintering golden plover population from potential collisions was assessed to be at a negligible (< 1% population effect) scale and *not significant* at the local/regional level.

To qualify this assessment in terms of the collision model run for golden plover as precautionary due to the application of a low avoidance rate. A species-specific avoidance rate is not provided for golden plover and therefore the default 98% rate was applied, as per SNH (2018)[183] guidelines. It has been suggested that the default rate may be appropriate for breeding population, as encountered in Scotland. However, post-construction monitoring studies indicate that higher avoidance rates should be applied for non-breeding golden plovers; and rates of 99.8% may generate more realistic modelled outputs, which are in line with avoidances rates applied for wintering geese (SNH, 2013)[184]. Collision risk for wader species, including golden plovers are generally considered to be low due to manoeuvrability in flight (Mc Guinness *et al*., 2015)[185]. In terms of recorded turbine mediate morality Hötker *et al*. (2006) assessing 127 wind farms across Europe only cites four golden plover collisions; however, this review does not control for survey effort, scavenging rates or surveyor detection rates. A dedicated study systematically searching turbines for victims of collisions undertaken at wind farms on a bird migration route in northern Germany (Fehmarn), detected a total of three golden plover fatalities (Grünkorn, 2011[186] and Grünkorn, 2015)[187].

Woodcock – Likely Operational Phase Effects

Both wintering and breeding woodcock population occur at Bracklyn. Wintering birds utilise the woodland/scrub within the wind farm site to roost up during the day and are likely to forage in the bogland, improved grassland and tillage during the night. Likewise, breeding birds nest in the ground cover within scrub and woodland habitats; and foraging bird will utilise the more open habitats adjacent to the woodland. During the breeding season, males undertake display flights (known as roding) around dusk, which involves males traversing up and down woodland rides and forestry edge. Observed, flight heights ranged from 5 m to just above the canopy (up to 30-40m),

Plover, (accessed on 06-May-2021) citation: Robinson, R.A. (2005) *BirdFacts: profiles of birds occurring in Britain & Ireland*. BTO, Thetford

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

184 SNH (2013). Avoidance rates for wintering species of geese in Scotland at onshore wind farms. Scottish Natural Heritage.

185 Mc Guinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015*). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland*. BirdWatch Ireland, Kilcoole, Wicklow

186 Grünkorn, T. (2011). Bird fatalities at wind turbines - How many birds actually collide with wind turbines at a well-known hotspot of bird migration, the island of Fehmarn in northern Germany? Poster for Conference on wind energy and wildlife impacts (CWW-2011), Norway

187 Grünkorn, T. (2015). A large-scale, multispecies assessment of avian mortality rates at onshore wind turbines in northern Germany (Progress). Conference on wind energy and wildlife impacts (CWW-2015), Berlin

which places birds within the collision risk zone of turbines. The heights of other nocturnal flights (e.g. from roost sites to foraging areas) are not known; as VP watch methodology is not designed for tracking night-time flights. It can be assumed that a proportion of flights will be within the zone of collision risk.

In relation to collision risk for breeding woodcock, Derouaux *et al*. (2012)[188] note that roding behaviour was thought to contribute to surprisingly high levels of woodcock mortality due to collision with powerlines in Belgium. As detailed in Loss *et al*. (2020)[189], American woodcocks on migration are susceptible to collision with manmade-infrastructure, with risk appearing to increase in relation to climatic conditions such as snow storms and low cloud. Wind farm avian mortality studies in Flanders, as reported in Everaert (2014)[190], list two woodcock as victim of collision with turbines; however, there are no details on seasonality provided, i.e. whether birds were on migration or breeding in the area.

There is evidence of operational turbines impacting on breeding woodcock and resulting in reduced display activity in roding males. As discussed in Dorka *et al*. (2014)[191], Schmal (2015)[192] and Straub *et al*. (2015)[193]; an 88% decline in territorial males was detected between pre-construction surveys and Year 1/Year 2 post-construction surveys. There are no published studies investigating the effects of operational wind farms on the wintering population. Surveyors from Woodrow deploying night recording cameras have (incidentally of the deployment) captured footage of woodcock flying into improved grassland to forage within 150 m of turbines. On another site a woodcock fatality, suspected of flying into a turbine was recovered during searches beneath turbines (only scavenged remains found). These examples illustrate as for many species, that while the effect of turbine displacement may be minimal, activity adjacent to turbines heightens the risk of collisions.

In terms of conservation concern, the wintering and breeding woodcock populations are considered to be different, with only the declining breeding population being BoCCI Red listed (Gilbert *et al*. 2021); therefore, at this location, wintering woodcock are classed as not being sensitive to proposed wind farm developments (Percival, 2003), with the breeding population classed as having *Medium* sensitivity. The Irish wintering population receives a massive influx of birds from continental Europe; and given the assumed stability of the population (e.g. there is no daily bag limit for shooting woodcock in Ireland), the constrained nature of the proposed development and the fact that there is an abundance of alternative cover in the adjacent area

188 Derouaux, A., Everaert, J., Brackx, N., Driessens, G., Martin Gìl, A., Paquet, J.-Y. (2012): Reducing bird mortality caused by high- and very-high voltage power lines in Belgium. Final Report, Elia and Aves-Natagora, 56 pp.

189 Loss, S.R., Lao, S. Anderson, A.W., Blair, R.B., Eckles, J.W. & Turner, R.J. (2020). Inclement weather and American woodcock building collisions during spring migration. *Wildlife Biology* 2020(1)

190 Everaert, J. (2014). Collision risk and micro-avoidance rates of birds with wind turbines in Flanders. *Bird Study*, 61:2, 220-230

191 Dorka, U. Straub, V.F. & Trautner, J. (2014). Wind power above forest - Courtship of the woodcock at risk? Findings from a case study in Baden-Wuerttemberg (Northern Black Forest) *Naturschutz und Landschaftsplanung*, 46: 69-78

192 Schmal, V.G. (2015). Sensitivity of the woodcock to wind power plants – contribution to the current discussion. *Naturschutz und Landschaftsplanung*, 47: 43-48

193 Straub, V.F., Trautner, J. & Dorka, U. (2015). Woodcocks are sensitive to wind power plants, and their harming can break legislation on species protection – Reply to Schmal (2015) in the context of the publication by Dorka *et al*. (2014). *Naturschutz und Landschaftsplanung*, 47: 49-58

means the magnitude of any operational effects are considered not significant for the wintering component of the population.

Vegetation clearance as part of mitigation to limit collision risk for bats, specifically felling operations around T4, T5, T6, T7, T10 & T11 to facilitate the creation of a 50 m standoff between roost swept areas and bat features (bat feature buffers) will alter habitat availability for both day roosting and breeding woodcock. These bat feature buffers will be managed as open areas of grassland, which are likely to be utilised by foraging birds.

The operational footprint of the proposed wind farm, inclusive of bat feature buffers has the potential to result in a localised displacement of wintering and breeding woodcock to adjacent areas with similar cover. However, post-construction availability of woodland/scrub cover is not considered to be a major factor likely to limit the occurrence of this species at this location; as ample cover will remain throughout the operational phase of the project. Through project design (embedded mitigation) the best examples of woodland habitat have been avoided. These areas of semi-natural woodland are not subject to commercial clear-felling and were found to support a dense understorey, which provides the cover required by ground nesting woodcock at the proposed development site. Typically, the understorey of conifer plantation is shaded out by the dense, closed-thick canopies and therefore is considered less suitable for woodcock. Likewise, the understorey of the young broadleaved plantations targeted for removal is relatively underdeveloped and unstructured. Therefore, on balance it is assessed that the magnitude of effect for potential habitat loss on both breeding and wintering woodcock is negligible and *not significant*.

Inappropriately monitored/phased felling operations and scrub clearance occurring during the breeding season, has the potential to result in direct disturbance to woodcock nests and precocious young within the bat feature buffers. During operations to clear vegetation there is also the potential for indirect impacts through displacement of woodcock nesting and roosting in areas adjacent the bat feature buffers. With consideration given to the inherently lower quality cover for woodcock provided by the plantations that are predominately targeted for removal; it is assessed that there is potential for direct/indirect disturbance impacts on nesting birds due to vegetation clearance activities, if conducted during the breeding season, which adopting a precautionary assessment (in view of data deficient population estimates) could result in a low level population effect (1-5%) and is therefore of *low significance*.

Collision risk and displacement of breeding woodcock due to operational wind turbines are considered here together, as there are several unknowns and any potential effects may be linked. For instance, do breeding birds simply avoid areas with turbines or do collisions contribute to localised population decline and then have a potential sink effect on the wider area, drawing in new birds that are then subject to collision risk/turbine mediated mortality. There are no recommended standoffs between turbines and woodcock breeding territories. At the proposed development site woodcock surveys found that the majority of the display (roding) activity occurred on the outer edge of the southern and eastern woodlands. The linear distribution of mature woodland around the outer edge of the turbine array could have a partial screening effect for birds on the periphery of the site.

Given the uncertainty surrounding the current status of the Irish breeding population, the number of territories potentially impacted at the proposed development site and how resident woodcock might react to the proposed turbine array, a precautionary approach is taken and the effect on the local population is assessed accordingly. Based on roding behaviour observed at the proposed development site it is estimated that there are 3-4 males holding territories. Taking a local (10-km square) population of 276 territories, based on a mean density of 2.76 bids/km^2 (Hoodless *et al*., 2009)[194]. Assuming all four territories are displaced during the operational phase, the magnitude of effect on the local population is low (1-5%); and this assessment holds down to a local population of 80 territories, which may be a more realistic figure given the low availability of woodland in the wider area. Therefore, the potential impact of displacement/collision on the local/regional woodcock breeding population is assessed as a low magnitude effect of *low significance*.

Lapwing – Likely Operational Phase Effects

As described in the ornithological baseline, a single pair of lapwings attempted to breed in the field surrounding the proposed location for T3. The breeding attempted failed in 2019 and no birds were recorded the following breeding seasons (2020 and 2021). The crop rotation over the monitoring period was thought to be the core contributory factor to unsuccessful breeding. However, the area may become suitable at stages during the operational phase of the project and lapwing have been found to exhibit fidelity to breeding sites, with young birds often returning to natal sites (Thompson *et al*., 1994)[195].

Wintering birds, although periodically recorded in the wider area (max. flock 50 birds) were rarely recorded within the 500 m turbine buffer area and typically these were commuting flights. Therefore, it is considered that given the very low levels of site usage by wintering lapwing, it is highly unlikely that this component of the population will be impacted by the proposed development, either directly (collisions) or indirectly (displacement).

As reviewed in Mc Guinness *et al*., (2015)[196], studies on lapwing populations breeding in the vicinity of operational turbines "*have found no discernible impact on populations of breeding Lapwings, either through collision, disturbance displacement or avoidance*". Post-construction observations by Woodrow surveyors undertaken at a two-turbine wind farm site in the Midlands (2015-2020), found that 3-5 pairs of lapwings have consistently, over a 5-year period, attempted to breed in an arable field within 290 m and 450 m of the closest turbine tower. There are some studies where displacement effects have been detected and for instance, Steinborn & Reichenbach (2011)[197] found that while lapwing bred within wind farm sites, there were displacement effects of up to 100 m. This finding fits with the mean disturbance

194 Hoodless, A.N., Lang, D., Aebischer, N.J., Fuller, R.J. & EwaldJ.A. (2009). densities and population estimates of breeding Eurasian Woodcock *Scolopax rusticola* in Britain in 2003. *Bird Study* 56: 15–25

195 Thompson, P.S, Baines, D. Coulson, J.C. & Longrigg, G. (1994). Age at first breeding, philopatry and breeding site-fidelity in the Lapwing *Vanellus vanellus*. *IBIS* 136, 4: 475-484.

196 Mc Guinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015*). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland*. BirdWatch Ireland, Kilcoole, Wicklow

197 Steinborn, H. & Reichenbach, M. (2011). Lapwing and wind turbines. *Naturschutz und Landschaftsplanung* 43(9): 261-270.

distance of 108 m, as reviewed in Hötker *et al*. (2006)[198], where a maximum disturbance distance for breeding lapwing of 350 m is reported.

Despite documented collision risk for breeding lapwing being exceptional low, a collision risk modelling was undertaken utilising observed flights for lapwing for the breeding season only, which amounted to 3,050 flight seconds within the collision risk zone, all recorded in March and April of the 2019 breeding season. As detailed in **Annex 5.7**, predicted breeding season collision risk (weighted and applying avoidance rate of 98%) was 0.6 collisions over 30 years (see **Table 5.27**). Applying an annual adult survival rate of 0.705 to 0.735 (Peach *et al*., 1994; as cited by Robinson, 2005 in BTO BirdFacts)[199], it is estimated that the number of collisions required to produce a 1% increase over background mortality would be 10.5 to 11.8 collisions/annum, based on the Irish breeding population of 2000 pairs (Lauder & Donaghy, 2008 in BWI, 2011)[200]. Based on predicted collisions (0.021 collision/annum) the additional annual mortality on the national breeding population would have an imperceptible effect adding an estimated 0.002% to annual breeding lapwing mortality.

Therefore, the magnitude of effect on the Irish breeding lapwing population from potential collisions is considered negligible (< 1% population effect) and *not significant* at the National scale. Collision risk in this species in considered inherently low and at this location displacement is more likely to be an issue. It is considered that current management of the areas under tillage at the proposed development site are not suitable for breeding lapwing due to crop rotation practices, which have effectively displaced this pair and currently there is limited risk of direct impacts to lapwing.

Snipe – Likely Operational Phase Effects

The baseline study identified snipe breeding territories along periphery of the 500 m turbine buffer within the southern bog. This area also supported most of the winter activity for this species. Direct loss of any substantial areas of breeding/wintering habitat are not anticipated, as the site layout avoids potential snipe habitat on wetter parts of the southern bog. Pearce-Higgins *et al*. (2009) suggests that breeding snipe densities may reduce by up to 47.5% within 400 m of operational turbines. The potential displacement effects on wintering and breeding snipe, due to the proposed development being operational have been assessed as unlikely to low, based on the highest densities of use being recorded at the periphery of the 500 m turbine buffer and beyond 400 m of proposed turbine locations.

The cryptic nature of snipe means that population estimates derived for both wintering and breeding birds are based on expert opinion, with the RoI population estimated at 4,275 pairs (BWI, 2010)[201] and in 2013 the NI population was estimated at 1,123 pairs

198 Hötker, H., Thomsen, K. M., & Köster, H. (2006). *Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats. Facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation*. Michael-Otto-Institut im NABU, Bergenhusen, 65.

199 Peach, W.J., Thompson, P.S. & Coulson, J.C. (1994). Annual and long-term variation in the survival rates of British Lapwings *Vanellus vanellus*. *J. Anim. Ecol*. 63: 60–70. As published on BTO BirdFacts https://app.bto.org/birdfacts/results/bob4930.htm (accessed on 06-May-2021) citation: Robinson, R.A. (2005) *BirdFacts: profiles of birds occurring in Britain & Ireland*. BTO, Thetford

200 BWI – BirdWatch Ireland (2011). Action Plan for Lowland Farmland Birds in Ireland 2011-2020. *BirdWatch Ireland's Group Action Plans for Irish Birds*. BWI, Kilcoole, Co. Wicklow

201 BirdWatch Ireland (2010). *Action Plan for Upland Birds in Ireland 2011-2020*. BirdWatch Ireland's Group Action Plan

(Colhoun *et al*. 2015[202] - see also Henderson *et al*., 2002[203]). The wintering population is bolstered by a significant influx of overwintering European birds. While both the wintering and breeding populations are BoCCI Red listed, there are unrestricted bag limits on taking wintering snipe, suggesting there is less concern with this component of the population.

Fatalities due to turbine collisions are reported (Hötker *et al*, 2006[204] & Fennelly, 2015[205]), and breeding snipe may be at higher risk of collision, due to the flight behaviour of territorial (drumming) birds. During baseline VP watches flight observations amounting to 1,669 seconds at rotor swept height were recorded within the 500 m turbine buffer. For snipe, a species known to fly at night, a correction of 25% was applied to account for potential nocturnal flight time. For species where no avoidance rates have been estimated, SNH (2018)[206] recommend applying a rate of 98%. Predicted collision risk (weighted and applying avoidance rate) was estimated to be exceptionally low at 0.4 collisions over 30 years, equivalent to one bird every 73 years.

However, as reviewed in Madder & Whitfield (2006)[207] relying on VP watch data and the resultant CRMs may not be an appropriate methodology for assessment of an elusive species like snipe, as flight time can be underestimated. It is estimated that to have a perceptible effect on the Irish breeding population (i.e. > 1% than background mortality), Irish wind farms cumulatively would have to result in direct impacts on 5,000-6,000 snipe per annum. While acknowledging the inherent uncertainties surrounding predicted collision rates and population estimates for snipe, the magnitude of effect at the population level for collision risk is *negligible*. Therefore, in view of *Medium* population sensitivity (Percival, 2003), the potential direct operational phase impacts on snipe wintering and breeding within the proposed development site is considered *not significant*.

Kestrel – Likely Operational Phase Effects

During VP watches kestrels were one of the most frequently detected species within the 500 m turbine buffer. Overall flight time within the 500 m turbine buffer was 16,119 seconds, with 15,086 seconds recorded at heights within the rotor swept area. Within the proposed development site, the mosaic of different habitats creates lots of edge effects which can be exploited by foraging kestrels. There are breeding options within the proposed development site; however, the closest active nest site identified during the baseline study was c. 1 km from the closest proposed turbine.

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for Irish Birds. BWI Kilcoole, Co. Wicklow

202 Colhoun, K., Mawhinney, K., & Peach, W.J. (2015). Population estimates and changes in abundance of breeding waders in Northern Ireland up to 2013. *Bird study* 62. 394–403.

203 Henderson, I.G., Wilson, A.M., Steele, D. & Vickery, J.A.(2002). Population estimates, trends and habitat associations of breeding Lapwing *Vanellus vanellus*, Curlew *Numenius arquata* and Snipe *Gallinago gallinago* in Northern Ireland in 1999. *Bird Study* 49: 17–25.

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

205Fennelly, R.F. (2015). A Review of Bird Strike Mortality at Irish Onshore Windfarms. *CIEEM in-practice* Issue 88 June 2015

206 Scottish Natural Heritage (2018). Avoidance rates for the onshore SNH wind farm collision risk model. SNH.

207 Madder & Whitfield (2006). Upland raptors and the assessment of wind farm impacts. *IBIS* 148:1 43-56

Flight behaviour means kestrels are a species emerging as notably susceptible to collision with turbines and this is acknowledged within the collision risk model, which is run with a lowered avoidance rate for kestrel (95% avoidance rate). Based on observed flight activity within the 500 m turbine buffer, the collision risk (weighted and applying avoidance rate) was predicted to be 6.7 collisions over 30 years, equivalent to 1 bird every 4.5 years. Despite declining numbers, kestrel remain a common and widespread raptor in Ireland (9,918-17,393 pairs cited in Lewis *et al*. 2019a)[208] and on a country wide population basis this magnitude of effect on a single pair would be considered *negligible*. If considering the magnitude of the effect on local kestrel populations (e.g. 6 birds within 10 km) then the magnitude would be assessed as *moderate* (*c*. 6-20% of local population affected).

Foraging and (probably) breeding kestrel do not appear to suffer displacement effects from operational turbines, which combined with flight behaviour may explain the higher levels of collisions associated with this species. Generally, kestrels would be considered a species that becomes habituated to human activity; for instance, birds regularly nest in active quarries. At one wind farm site, Woodrow surveyors located a pair of kestrels using a hooded crow nest in a treeline of Sitka spruce, which was located *c*. 95 m from a turbine tower. Often post-construction habitat within wind farm sites, e.g. felled areas, tracks and habitat management areas, creates good foraging habitat for kestrels and may actively attract birds into the site, increasing the potential for collisions to occur.

Recently upgraded from the amber to the red listed (BoCCI, 2020-2026), kestrels are now classed as *Medium* sensitivity at this locality; and in view of predicted collision risk acting at a local level, it is considered that the direct impacts of the operational wind farm will be *moderate*, resulting in an effect of *low significance* on the local population. Any potential secondary impacts are considered *not significant*.

Swift – Likely Operational Phase Effects

Swift (up to 12 birds) were recorded foraging over the proposed development site. This species exploits swarming insects, taking them on the wing. Swifts do not breed locally and travel into the area to forage, most likely on an opportunistic basis, as foraging birds were only recorded periodically. Depending on weather conditions swifts often foraging at heights of 50 to 100 m placing them within the collision risk zone. As swifts are habituated to manmade structures it is considered unlikely that foraging birds will be displaced by operational turbines and conversely this species (along with swallows) may be actively drawn towards turbines to glean insects that are attached to/more active around to turbine towers and hardstands (Rydell *et al*., 2012)[209]. While the mechanism and potential effects are poorly understood at this stage, it is considered likely that this behaviour leads to heighted collision risk for this species. In Germany 3% of 1,192 report fatalities due to collisions with wind turbines between 1989 and 2010 were swifts, which when combined with swallow morality was

208 Lewis, L. J., Coombes, D., Burke, B., O'Halloran, J., Walsh, A., Tierney, T. D. & Cummins, S. (2019a) Countryside Bird Survey: Status and trends of common and widespread breeding birds 1998-2016. *Irish Wildlife Manuals*, No. 115. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland.

209 Rydell, J., Engström, H., Hedenström, A. Larsen, J.K., & Green, M., (2012). *The effect of wind power on birds and bats – A synthesis report*. Report 6511 Swedish Environmental Protection Agency

proportionally higher than would be expected for small, fast-flying and mobile species like swifts and hirundines (Dürr, 2010 in Rydell *et al*., 2012).

At the time of surveying swifts were Amber listed (Colhoun & Cummins, 2013)[210] and were not considered as target species, as populations are not generally considered sensitive to wind farm developments. Therefore, no flight line data was not collected and collision risk modelling has not been undertaken. Subsequently, after the completion of the study the conservation status of swifts was upgrade to Red (Gilbert *et al*., 2021)[211]. Although no collision risk model was undertaken for this species, based on recorded site usage, collision risk at the proposed development was considered to be relatively low; as small numbers of foraging swifts were only periodically recorded within the 500 m turbine buffer. In addition, swifts appeared to demonstrate preferential usage of the airspace over the southern bog, removing core activity levels from the proposed turbine array. This selective foraging behaviour would be expected over bogland, where biomass of emergent insects is likely to be consistently higher over the summer months when compared to intensively managed farmland and agroforestry.

It is estimated that the number of collisions required to produce a 1% increase over baseline mortality would be 49 to 251 collisions/annum, based on the national (RoI) population of 68,920 birds - range: 25,520 to 130,540 birds (Crowe *et al*. ,2014)[212] and an annual adult survival rate of 0.808 (Balmer & Peach, 1997)[213]. This level of mortality is judged to be highly unlikely to occur at this location. Therefore, the magnitude of effect due to potential collisions is *negligible* and considered *not significant* at the national level. To generate a > 1% effect of on the regional population additional annual mortality due to turbine collisions would have to be in the region of 0.5 to 0.7 collisions/annum, based on a regional swift population estimate of 300-400 birds (estimated from data in Krastev *et al*., 2018[214] and the online Swift Conservation Project[215]). At the lowest rate this equates to approximately 1 collision every 2 years. This rate is higher than the predicted collision rates for most of the target species recorded during the study, including those of buzzards, which registered significantly higher densities of use within the 500 m turbine buffer (see **Table 5.27**). Again, this level of collision is considered unlikely at this location, based on observed usage of the proposed development site by swifts. Therefore, it is concluded that the magnitude of effect due to potential collisions is *negligible* and assessed as *not significant* at the regional/county level. However, a low rate of turbine mediated mortality is considered likely to have *Negligible* to *Low* magnitude effect on the local breeding population of *very low* to *low significance*.

Barn owl – Likely Operational Phase Effects

Proposed development site is within the range of the known breeding site that is located within 1.5 km of the proposed development. The arable fields and woodland

210 Colhoun, K. & Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014–2019. *Irish Birds* 9: 523—544

211 Gilbert, G., Stanbury, A. & Lewis, L. (2021). Birds of Conservation Concern in Ireland 2020 –2026. *Irish Birds* 43: 1–22

212 Crowe, O., Musgrove, A.J. & O'Halloran, J. (2014). Generating population estimates for common and widespread breeding birds in Ireland. *Bird Study* 61(1): 82-92

213 Balmer, D,E. & Peach, W.J. (1997) *Review of Natural Avian Mortality Rates*. BTO Research Report No. 175

214 Krastev, A., Whelan, R. & Caffrey, B. (2018). *Westmeath Swift Survey 2018*. Report by BirdWatchIreland

215 Swift Conservation Project: Online ArcGIS project. Accessed 06-May-2021 via: Swift Conservation Project (arcgis.com)

edge within the proposed development site provide foraging opportunities for this species. Recorded usage of the site was low; however this was likely to be a function of the nocturnal habits of this species making is difficult to detect. The proposed development site was considered to offer limited suitable breeding locations. The relatively young commercial plantations and limited lengths of older treelines that will be targeted for felling to establish bat feature buffers did not hold the veteran trees with suitably developed cavities capable of supporting breeding barn owl. The only potential breeding site identified was the abandon cottage adjacent to the access track close to the site entrance. No evidence of occupation by barn owls was reported during licenced building inspections for bats. There are no plans to alter the cottage as part of this proposal.

Owl species have been identified as being at risk of collision as a result of wind farm developments (Langston & Pullan 2003)[216], due to their size and nocturnal/crepuscular hunting behaviour. Barn owl collisions with turbines are reported in the unpublished literature; however, these appear to be predominately associated with small domestic turbines and the lattice tower structure employed widely in the erection of wind turbines in North America. It is generally considered that low level flight behaviour of barns owls (typically < 3-4 m) limits collision risk with larger turbines in the UK (and Ireland) where lattice towers are not commonly employed (Barn Owl Trust, 2015)[217]. Furthermore, the Barn Owl Trust (2015) goes on to state:

"*Based on available evidence, the Barn Owl Trust takes the view that, overall, the level of threat posed to Barn Owls by wind turbines in Britain is relatively very low*."

As discussed in relation to construction phase impacts, barn owls are generally considered relatively tolerant of human activities. Barn owls have been recorded breeding successfully within 750 m of a wind farm comprising 16 turbines and have been bred successfully over three years within 35 m of a smaller domestic turbine (Barn Owl Trust, 2015). In addition, barn owls are reported as successfully breeding at an operational large wind farm in Scotland (Crystal Rig)[218] and at a nine-turbine site under construction, also in Scotland (Twentyshilling)[219]. At both these wind farms nest boxes have been provided to maintain barn owls breeding sites.

Based on the distance between the known breeding site and closest proposed turbine (c.1.4 km), as well as the low collision risk to barn owls posed by operating wind turbines; it is concluded that the operational phase of the proposed development will have a *negligible* effect on barn owls and all potential indirect or direct impact are assessed as being *not significant*.

Non-breeding Medium Sensitivity Target Species Occurring at Low Densities

Six of the medium sensitivity target species recorded during VP watches were only observed commuting or foraging through the 500 m turbine buffer on a limited number of occasions. With the exception of the three foraging raptor species, no

216 Langston, R.H.W. & Pullan, J. (2003). *Windfarms and Birds: An analysis of the effects of windfarms on birds, and guidance on environmental assessment criteria and site selection issues*. RSPB/BirdLife.

217 Barn Owl Trust (2015). *Barn Owls and Rural Planning Applications- a Guide*. The Barn Owl Trust – see Wind turbines and Barn Owls - The Barn Owl Trust

218 See press release at: http://www.pes.eu.com/wind/ornithological-plan-leads-to-barn-owl-success/

219 See press release at: Breeding Barn Owl Pair Get New Spring Home (dgwgo.com)

breeding, roosting or foraging sites were recorded within or adjacent to the works corridor. This included:-

• Little egret	1 observation	55 seconds within the collision risk zone
• Whooper swan	2 observations	192 seconds within the collision risk zone
• Greenland white-fronted geese	1 observation of 42 birds	18,900 seconds within the collision risk zone
• Merlin	5 observations	0 seconds within the collision risk zone
• Peregrine	2 observations	220 seconds within the collision risk zone
• Barn owl	1 observation	See assessment in previous section

A collision risk model was only run for Greenland white-fronted geese, as flight times captured for the other species were so low. Based on the single observed flight line of 42 geese commuting through the 500 m turbine buffer; the predicted collision rate (weighted and applying an avoidance rate of 98%) for Greenland white-fronted geese was 0.2 collisions over 30 years, equivalent to 1 bird every 169 years. This is considered well below background mortality for this species.

Therefore, taking account of the *medium* population sensitivity (Percival, 2003) for these six species, it is assessed that the potential direct and indirect impacts during the operational phase, including specifically predicted collision rates, are of *negligible* magnitude and therefore *not significant*.

Red Listed Passerines – Likely Operational Phase Effects

Four species of red listed passerine were recorded within the 500 m turbine buffer, including redwing (wintering), grey wagtail (occasional non-breeding), meadow pipit (breeding/wintering) and yellowhammer (one pair).

Information on the effects of operational wind farms on small passerine birds is limited compared to studies on larger collision risk species, such as eagles and hen harriers. Some studies find limited effects of active turbines on passerine assemblages (e.g. Devereux *et al*. 2008)[220], with other reporting mild to moderate displacement effects (e.g. Wilson *et al*., 2015[221] & Pearce-Higgins *et al*., 2012[222]). A study by Gómez-Catasús *et al*., (2018)[223] investigating the effects of wind farms on a threatened passerine (Dupont's lark) suggests that wind farms can have a significant and deleterious impact, with a magnitude of annual decline four times higher than for similar populations occurring in control areas without wind turbines.

For grey wagtails no impacts are anticipated in terms of operational disturbance or due to collision risk. As discussed for construction related impacts, this species is sensitive to deterioration in water quality. In the absence of mitigation to protect water quality during the operational phase of the project, especially felling to create bat

220 Devereux, C. L., Den`ny, M. J. H. & Whittingham, M. J. (2008). Minimal effects of wind turbines on the distribution of wintering farmland birds. *Journal of Applied Ecology* 45: 1689-1694.

221 Wilson, M, Fernández-Bellon, D., Irwin, S. & O'Halloran, J. (2015). *The interactions between Hen Harriers and wind turbines*. Windharrier. Final project report, prepared by School of Biological, Earth & Environmental Sciences, University College Cork, Ireland.

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

223 Gómez-Catasús, J., Garza, V. & Traba, J. (2018). Wind farms affect the occurrence, abundance and population trends of small passerine birds: The case of the Dupont's lark. *Journal of Applied Ecology* 55(40: 2033-2042

buffers there is potential for negative impacts on the grey wagtails utilising downstream areas for foraging. At the population level, isolated/localised impacts on a small number of birds (probably a single pair) is unlikely to result in any impact above an effect of *negligible* magnitude; therefore, the potential impact would be classed as *not significant*. Vegetation clearance along drains within the proposed development site may actually have a slight positive impact for this species, by opening up overgrown watercourse and creating better foraging conditions. In addition, any of the more substantial drain crossings can create nesting cover for this species e.g. in the rock armouring associated with culverts.

Wintering redwing are likely to be displaced over the short-term during felling operations to create bat feature buffers if activities are conducted during the winter. Areas holding the invasive species cherry laurel are targeted for removal and redwing will lose several dense stands of this potential food sources. However, it is considered that there are ample alternative foraging/roosting habitats in the vicinity of proposed development site and the magnitude of effect on the wintering population is considered *negligible* and therefore *not significant*. A detailed collision risk study conducted in the Netherlands using radar to track bird movements (see Krijgsveld *et al*., 2009)[224], did record a single redwing fatality. However, the density of birds tracking through the zone of collision risk (including redwing and other thrushes) and the actual number of collisions recorded was substantially lower than expected. This was suggestive of high levels of avoidance, even during conditions when collision risk was considered high, e.g. nights with poor visibility due to low cloud and rain. Therefore, no significant population level impacts are anticipated in terms of operational disturbance or due to collision risk for redwings.

As highlighted in the ornithological baseline, the core meadow pipit breeding locations are associated with the southern bog and are removed from the area that will be occupied by the operational footprint of the proposed development, including areas for bat feature buffers. Pearce-Higgins *et al*. (2012)[225] suggest positive effects for breeding densities for meadow pipits on wind farm sites post-construction related to changes in vegetation structure improving nesting opportunities. There is potential for this to occur at the proposed development site, especially in areas where forestry will be felled to create bat buffers. Therefore, operational impacts on breeding meadow pipit are considered neutral/potentially positive and *not significant*.

As for meadow pipits, the current breeding distribution for yellowhammer (only one pair located during baseline surveys) was found to be beyond the operational footprint for the proposed development site, including areas for bat feature buffers. Yellowhammers are a species associated with intensive agricultural landscape along with associated management activities, such as ploughing and hedgerow maintenance. Therefore, any disturbance factors emanating from operational turbines are not considered likely to result in negative impacts for this species. Removal of forestry plantations for bat feature buffers may, depending on post-construction land-use create foraging habitats for yellowhammers. Overall, there will be very

224 Krijgsveld, K.L., Akershoek, K., Schenk, F., Dijk, F. & Dirksen, S. (2009). Collision risk of birds with modern large wind turbines. *Ardea* 97: 357–366

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

limited net loss of potential nesting habitat for this species; and while removal of a hedgerow/treeline is required at T4 to implement the bat feature buffer for this turbine, which does remove potential nesting habitat for yellowhammer (all be it not currently occupied), any length of hedgerows removed will be replaced. Therefore, the potential for direct/indirect impacts to yellowhammers was considered unlikely and therefore *not significant*.

Amber Listed Breeding Passerines – Likely Operational Phase Effects

There were seven Amber listed passerines recorded breeding in the 500 m turbine buffer including: goldcrest, willow warbler, skylark, spotted flycatcher, starling, linnet and greenfinch. Other Amber listed passerines recorded within the 500 m turbine buffer, but not breeding included house martin, sand martin, swallow and house sparrow. Wheatear was recorded on passage and is not considered to be breeding in the vicinity of the proposed development.

During the operational phase of the proposed development inappropriately timed removal of vegetation to create bat feature buffers has the potential to result in direct/indirect disturbance to Amber listed breeding passerines that nest in scrub, hedgerow, treelines and woodland/commercial forestry habitats, within or directly adjacent to the felling zones. This includes: goldcrest, willow warbler, spotted flycatcher, starling, greenfinch and linnet. In terms of population dynamics these species, which although Amber listed, are generally considered as common and wide spread (Crowe *et al*., 2014[226] & Lewis *et al*. 2019a[227]). A precautionary assessment of *low* magnitude of effects (1-5%) for potential direct/indirect impacts due construction related disturbance on *low* sensitivity receptors returns an effect of *very low significance*.

Skylark would not be impacted as this species is ground nesting and does not nest in forestry. Therefore, potential for direct disturbance to ground nesting birds of open habitats was assessed as *not significant*. The creation of open habitats around turbines may actually benefit this species and there is potential for *positive effects* for skylark, provided sufficient ground cover is retained during ongoing management. Currently, the proposed development site supports very low densities of breeding skylark, which is probably due to the intensive agricultural management system employed.

In terms of direct impacts from turbine mediated fatalities, globally post-constructions turbine searches have recovered a wide range of passerines causalities. The passerine species or very similar species recorded at the proposed development site have all been documented as having suffered collisions with operational turbines. The high productivity of most passerines means that populations are not likely to be affected to any significant degree by collisions with turbines. In addition, many of the species moving through the proposed development site, especially scrub and woodland nesting birds are likely to be doing so at an altitude below collision risk height. Conversely, based on studies employing radar and observer effort, passerines on migration tended to undertaken flights trajectories at heights above the collision risk

226 Crowe, O., Musgrove, A.J. & O'Halloran, J. (2014). Generating population estimates for common and widespread breeding birds in Ireland. *Bird Study* 61(1): 82-92

227 Lewis, L. J., Coombes, D., Burke, B., O'Halloran, J., Walsh, A., Tierney, T. D. & Cummins, S. (2019a) Countryside Bird Survey: Status and trends of common and widespread breeding birds 1998-2016. *Irish Wildlife Manuals*, No. 115. NPWS, Department of Culture, Heritage and the Gaeltacht, Ireland

zone, especially overnight; and when confronted with turbine arrays during the day birds have been observed employing marco-avoidance (e.g. Blew *et al*, 2008[228], Krijgsveld *et al*., 2011[229], Lindeboom *et al*., 2011[230]).

Generally, passerines are considered to exhibit low levels of sensitivity to ongoing operational indirect disturbance at wind farms and where detected, effects are typically of limited extent only exerting an influence over 100–200 m (as reviewed in Pearce-Higgins *et al*., 2012)[231]. Breeding densities of some species (as discussed for meadow pipits) were found by Pearce-Higgins *et al*. (2012) to exhibit potential positive effects of wind farm construction including species nesting in more open habitats like skylarks and stonechats; although data suggested that wheatear may exhibit a degree of turbine avoidance. The findings of Pearce-Higgins *et al*. (2012) contrast somewhat to those Fernández-Bellon *et al*. (2018)[232] who suggest based on studying bird populations at Irish windfarms, that large wind farms held lower densities of open-habitat species such as meadow pipit, skylark and wheatear. However, this study lacked the pre-construction comparative surveys employed in Pearce-Higgins *et al*. (2012).

For woodland and scrub nesting species, it is acknowledged that vegetation clearance to facilitate bat feature buffers will alter habitat availability and the operational footprint of the wind farm will result in a localised displacement of these woodland/scrubland birds into adjacent areas of habitat. It is considered that there is amble areas of suitable habitat in the environs of the operational footprint of the proposed development to accommodate displaced birds. In addition, the overall quality of the woodland habitat being removed was considered of sub-optimal for breeding birds, being dominated by monocrops of Sitka spruce and ash. Therefore, it is considered that the magnitude of effect of indirect impacts is *negligible* and displacement effects on breeding passerines during the operational phase of the proposed development are *not significant*.

The amber listed species, as with the majority of the passerines recorded within the proposed development site are considered relativity abundant and widespread species (Crowe *et al*., 2014 & Lewis *et al*. 2019a), which have high reproductive rates with populations that are unlikely to be affected to any degree by the operational wind farm, and the magnitude of the effect would be classed as *negligible* on a populations of *low* sensitivity and therefore impacts on amber listed passerines during the operational phase of the project are considered to be *not significant*.

228 Blew, J., Hoffman, M., Nehls, G. & Hennig, V. (2008). Investigations of the bird collision risk and the responses of harbour porpoises in the offshore wind farms Horns Rev, North Sea, and Nysted, Baltic Sea, in Denmark. Part I: Birds. Universität Hamburg and BioConsult SH Report.

229 Krijgsveld, K.L., Fijn, R.C., Japink, M., van Horssen, P.W., Heunks, C., Collier, M.P., Poot, M.J.M. & Dirken, S. (2011) Effect studies Offshore Wind Farm Egmond aan Zee: Final report on fluxes, flight altitudes and behaviour of flying birds. Bureau Waardenburg report no. 10-219. Commissioned by NordzeeWind

230 Lindeboom, H.J., Kouwenhoven, H.J., Bergman, M.J.N., Bouma, S. Brasseur, S., Daan, R., Fijn, R.C., de Haan, D., Dirksen, S., van Hal, R. Hille Ris Lambers, R., ter Hofstede, R., Krijgsveld4, K.L., Leopold, M. & Scheidat, M. (2011). Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. *Environ. Res. Lett*. 6: 1-13

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

232 Fernández-Bellon, D., Wilson, M.W., Irwin, S. and O'Halloran, J. (2018). Effects of development of wind energy and associated changes in land use on bird densities in upland areas. *Conservation Biology* 33(2): 413-422.

Mallard and Teal – Likely Operational Phase Effects

No direct or indirect impacts resulting from felling operations to implement bat feature buffer are anticipated for mallard or teal, as the core area utilised by these species (Bracklin Lough) is beyond the proposed development site and the areas earmarked for felling.

Collision risk for teal was considered almost nil; and as only 367 seconds of flight time was recorded within the collision risk zone, no collision risk model was run for this species. Flight time for mallard was higher (1,781 seconds); however, this generated an exceptionally low predicted collision rate for this species. Based on observed flight activity within the 500 m turbine buffer, the collision risk (weighted and applying an avoidance rate 98%) for mallard was predicted to be 0.4 collisions over 30 years, equivalent to 1 bird every 70 years.

For both these *Low* sensitivity species (Percival, 2003), any magnitude of effect for both indirect and direct impact during the operational phase of the proposed development was *negligible* and therefore ***not significant***.

Non-breeding Low Sensitivity Target Species Occurring at Low Densities

Five of the low sensitivity target species recorded during VP watches were only observed commuting or foraging through the 500 m turbine buffer on a limited number of occasions. With the exception of foraging goshawks, no breeding, roosting or foraging sites were recorded within or adjacent to the operational foot print of the proposed development. This included:

- Cormorant 3 observations 181 seconds within the collision risk zone
- Mute swan 1 observation 75 seconds within the collision risk zone
- Goshawk 2 observations 373 seconds within the collision risk zone
- Black-headed gull 2 observations 120 seconds within the collision risk zone
- Lesser black-backed gulls 8 observations 2,371 seconds within the collision risk zone

A collision risk model was only run for lesser black-backed gulls, as flight times captured for the other species were so low. Based on observed flight activity within the 500 m turbine buffer, the predicted collision rate (weighted and applying an avoidance rate of 98%) for lesser black-backed gulls was exceptionally low at 0.18 collisions over 30 years, equivalent to 1 bird every 168 years.

Therefore, taking account of the *low* population sensitivity (Percival, 2003) for five these species, it is considered that the potential direct and indirect impacts during the operational phase, specifically predicted collision rates are of *negligible* magnitude and therefore *not significant*.

Green Listed Secondary Avian Target Species with High Recorded Usage

Based on usage of the site the impacts on two Green listed raptors are considered, including: sparrowhawk and buzzard.

Sparrowhawk

Sparrowhawk breed in the proposed development site and there is potential for direct and indirect impacts from felling operations required to create bat feature buffers, that could result in destruction of nests or displacement of breeding birds leading to nest failure. As discussed for construction related impacts, sparrowhawks are considered to be relatively tolerant of felling operations. In addition, it is considered

unlikely the proposed felling operations will result in the displacement of a sparrowhawk breeding site in the small woodland between T2 and T3. Taking account of this, and the unrated conservation importance of sparrowhawk in Percival (2003); it is considered that the potential indirect/direct impacts on breeding sparrowhawk due to felling operations for bat feature buffers are *negligible* and therefore *not significant*. Nevertheless, best practice dictates that this potential impact will be minimised through project design to ensure removal of vegetation at appropriate times of the year, i.e. out of the breeding season. Secondary impacts due to displacement of foraging birds or displacement of prey species from areas around the proposed development are also considered *not significant*.

Despite the presence of at least one breeding pair in the 500 m turbine buffer, sparrowhawks were only recorded flying within the buffer for 2,759 seconds during VP watches, with 2,371 seconds judged to be at heights within the collision risk zone. Based on observed flight activity within the 500 m turbine buffer, the collision risk (weighted and applying avoidance rate) was predicted to be 0.43 collisions over 30 years, equivalent to 1 bird every 70 years.

As reviewed in Madder & Whitfield (2006)[233] relying on VP watch data and the resultant CRMs may not be an appropriate methodology for assessment of collision risk in a small raptor species like sparrowhawk. This species spends a high proportion of the time utilising cover, typically employing low hunting flight behaviour to ambush prey, which means a certain amount of the flights are likely to go undetected behind vegetation or other features. Typically, sparrowhawk flights are low level (< 20 m), which inherently reduces the likelihood of collision for this species. However, higher level display/territorial flights are observed during the breeding season, as was the case within the 500 m turbine buffer and there may be a seasonal increase in collision risk for this species. A relatively small number of sparrowhawk fatalities have been reported from Irish wind farm sites (e.g. Cullen & Williams 2010)[234]

Based on low levels of predicted collision risk for sparrowhawk, the magnitude of effect from direct and indirect operational impacts would be considered *negligible* and at the national population level are considered *not significant*.

Buzzards

Buzzards utilise woodland within the proposed development site for nesting and there is potential for direct and indirect impacts from felling operations required to create bat feature buffers, that could result in destruction of nests or displacement of breeding birds leading to nest failure. As discussed for construction related impacts, buzzards are considered to be relatively tolerant of felling operations. Taking account of this, and the unrated conservation importance of buzzard in Percival (2003); it is considered that the potential indirect/direct impacts on breeding buzzard due to felling operations for bat feature buffers are *negligible* and therefore *not significant*. Nevertheless, best practice dictates that this potential impact will be minimised through project design to ensure removal of vegetation at appropriate times of the year, i.e. out of the breeding season.

233 Madder & Whitfield (2006). Upland raptors and the assessment of wind farm impacts. *IBIS* 148:1 43-56

234 Cullen, C. & Williams, H. (2010). Sparrowhawk *Accipiter nisus* mortality at a wind farm in Ireland. *Irish Birds*, 9: 125-126

Buzzards were the most commonly recorded target species over the baseline study, with 319 observations recorded within the 500 m turbine buffer during VP watches, which generated a relatively high number of flight seconds (54,794 seconds). A high proportion of flight time (95%) was recorded within the collision risk zone.

Pearce-Higgins *et al*. (2009)[235] suggest that buzzards showed reduced flight activity and avoided an area of 500 m around turbines. This displacement effect may be pronounced immediately after construction and in the first few years of the operational phase. However, it is emerging that some species (including buzzard) develop tolerance to active turbines over time, which may result in a lag time of 2-3 years in the manifestation of post-construction collision related fatalities. Surveyors from Woodrow monitoring active wind farm sites across Ireland have identified several pairs nesting in close proximity to turbines, the closest occupying a small linear oak-hazel woodland within 190 m of a turbine. Clearly nesting near turbines carries an increased collision risk (especially for young recently fledged birds that are mastering their power of flight and likely to be naïve to the threats posed by turbines). Two buzzard fatalities (uncorrected for scavenger removal/observer rates) were attributed to collisions with turbines over four years of post-construction monitoring at the wind farm mentioned above.

Increasingly, as post-construction monitoring programmes improve, buzzards are a species emerging as notably susceptible to collision with turbines and this is acknowledged within the collision risk model, which is run with a lowered avoidance rate (98% avoidance rate). Based on observed flight activity within the 500 m turbine buffer, the collision risk (weighted and applying avoidance rate) was predicted to be 10.8 collisions over 30 years, equivalent to 1 bird every 2.7 years.

The buzzard population in Ireland has increased exponentially over the last 20 years and is still expanding into new areas; seemly only limited by the availability of nesting habitat, typically in trees (Lusby, 2011[236], Balmer *et al*. 2013[237]). The success of buzzards in Ireland can be attributed to having notably high fecundity for a raptor (capable of fledging broods of 6 young); and the species' ability to exploit numerous food sources, ranging from carrion, worms and larger more mobile prey items like rabbits. Buzzards also employ a variety of foraging techniques (e.g. sitting in tree or active hunting flights), depending on habitat, seasonality and prey types; which has allowed them to expand into a wider range of ecological niches when compared to other raptors. Although no population estimate is available for buzzards in Ireland, as indicated by the BoCCI Green listing the species is now a common and widespread raptor in Ireland. Therefore, on a country wide population basis the magnitude of effect from direct and indirect operational impacts would be considered *negligible* and at the national population level any effects are considered *not significant*.

235 Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology*, 46, 1323–1331.

236 Lusby, J. (2011). Species Focus: Buzzard comeback – Numbers continue to soar. *Wings* Spring 2011, BirdWatch Ireland publication.

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

5.4.3.6 Terrestrial (non-volant) Mammals – Potential Operational Phase Effects

Based on habitat availability and/or occurrence within the proposed development site five species of protected mammal were considered as important ecological features; including: otter, badger, pine marten and hare. Potential habitat suitability for red squirrel was identified within the older growth woodland on the periphery of the proposed development site; however, no evidence of squirrels was recorded.

Likely Direct Effects -Operational Phase

Inappropriately timed vegetation removal required to implement bat feature buffers has the potential to directly impact on resting sites of borrowing and arboreal mammals, where young or resting animals can be killed or injured; although in some instance proposed activities may only result in the destruction of the resting site itself. As detailed in **Section 5.3.9**, the only mammal species where resting sites were identified within the proposed development site were badger setts and no setts were located within the bat feature buffers. No otter holts/layups, pine marten dens or red squirrel dreys were identified within the proposed development site. The woodland habitats targeted for vegetation removal are not considered suitable for hares.

Therefore, no potential for direct impacts were identified for the five terrestrial mammal species identified as important ecological features, including: badgers, otter, pines martens, red squirrels or hares.

Likely Secondary Effects - Operational Phase

Overall mammal species are generally considered tolerant of operational wind farms and no secondary impacts are expected to result from the operating turbines or servicing activities.

Vegetation removal required to implement bat feature buffers has the potential to have long-term displacement effects on certain species of mammals, due to loss of potential foraging, commuting and sheltering habitat. The exact area to be targeted for removal will be determined by turbine dimensions in relation to feature heights, with the maximum felling proposed area calculated as 28ha. As discussed under construction impacts, removal of woodland, is likely to reduce habitat availability for arboreal species like pine martin and red squirrel; however, may 'open up' new foraging opportunities to badgers and hares.

The bat feature buffers (turbine layout) were designed to avoid old growth woodland; and as outlined in **Section 5.4.3.2** detailing habitat loss/alteration for bat feature buffers, felling operations will largely target commercial conifer and broadleaved plantations that are generally considered less valuable for biodiversity, including as offering long-term, structural diverse habitats for mammals. These mono-crop plantations would be subject to future felling independently of the proposed development. In addition, the broadleaf plantations that are dominated by ash are likely to require pre-mature removal, as part of nationwide measures to control ash dieback. While substantial areas of commercial plantations will be removed around turbines to implement bat felling buffers, these buffers have been designed to ensure that overall connectivity through the proposed development site will be retained and there will be no fragmentation of older growth woodlands that have an inherently higher value for biodiversity.

The noise and human activity associated with felling operations has the potential to result in a level of short-term displacement of foraging mammals; and if

inappropriately timed displacement of breeding mammals from adjacent areas of habitat due disturbance. As outlined in **Section 5.4.2.6**, the zones of influence for pine marten and red squirrel breeding sites are 100 m and 50 m, respectively. While the majority of habitats within the bat buffers, by virtue of being commercial plantations were considered as offering low quality foraging and breeding habitats for mammals; the adjacent habitats at some locations were of significantly higher quality, consisting of old growth woodland. These areas support foraging pine marten and have the potential to support breeding sites for this species, as well as red squirrel. However, no significant displacement effects of on arboreal species are anticipated, as there is ample good quality (old growth) habitat in the wider area that falls beyond the zone of influence of disturbance for the proposed felling operations. No resting sites for badgers or otter were located within the felling zones and as these species are largely nocturnal disturbance of foraging animals is considered unlikely.

In the absence of mitigation, potential deterioration in water quality within the drainage channels associated with the operational wind farm may result in reduced prey availability for otter both locally and downstream. As detailed in **Section 5.4.2.6**, if individuals noted as occasionally foraging in the proposed development site are displaced from the area due to short-term disturbance from felling operations and/or limited prey availability due to deterioration in water quality there is potential for increased pressure on resources within the downstream River Boyne and River Blackwater SAC.

For pine marten and red squirrel, potential secondary impacts resulting from habitat alteration during the creation of bat feature buffers are considered to have the potential for *Slight effects* at the *Local (higher)* level.

In the absence of mitigation and applying the precautionary principal, secondary impacts resulting from deterioration in water quality due to the creation of bat feature buffers are considered to have the potential for *Significant* at the *International* level for otter.

Secondary impacts resulting from potential habitat alteration due to the creation of bat feature buffers are considered to have the potential for slight *Positive* effects at the *Local (higher)* level for badger and hare.

5.4.3.7 Operational Phase Effects on Bats

Both direct collision with rotor blades and barotrauma (injuries to internal air cavities and blood vessels caused by sudden change in air pressure behind a moving blade), have been found to directly impacts bats (e.g. Cryan & Barclay, 2009[238], Rydell *et al*., 2010[239], Cryan *et al*. 2014[240] & Mathews *et al*., 2016[241]). The evaluation of Irish bat species likely to be at risk from collision and barotrauma is detailed in **Table 5.7**; and is

238 Cryan, P. & Barclay, R (2009). Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. *Journal of Mammalogy* 90, 1330-1340

239 Rydell, J., L. Bach, M. J. Dubourg-Savage, M. Green, L. Rodrigues & A. Hedenström. (2010). Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12:261-274.

240 Cryan, P. M., P. M. Gorresen, C. D. Hein, M. R. Schirmacher, R. H. Diehl, M. M. Huso, D. T. Hayman, P. D. Fricker, F. J. Bonaccorso & Johnson D. H. (2014). Behavior of bats at wind turbines. *Proceedings of the National Academy of Sciences* 111:15126-15131.

241 Mathews, F. Richardson, S. Lintott, P. & Hosken, P. (2016). *Understanding the Risk to European Protected Species (bats) at Onshore Wind Turbine Sites to inform Risk Management*. Final Report from University of Exeter University for RenewableUK and the UK Department of Energy & Climate Change (DECC)

in part related to the likelihood of different species flying at rotor blade height in an open landscape.

Different bat species have different foraging behaviours and ecological requirements, infrastructure such as wind turbines may affect different species in different ways. Each bat species recorded at the proposed development site are considered in the following sections. It is important to note that the probability of impact is lower for those turbines located away from habitat features. In open habitat, the probability of such an impact is considered less likely. However, where turbines are located within close proximity to features such as hedgerows and treelines (notably T4, T5, T6, T7, T10 and T11), there is potential for a greater occurrence of bats within the rotor-swept area, resulting in increased potential for impact.

The potential operational impacts of the proposed development on bat populations in the area need to be considered in the context of proposed mitigation measures for bats. Mitigation will include minimum separation distances from likely (foraging and commuting) features of 50 m to the rotor swept areas for all turbines. This necessitates a requirement for vegetation clearance; and then re-planting appropriate areas to compensate for the habitat loss and ensure integrity of the wider area for foraging and commuting bats. The extent of felling areas around turbines are shown in **Annex 5.5** – see **Appendix 2**. As proposed felling will take place during the construction phase, any likely significant effects of felling operations on roosting and foraging bats have been assessed under construction related impacts in **Section 5.4.2.7**.

Turbine layout and the requisite felling areas to maintain the minimum 50 m turbine-bat feature standoffs (bat feature buffers) were designed to minimise the amount of clearance of semi-natural woodland, hedgerows and treelines that is required. As outlined in **Habitats that** are identified as being Important Ecological Features for the purposes of this impact assessment are marked with a *

Table 5.26 in **Section 5.4.2.2** the majority of vegetation clearance requires the removal of commercial conifer and broadleaf plantations. Removal of trees around proposed turbines will create linear feature adjacent to the turbines creating a risk of higher activity than previously recorded. There was a difference in documented activity at D.10 across deployments considered to be due to felling in the area. After felling the detector was placed along a newly created linear feature and recorded higher levels of activity post-felling. This highlights the importance of implementing 50 m standoffs (minimum) between bat features and rotor swept areas.

Likely Direct Operational Phase Effects on Common and Soprano Pipistrelles

As listed in **Table 5.7** both common pipistrelle and soprano pipistrelle are considered to be of high risk of injury or mortality from turbines, resulting from either barotrauma (injuries to internal air cavities and blood vessels caused by sudden change in air pressure behind a moving blade) or collision, based on the behaviour and foraging techniques of this species. Both species typically show an affinity to habitat features such as woodland/plantation edge, scrub, treelines and hedgerows; however, pipistrelles are also known to forage more regularly in open habitat. Some of the proposed infrastructure at the site is close to features that are used by these species for foraging/ commuting. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found that these two species of pipistrelle were amongst the casualties most commonly recorded during turbine searches.

As discussed for bat activity monitored at height in **Annex 5.5**, there was an increased in bats activity at height during periods of dry, calm and warm weather conditions. However, this was largely driven by Leisler's bats and only 11% and 3% of the bat passes recorded at c. 50 m (n = 1,241 passes 23 Jun. to 05 Oct.) were attributed common (130 passes) and soprano (n = 34 passes) pipistrelles, respectively. In addition, to low levels of flight activity at height, the periods where tightly constrained to a small number of nights with optimal flight conditions. In particular concentrations occurred around mid-August for both species, with activity also clustered to within 1.5 hours of sunset. Therefore, based on the data collected from the open location where monitoring at height occurred, the inherent risk of collisions/barotrauma to pipistrelles is appears to be relatively low.

As summarised in **Annex 5.5** – **Table 20**, common and soprano pipistrelles are widespread and common throughout Ireland; however due to flight behaviour, population vulnerability to windfarm developments for both species is classed as *Medium*. Overall common pipistrelle activity was classed as high and soprano pipistrelle activity was classed as 'Moderate/High' with 'High' seasonal activity, which gives a risk assessment of high.

Some of the infrastructure proposed for the development is close to features that are used by these species for foraging, notably proposed turbine locations in the eastern part of the site, that are adjacent to treelines. Recorded levels of these species occurring at proposed turbine locations were considered to be high at T2. T4, T5, T6, T7, T10 and T11, with high levels of common pipistrelle activity being recorded in either spring, summer or autumn deployments at these locations.

Without mitigation, potential impacts of the operational phase upon common pipistrelle and soprano pipistrelle are considered to be *Significant* at the *Regional* level.

Likely Direct Operational Phase Effects on Nathusius' Pipistrelle

As listed in **Table 5.7**, Nathusius' pipistrelles are considered as *high risk* of injury or mortality from wind turbines resulting from either barotrauma or collision; as this species regularly flies in the open and at heights. Nathusius' pipistrelles are strong flyers and known to be migratory in parts of their European range and may fly at height during migration. A review of turbine related bat fatalities in Europe (Rydell *et al.*, 2010)[242] found that 13% of the casualties were Nathusius' pipistrelles.

As summarised in **Annex 5.5** – **Table 20**, Nathusius' pipistrelles are classed as having high population vulnerability to wind farm developments due the assumed vulnerability of the population and flight behaviour. It is acknowledged that there is limited population assessment data available for this species in Ireland; however, indications are that the range and frequency with which this species are recorded is increasing. In an Irish context, the apparent range expansion could be an apparition caused by increased survey effort and improved survey techniques.

For the proposed development site Nathusius' pipistrelles activity was classed as 'Low' according to Kepel *et al.* (2011) or 'Moderate/ Low' according to SNH *et al.* (2019) with an increased level of activity in spring, which gives an overall risk assessment of

242 Rydell, J., L. Bach, M. J. Dubourg-Savage, M. Green, L. Rodrigues & A. Hedenström. (2010). Bat mortality at wind turbines in northwestern Europe. *Acta Chiropterologica* 12:261-274.

medium for this species in the context of the wind farm site. Even when considering seasonal or localised risk the assessment remains medium. Supporting the assertion that it is only a relatively small number of migratory animals (1-2 bats) that occasionally occur at proposed development, there was only one Nathusius' bat pass recorded on the continuously recording 2 no. microphone (2m & 50m), which was deployed from 23 June to 05 October.

Without mitigation, potential impacts of the operational phase on Nathusius' pipistrelles are considered to be *Significant* at the *County* level.

Likely Direct Operational Phase Effects on Leisler's Bats

As listed in **Table 5.7**, Leisler's bats are considered to be at *high risk* of injury or mortality from wind turbines, resulting from either barotrauma or collision, based on species behaviour and foraging techniques. Leisler's bats are strong and fast in flight, regularly foraging over, or taking direct flights across, open habitats at heights within the collision risk zone for turbines. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found that common noctule bats (*Nyctalus noctula*), were amongst the casualties most commonly recorded during turbine searches (along with common and soprano pipistrelles). Common noctule bats are not known to occur in Ireland; however, it is a similar species to Leisler's bats (lesser noctule bats) in terms flight behaviour, and therefore similar levels of collision-risk would be predicated. Leisler's bats are very sparsely distributed in England and Wales, and only occasionally recorded in Scotland; and this explains why it was not encountered during turbine searches based in the UK.

As summarised in **Annex 5.5** – **Table 20**, population vulnerability to windfarm developments is classed as *High*, given the importance of Ireland as a global stronghold for Leisler's bat.

Overall, activity for Leisler's bat was assessed as low for the proposed development site, with a few seasonal hotspots emerging. Activity levels were highest in spring, with D.04, D.05, D.09 and D.10 emerging as the most active areas. Activity at D.09 emerged as a hotspot for activity during the summer deployment and D.04 during the autumn deployment. The spring flux in Leisler's activity is consistent with other sites monitored by Woodrow and it is thought prior to occupying maternity roosts this species travels widely to forage. Radio tracking of Leisler's bat in Ireland by Shiel *et al*. (1999)[243] found that during the spring this species may actively select foraging opportunities over lakes and conifer plantations. This could explain the relatively high levels of activity recorded by D.09 that was deployed near Bracklin Lough and D.10 that was in mature plantation, which was subsequently felled prior to the summer deployment. If the drop off in activity between spring and summer at D.10 was a result of felling operations, then this may be indicative of the effects that can be expected when bat feature buffers are implement around turbines. Activity associated with D.04 and D.05 were thought to be linked to bats commuting to Bracklin Lough to forage. The proposed development avoided Bracklin Lough and this feature is now 400m from T4, the closest turbine.

243 Shiel, C.B., Shiel, R.E., & Fairley, J.S. (1999) Seasonal changes in the foraging behaviour of Leisler's bats (*Nyctalus leisleri*) as revealed by radio-telemetry. *Journal of Zoology*: 249: 347-358

As would be expected, monitoring of activity at height found that Leisler's bat dominated the records with 1,074 passes recorded at 50m between 23 June and 05 October (86.5% of the passes at height). Through monitoring at height, the relationship between bat usage and weather parameters, were starting emerging including flights at height were almost all on dry nights, at wind speeds < 7m/s and temperatures 8°C, as measures at 50m.

Without mitigation, potential impacts of the operational phase upon Leisler's bat are considered to be *Significant* at the *County to Regional* level.

Likely Direct Operational Phase Effects on *Myotis* Species

As listed in **Table 5.7**, bats of the genus *Myotis* are considered as being at low risk of impact from wind turbines based on species behaviour and foraging techniques. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found a single carcass of a *Myotis* bat during the searches (a Natterer's bat - *Myotis nattereri*). *Myotis* species in the UK are rarely recorded fly at heights above the canopy (20 to 30 m) and tend to prefer a more cluttered habitat due to their short range, high frequency echolocation characteristics. Furthermore, their relatively slow flight speed allows them to manoeuvre well and therefore have the agility to avoid collision events (Mathews *et al*., 2016 & Rydell *et al*., 2010). Because of the behaviour exhibited by these species, the probability of direct operational impact is *Unlikely*. The low flight behaviour was confirmed at the proposed development site by the continuously deployed unit, which found that no *Myotis* species were recorded at height (see **Annex 5.5** – **Figures 22** & **23**).

As summarised in **Annex 5.5** – **Table 20**, overall *Myotis* bat activity was classed as 'Low' (Kepel *et al*., 2011) or 'Moderate/ Low' (SNH et al., 2019) and population vulnerability to windfarm developments for all three *Myotis* species regularly occurring in Ireland is classed as Low. Therefore, no overall collision risk assessment is required for this Genus.

Even without further mitigation, potential impacts of the operational phase upon *Myotis* species are considered to be *Not Significant*.

Likely Direct Operational Phase Effects on Brown Long-eared Bat

As listed in **Table 5.7**, brown long-eared bats are considered as being at low risk of impact from wind turbines. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found a single brown long-eared bat carcass during the searches. The static detector recording at height (50 m) recorded two brown long-eared bat at this height, which is unusual for this species. Typically, this species flies at low height and close to vegetation. However, this behaviour is highly anomalous for this species and the presence of 1 or 2 individuals does not reflect the risk posed to the species population as a whole. The standard mode of flight behaviour exhibited by this species results in the probability of an impact from wind turbines to be *Unlikely*.

As summarised in **Annex 5.5** – **Table 20**, overall brown long-eared bat activity was classed as 'Low' (Kepel *et al*., 2011) or 'Moderate/ Low' (SNH *et al*., 2019) and population vulnerability to windfarm developments for this species is classed as *Low*. Therefore, no overall collision risk assessment is required for this species.

Even without further mitigation, potential impacts of the operational phase upon brown long-eared bat are considered to be *Not Significant*.

Likely Secondary Effects During the Operational Phase

As proposed felling operations will take place during the construction phase, any likely significant effects of vegetation removal on roosting and foraging bats have been assessed under construction related impacts in **Section 5.4.2.7**.

Disturbance of roosting bats and disturbance of foraging bats though lighting impacts during the operational was considered to be *Unlikely*, as the installation of additional lighting proposed will be minimal. There will be additional lighting on the substation, which in the absence of mitigation has the potential to result in the displacement of light sensitive species. The species utilising this area most – Leisler's bat, soprano pipistrelle and common pipistrelle – are less sensitive to light pollution than the less commonly recorded species – brown long-eared bats and *Myotis* species.

5.4.3.8 Likely Cumulative Effects During the Operational Phase

In relation to additive/incremental effects upon ecological receptors consideration was given to other currently operational wind farms and those consented/under construction, including:-

• Yellow River WF - Operational target date: 2023	Co. Offaly	17 km SW*	29-turbines	Construction
• Coole WF - Subject to Judicial Review	Co. Westmeath	25 km NW*	15-turbines	Consented
• Cloncreen WF - Operational target date: 2022	Co. Offfay	30 km S*	21-turbines	Construction
• Mount Lucas WF	Co. Offfay	30 km SSW*	28-turbines	Operational
• Liffey Meats WT	Co. Cavan	31 km NNW*	1-turbine	Consented
• Teevurcher	Co. Meath	35 km NNE	5-turbines	Operational
• Moanvane WF	Co. Offaly	40 km SW*	12-turbines	Consented
• Gartnaneane WF	Co. Cavan	41 km NNE*	10-turbines	Operational
• Dunmore/Collon WF	Co. Louth	41 km NE*	4-turbines	Operational
• Mountain Lodge-Bindoo-Carrickale-Edrans complex	Co. Cavan	45 km N*	65-turbines	Operational

*Distances are taken from turbine locations at the proposed development site to closest operational turbine/part of consented site

Also considered in the assessment of cumulative effects was the proposed Ballivor Wind Farm[244], which will involve an application for planning permission for 26 no. turbines in the boglands to the south and east of the proposed development.

In the absence of mitigation, the key potential cumulative impacts upon ecology during the operational phase of the proposed development are:-

- Deterioration of water quality locally within the Stoneyford catchment and within the River Boyne catchment with potential for downstream effects on QI species and habitats of the River Boyne and River Blackwater SAC/SPA;
- Collision risk and barrier effects on sensitive bird populations;
- Local habitat loss/secondary disturbance effects on birds and bats; and
- Collision risk impacts on bat species.

[244] Pre-planning information for Ballivor Wind Farm is available at Bord na Móna Wind Farm | Ballivor Wind Farm

Water Quality

The proposed Ballivor Wind Farm would drain into some of the same local watercourses as the proposed development which form the Stonyford River subcatchment. The Yellow River Wind Farm (currently under construction) is within the River Boyne catchment and the Mongagh River-Castlejordan River-Yellow River subcatchment drains into the River Boyne approximately 25.5km upstream of the Stonyford River subcatchment. The Teevurcher Wind Farm and Gartnaneane Wind Farms are located in the northern most part of the River Boyne catchment, within the Moynalty and Blackwater [Kells] subcatchments, respectively. Both these subcatchments flow into the River Boyne via the River Blackwater [Kells] approximately 30.5km downstream of the Stonyford catchment. The Maighne Wind Farm as originally proposed consisted of several sub-sites located c. 20 km of SSE the proposed development between Enfield and Edenderry (Co Kildare/Co. Meath), including Drehid-Hortland (21 turbines), Windmill (3 turbines) and Ballynakill (10 turbines), which are located in the southern extent of the Boyne catchment, either draining into the head waters of the River Boyne or into the Blackwater [Longwood]. The Maighne Wind Farm proposal has altered since the original submission and is now being progressed as separate sites, e.g. Drehid WF (12-turbines) and all these sub-sites are located > 30km upstream of the upstream of the Stonyford River subcatchment.

As discussed in **Section 5.4.3.1** and **Section 5.4.3.3**, site infrastructure, felled areas and sections of the grid connection route were identified as potential sources of sediment laden runoff, which in the absence of mitigation could adversely affect water quality locally and downstream of the proposed development. As detailed in **Chapter 7**, it is considered that the highest risk to downstream waterbodies from wind farm developments is during construction; particularly if assessing the potential for cumulative hydrological effects of the proposed development in-combination with the proposed 26 turbine for the Ballivor Wind Farm, which fall within the Stonyford River sub-catchment. However, during the operational phase the flood risk assessment (see **Chapter 7**) demonstrates that even in the absence of mitigation, the potential for increased runoff is negligible. Therefore, the implementation of the proposed drainage control (as outlined in **Chapter 7**), which will release wind farm drainage at greenfield rates, will ensure cumulative effects with regard to sedimentation will be neutral. Therefore, potential cumulative surface water quality effects, are assessed as imperceptible and not significant, both locally within the Stonyford subcatchment and downstream within the River Boyne and River Blackwater SAC and SPA

Birds

The likely significant effects due to cumulative impacts on bird are considered to be limited to the influence of other wind farms, together with the proposed development, on displacement, collision or barrier impacts on birds.

Based on the low-density of operational and consented wind farms within 50km of the proposed development and in the vicinity of the SPAs covering the Midlands loughs complex (Lough Ennell SPA to Lough Sheelin SPA), likely significant additive/incremental effects on QI species/waterbird assemblage of SPAs, due to displacement and collision risk can be ruled out on the basis of low observed usage of the proposed development site by QI species. The outputs from the collision risk model concluded that there are no potential significant population effects on waterbird populations arising from collision risk associated with the proposed

development. In addition, the separation distances between the SPAs covering the Midlands loughs complex and operational/contented wind farms, are beyond the zone of influence/zones of sensitivity for waterbird species, as detailed in SNH (2016)[245] and Mc Guinness *et al*. (2015)[246].

Analysis of ornithological data collected from the proposed development and the proposed Ballivor Wind Farm, VP watch data in particular, would be required to provide a robust assessment of the likely cumulative effects on birds from both developments. In isolation, the dimension and spacing of the turbine array for the proposed development (9 No. turbines clustered over c. 3 km) does not form a significantly elongated or dense barrier effect to bird populations utilising or moving through the area. The proposed development is not considered to be on a significant migration route or regularly utilised flight line between any roost/breeding sites and foraging areas. Based on wintering waterbird and breeding raptor surveys conducted in the wider area surrounding the proposed development (5km and 2km, respectively, i.e. encompassing parts of Ballivor Wind Farm) and examining habitat availability across the Ballivor Wind Farm site, the areas of both proposed sites combined are considered unlikely to contribute significantly to disruption of migrating birds or birds using regular flight paths from roosts to foraging areas. Modelling based on ornithological studies for wind farms in Germany where large number of turbines are widely dispersed across farmland, suggests that the cumulative effects of avian collision risk for some sensitive bird populations, e.g. red kite (Schaub, 2012)[247], may be limited by clustering turbines; as would be the case for the proposed development and the proposed Ballivor Wind Farm combined.

The additive effects of the 9-turbine proposed development, in-combination with the 26-turbines proposed for the Ballivor Wind Farm, are considered likely to result in a cumulative effect on some local bird populations. Based on the outputs from collision risk models conducted for the proposed development (see **Annex 5.7**) local populations of kestrels and wintering golden plovers are species for which significance of effects (as determined using Percival, 2003) may be increased as a result of cumulative consideration. Cumulative collision risk and displacement effects on breeding woodcock are also likely to occur if turbines are constructed on Lisclogher Bog, as part of Ballivor Wind Farm. Mitigation and enhancement measures are proposed in **Section 5.5.2.2** to limit significant effects on local bird population; however additional mitigation measures may be required to offset cumulative effects. Working in tandem with mitigation measures proposed in this chapter, the EIAR for the Ballivor Wind Farm should identify and mitigate for any significant effects on local bird populations. Therefore, it is anticipated that cumulative operational effects on local bird populations will be adequately addressed through mitigation measure proposed within the respective EIARs. This highlights the importance of an appropriate monitoring programme and associated potential mitigation, should a situation arise

245 Scottish Natural Heritage (2016). *Assessing Connectivity with Special Protection Areas (SPAs)* Guidance (Version 3 – June 2016). SNH

246 Mc Guinness, S., Muldoon, C., Tierney, N., Cummins, S., Murray, A., Egan, S. & Crowe, O. (2015*). Bird Sensitivity Mapping for Wind Energy Developments and Associated Infrastructure in the Republic of Ireland*. BirdWatch Ireland, Kilcoole, Wicklow

247 Schaub, M. (2012). Spatial distribution of wind turbines is crucial for the survival of red kite populations. *Biological Conservation* 155: 111-118

whereby usage levels by species prone to collision risk increases as a result of ex situ or cumulative factors. A monitoring programme is detailed in **Section 5.6.1.5**.

Bats

Without mitigation, the additive effects of the 9-turbine proposed development, in-combination with the 26-turbines proposed for the Ballivor Wind Farm, are considered likely to have a cumulative effect on some local bat populations; specifically for high collision risk bat species (Leisler's bat, Nathusius', common and soprano pipistrelle). However, as detailed in **Annex 5.5**, it is anticipated potential collision risk will be sufficiently reduced through implementing bat feature buffers around turbines at the proposed development and ensuring that the proposed replacement planting maintains the overall amount of foraging habitat and connectivity through the proposed development site. Provided similar mitigation measures are implemented for the proposed Ballivor Wind Farm any cumulative effects from collision risk should be sufficiently mitigated.

As acknowledged by SNH *et al*. (2019), predicting bat behaviour post-construction is problematic and further operational mitigation measures can often be required. Therefore, for local populations of higher risk species there are residual effects of low significance. As detailed in **Annex 5.5**, a programme of post-construction monitoring of bat activity is proposed and this will inform requirements for any further operational mitigation. Provided this measure or equivalent is implemented at both proposed wind farm sites any residual effects can be reduced to not significant.

5.4.4 Decommissioning Phase Effects

Decommissioning phase effects are likely to be broadly similar to construction phase impacts, in terms of disturbance through increased noise levels, ground clearance works, and reinstatement. There will also be the potential for surface water quality impacts from ground disturbance, refuelling and the storage of potentially hazardous materials onsite.

Certain aspects of activities occurring during the construction phase are anticipated to occur at reduced levels during decommissioning, such as excavation of turbine foundations that will be left in situ and covered with soil for reinstatement. Access tracks will also remain for ongoing usage as farm and forestry tracks. In addition, the use of building materials, including concrete and aggregates will not be required.

5.5 Mitigation & Monitoring Measures

5.5.1 Construction Phase

5.5.1.1 Watercourses and Downstream Designated Sites

Proposed mitigation measures, required to prevent adverse effects on downstream Natura 2000 sites during construction, are outlined in the Natura Impact Statement (NIS) for the proposed development. The mitigation measures included in the NIS relate to protection of water quality flowing into the River Boyne and River Blackwater SAC and SPA. The mitigation measures proposed are taken from **Chapter 7** and the CEMP (**Annex 3.8**) and are designed to avoid adverse effects on local watercourses and groundwater. If these measures are implemented in full, they will ensure avoidance of impacts on the Natura 2000 sites, and the Qualifying Interests (QIs), including river lamprey, Atlantic salmon, otter and kingfisher. Mitigation measures provided in the NIS include:-

- Avoidance of sensitive aquatic areas where possible by implementing a 50m construction zone buffer. Note: The majority of the proposed development (including all turbine locations) are located outside of areas that have been assessed to be hydrologically sensitive, apart from some sections of access track, the T7 hardstand, a section of the construction compound along, the north-western corner of the substation, sections of the grid connection route and locations of watercourse crossing.
- As described in **Chapter 3**, specific mitigation measures, incorporated into the design of the development and through implementation of best practice methodologies will be employed where work inside buffer zones is proposed.
- Works for stream crossings will be carried out during the working window for instream works. This working window is defined by Inland Fisheries Ireland (IFI) as July to September to avoid vulnerable spawning salmonids/lamprey that may be present in downstream environments outside of this window. Any works outside of this period would require a derogation under the Local Authorities (Works) Act, 1949;
- There will be no crossing of rivers or streams by machinery during the construction phase, other than by constructed access routes, and all machinery must remain within the works corridor and utilise designated access routes;
- There will be no direct dewatering to watercourses during the construction phase. All outflows from drainage associated with construction will be by diffuse overland drainage at appropriate locations and through settlement ponds;
- For locations where works will be undertaken within water protection buffer zones (i.e. within 50m of watercourses), double silt fences will be installed around the watercourse to prevent sediment/silt infiltration into the watercourse;
- Cement leachate, hydrocarbon oils and other toxic poisonous materials will require full containment and will not be permitted to discharge to any waters, and control measures to be place will include:-
  - Appropriate bunded storage area for storage of fuels/oils, with onsite storage of hydrocarbons to be kept to a minimum;
  - Mobile double skinned fuel bowser will be used for re-fuelling on-site;
  - No refuelling will be permitted at works locations within the 50m hydrological buffer;
  - Spill kits will be readily available to deal with any accidental spillage;

  - There is an outline emergency plan for the construction phase to deal with accidental spillages;
  - Ready-mixed concrete will be brought to site, with no batching of wet-cement products occurring on site;
  - Where possible pre-cast products will be installed, including all watercourse crossings;
  - Use of wet-cement products within the hydrological buffer will be avoided, insofar as possible;
  - Lined cement washout ponds will be used for chute cleaning, with minimal use of water take will imported onto the site;
  - No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be permitted; and
- Wastewater emanating on-site (sewage, waste-water from site office) will be taken off-site for disposal/treatment at controlled facilities. To this effect, welfare facilities for construction site workers will include self-contained port-a-loos with an integrated waste holding tank. No water will be sourced on the site, nor will any wastewater be discharged to the site.

Chapter 7 and **Annex 3.8** also provide details of the Sustainable Drainage Systems (SuDS) that will be implemented to manage surface water taking account of water quantity (flooding), water quality (pollution) and biodiversity (wildlife and plants). This SuDS will adopt the following elements:-

- Open constructed drains for development run-off collection and treatment;
- Infiltration interception drains for upslope 'clean' water collection and dispersion;
- Flow attenuation and filtration check dams to reduce velocities, with consideration given to gradient with drains to determine spacing requirements; and
- Settlements ponds and buffered outfalls to control and store development runoff to allow settlement prior to discharge at Greenfield runoff rates. No outflow will be permitted directly into natural watercourses.

The site drainage and attenuation system will be installed prior to the main construction activities, and includes excavation of drainage ditches and installation of settlement ponds and soakaways. The site-specific drainage scheme is required to attenuate, hydraulically (flow) and hydrochemically (pollutants), the projected increase in runoff of *c*. 20.4 m^3/day (worst-case scenario) that will arise from the creation of additional areas of hardstanding.

Chapter 7 also provides details of management of soil/peat deposition areas to avoid impacting on water quality including:-

- Both proposed spoil deposition areas are located outside the 50m stream buffer zone;
- Silt fences, straw bales and biodegradable matting will be used to control surface water runoff for deposition areas; and
- Deposition areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff

Other measures include:-

- In order to avoid run-off of silt-laden water impacting upon water quality within surface water features adjacent to the works corridor, reinstatement works including measures to re-vegetate disturbed areas through re-seeding and/or placement of saved turves will be undertaken immediately after construction works;
- During construction, turves will be stored separately from spoil (soil/rock). Separate storage of turves will ensure vegetation is not significantly damaged and that turves can be replaced as a top-mat to facilitate rapid re-instatement of the surface vegetation, thereby significantly reducing the likelihood of soil erosion and the likelihood of silt laden surface waters affecting water quality;
- To ensure control measures are implemented appropriately, an Ecological Clerk of Works (ECoW) and Environmental Manager will be employed for the duration of the construction works; and
- Monitoring of water quality during construction will be undertaken, as outlined at **Annex 3.8**.

5.5.1.2 Important Habitats

As described at **Section 5.3.4**, semi-natural woodland habitats assessed as Local Importance (Higher Value) to Regional (County) Importance were identified during site surveys and the initial site layout was re-designed to avoid these areas. This iterative design process, described further at **Chapter 2**, included the omission of 2 no. turbines and revising the configuration of ancillary infrastructure to avoid areas of bog and natural/semi-natural woodland. These design iterations also assessed the requirement for felling to implement bat feature buffers around several turbines, which have been designed to avoid impinging on natural/semi-natural woodland. There are 2 no. locations where the proposed bat feature buffers would extend into important woodland habitats, including Annex I bog woodland at T10 and oak-birch-holly woodland at T11. However, these areas of woodland will be retained and additional post-construction monitoring for bats will be undertaken at these locations to determine if the residual habitat feature draws bats towards the rotor swept area (see **Section 5.6.1.6**).

The proposed development was designed to utilise existing agricultural/forestry access tracks and the infrastructural footprint largely targets lower value habitats including tillage, improved grassland and commercial monocrop plantations. Likewise, areas where felling is required to implement bat feature buffers generally comprise commercial forestry and the lengths of treelines and hedgerows to be removed has been keep to a minimum. Similarly, the number of locations where access tracks are required to intersect hedgerows/treelines has been limited thus minimising the extent of hedgerow/treeline removal.

Potential damage to sensitive habitats adjacent to proposed site infrastructure, has largely been avoided; as construction for the majority of the proposed site access tracks will involve upgrading existing forestry and farm tracks. Likewise, the majority of internal site cabling will be buried directly adjacent to or within the existing tracks. For sections of newly proposed access track, a 5m buffer from woodland and treelines has been implemented within which there will be no excavation work, tracking of heavy plant or storage of materials. Measures required to protect watercourses (e.g. erection of silt fence) will be permitted. If for unforeseen circumstances during the course of construction works any of these activities are required to occur within the buffer an appropriately qualified arboriculturist will undertake a pre-construction

assessment to ensure impacts to vegetation are avoided. This 5m treeline/woodland buffer will be implemented along sections of access track running in improved grassland to T10/T11 and from T4 to T5.

To avoid widespread disturbance to habitats, access within the proposed development site will be restricted to the footprint of the proposed works corridor and no access between different parts of the proposed development will be permitted, except via the proposed works corridor. An ECoW will be employed throughout the construction phase to ensure that construction activities do not encroach, unnecessarily, into any important habitats.

5.5.1.3 Non-native and Invasive Species

The presence and distribution of non-native species within the proposed development site were identified and mapped during walkover surveys (see **Section 5.3.4.1** and **Annex 5.1**). No Third Schedule invasive species were identified; however, best practice guidelines will be employed during construction to ensure that non-native species are not spread and, where feasible, are controlled. In particular, it is proposed to implement measures to control the presence of cherry laurel between turbines T10 and T11. Details of proposed measures to control cherry laurel are provided within the Habitat Management Plan at **Annex 5.6**.

To avoid non-native species being introduced to the site, quarry material will be sourced from licensed quarries, and certification that materials do not contain invasive species will be required. A pre-construction walkover survey of the works corridor will confirm the presence of any invasive non-native species that may have escaped into the area since the baseline surveys were conducted.

5.5.1.4 Birds

As part of the iterative design process (embedded mitigation), areas of old growth woodland have been avoided and will be retained. These areas were identified as important for woodland birds, especially breeding woodcock as well as a range of Amber listed breeding passerines.

To avoid widespread disturbance to birds, access within the proposed development site will be restricted to the footprint of the proposed works corridor and no access between different parts of the site will be permitted except via the proposed works corridor. Measures proposed at **Section 5.5.1.1** to protect water quality will avoid adverse effects on birds that rely on downstream aquatic habitats, such as grey wagtail and kingfisher.

To avoid direct and indirect disturbance to breeding birds, the following restrictions on timings of construction works will, where feasible, be applied:-

- Construction will be timed to commence outside the bird breeding season (March to August inclusive). This does not preclude construction continuing during the breeding season, but would allow sensitive bird species to choose nesting sites away from sources of potential disturbance;
- Where removal of suitable nesting habitat is required to facilitate the works, habitat clearance works will be undertaken prior to the 1st March in the construction year;
- Vegetation removal required for creation of bat feature buffers around turbines will be undertaken outside the bird breeding season;

- Once vegetation has been removed within the works corridor, these areas will be retained in a condition that limits suitability for nesting birds for the remainder of the construction phase. Any areas of potential cover, particularly cover for ground nesting species, will be rendered unsuitable by cutting vegetation or tracking over with an excavator;
- Should the clearance of vegetation suitable for nesting birds be required during the bird breeding season, the relevant vegetation will be surveyed in advance by the ECoW (with ornithological survey experience);
- Any construction works proposed during the breeding bird season will be preceded by a survey and will ensure the implementation of buffer zones (if nests/territories are identified) and measures required in order to avoid disturbance. Particular attention will be given to sensitive bird species (including breeding raptors and waders); and
- If works are scheduled to commence in February, a pre-construction visit will be required to monitor potential lapwing breeding sites in the tillage fields surrounding T2 and T3, as this species can be present on territories early in the season (late-February/early March).

5.5.1.5 Mammals (excluding bats)

The likelihood of effects on aquatic mammals, specifically otter foraging habitats, will be avoided through water quality protection measures as described at **Section 5.5.1.1**.

The proposed development has been designed to minimise the impact on features which are important for mammals such as hedgerows and drains. Old growth woodland and treelines have been avoided insofar as possible. While commercial forestry will be removed, care has been taken to ensure that overall connectivity between existing woodland and linear features is retained throughout the construction and operational phases of the proposed development.

During the design phase of the proposed development, a badger main sett was located within the footprint of the proposed substation. The dimensions of the substation compound were altered to avoid directly affecting the sett and a set-back distance of 30m was imposed. Likewise, an outlier sett in an earth bank southwest of the T2 hardstand (see **Figure A5.8.1** at **Annex 5.8**) was avoided by re-aligning the access track to ensure a standoff of in excess of 30m was retained. There was also badger activity recorded at the southern end of the field, adjacent to the southern-most part of the spoil deposition area. An appropriate 30m standoff will be maintained from the spoil storage and the felling area for T4. Proposed excavation for cabling running along this tree line to the meteorological mast will be buffered by 30m from sett entrances.

It is acknowledged that the distribution of mammal resting places can change over time. Therefore, in order to avoid accidental disturbance during the construction phase, a pre-construction walkover survey of the proposed development site will be undertaken. If any mammal resting places are identified, then appropriate exclusion zone(s) will be implemented and construction activities will be timed to avoid sensitive periods for the species affected, i.e. the breeding season.

Likewise, inappropriately timed vegetation removal, required to implement bat feature buffers has the potential to directly affect the resting sites of borrowing and arboreal mammals. Although during baseline surveys, no mammal resting places were

identified within the footprint of the proposed development or proposed felling areas, a pre-construction walkover survey will be undertaken prior to commencement of construction.

Pre-construction/felling surveys will cover all suitable habitat for protected mammals including within 50m of the works corridor for badgers and red squirrel, 100m for pine martin and 150m for otter. The aim of the surveys is to identify the resting sites of protect mammals and implement appropriate exclusion zone buffers, if required.

The following mitigation measures will be applied to avoid disturbance to badgers:-

During the breeding season (December to June inclusive), no construction works should be undertaken within 50m of active setts, nor blasting or pile driving within 150m of active setts.
Out of the breeding season (July to November, inclusive), the following restrictions will apply:

- No heavy machinery should be used within 30m of badger setts (unless carried out under licence);
- Lighter machinery (generally wheeled vehicles) should not be used within 20m of a sett entrance; and
- Light work, such as digging by hand or scrub clearance should not take place within 10m of sett entrances.

Disturbance to foraging mammals will be avoided by:-

- Construction works being largely limited to daylight hours thus allowing nocturnal animals like badgers and otters to forage through the night; and
- Minimising the risk of mammals becoming trapped if falling into excavations through the provision of egress points, e.g. placing escape planks or spoil runs.

5.5.1.6 Bats

The removal of vegetation is likely to impact on habitats utilised by roosting, foraging and commuting bats. **Annex 5.5** provides a detailed discussion on, and assessment of, the likely effects on bats and proposed mitigation measures to avoid likely significant effects.

During the construction phase of the proposed development, mitigation largely focuses on avoidance of direct effects to roosting bats, with further consideration given to likely indirect effects on foraging/commuting habitats.

Direct Effects on Roosting Bats

The iterative design process, as described at **Chapter 2**, has insofar as possible, avoided the removal of older growth treelines and woodland habitats likely to be utilised by roosting bats. In addition, the proposed development avoids impacting on a potential roosting site within the abandon cottage near the site entrance.

While several trees/treelines were noted as supporting Potential Roost Features (PRFs) within the works corridor, no active roosts were identified during surveys. However, given that a period of time is likely to elapse prior to the commencement of construction, it is acknowledged that roosting bats could occupy 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 PRFs 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 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.

Trees requiring felling, and identified as having moderate-to-high PRF, where surveying proves inconclusive will be 'soft felled', as outlined in the NRA (2005) guidelines[248]. This procedure must be carried out in suitable weather conditions, at an appropriate time of year, and involves:-

- Removing the tree in sections, starting with the top branches and then working down the trunk trying to avoid cutting through cavities;
- Any sections with PRFs must be lowered with care and laid on the ground with potential entrances to roosts orientated upwards to allow bat to vacate the roost; and
- Sections must be left in situ for at least 24 hours in suitable weather conditions to allow any bats to disperse.

For any occupied roost sites where vegetation removal is not proposed, an exclusion zone will be implemented to prevent disturbance during times of occupancy. **Table 5.28** provides optimal time periods for works at different roost types and, therefore, by extension, restrictive periods for construction works during which the exclusion zone for construction work would be applicable. The extent of the exclusion zone can be up to 30m for any notably disruptive works such as piling/rock breaking; however, this measure should be proportional to the disturbance levels emanating from the construction activity.

Bat usage of site	**Optimum period for carrying out works** Note: There is some variation between species
Maternity	01-Oct to 01-May
Summer (not a proven maternity site)	01-Sep to 01-May
Hibernation	01-May to 01-Oct
Mating/swarming	01-Nov to 01-Aug

Table 5.28: Optimal season for works at different roost types

248 NRA (2005). Guidelines for the Treatment of Bats prior to the Construction of National Road Schemes. Environmental Series on Construction Impacts, Transport Infrastructure Ireland - TII (formerly NRA), Dublin. Available at: https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Bats-during-the-Construction-of-National-Road-Schemes.pdf

Source: Kelleher & Marnell (2006)[249]

5.5.2 Operational phase

5.5.2.1 Watercourse & Downstream Designated Site

Mitigation measures to protect water quality during the operational phase of the proposed development are detailed in **Chapter 7**. The implementation of these measures, as detailed at **Annex 3.8**, will ensure that a deterioration of water quality in downstream watercourses will not occur such that aquatic species and habitats and designated sites do not experience any likely significant adverse effects.

5.5.2.2 Birds

Reducing habitat suitability

The most likely adverse effect on birds during the operational phase of wind farm developments is mortality arising from collisions with turbines and the consequential effects on sensitive populations. Collision risk modelling, based on flight times for target species recorded within the 500m turbine buffer, found that predicted risk would have a 'low-to-moderate' effects on the local populations for kestrel, which were classed as effects of low significance (Percival, 2003). Similar low significance operational effects on local populations of breeding woodcock are anticipated and may result in a reduction of breeding birds.

Mitigation measures will be implemented to limit kestrel foraging activity around turbines. This will be achieved through habitat management targeted at reducing prey availability in an area of 80-100m around turbines, as follows:-

- Creating a uniformly short/cropped vegetation structure maintained through grazing/mowing will support less prey items (rodents/birds);
- Or, alternatively, seasonally uniform vegetation heights can be maintained to facilitate silage production or oil seed rape;
- Timber and brashed material resulting from felling for bat feature buffer will be removed. Any remaining tree stumps will be chipped down to ground level;
- Finely chipped wood and spoil will, as necessary, be broadcast to create a flat surface for re-seeding; and
- Any open field/forestry drains must be piped and filled over.

Importantly, also As discussed in **Section 5.4.2.5**, predicted collision risk for golden plover is assessed to have been inflated by the use of an unrealistic avoidance rate and no specific measures to limit collision risk for this species are proposed as no likely population effects beyond a localised displacement of low significance (Percival, 2003) are anticipated. Post-construction monitoring, including turbine searches will be undertaken (see **Section 5.6**) and if golden plover collisions are detected, then contingency measures to reduce the attractiveness of the site will be implemented. This will involve limiting the amount of tillage around turbine locations, specifically T2 and T3 under the current management regime.

For kestrel and breeding woodcock enhancement measures are proposed to offset any low levels of direct or indirect effects of low significance on local populations.

249 Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. *Irish Wildlife Manuals*, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland

Measures to Offset Predicted Avian Collision Risk

For kestrels the provision of nest boxes is proposed as a compensatory measure to increase productivity in the area and offset the potential negative effects of direct effects during the operational phase. This type of enhancement measure is considered appropriate for kestrels, as this species often struggles with inter-specific nest site competition, e.g. interaction with buzzards. Provision of nest boxes at selected sites around the periphery of the proposed development is proposed to provide this species more nesting options in the area.

The habitat enhancement proposed for the area of bog woodland between T10 and T11, will ensure the protection of woodland habitats for breeding woodcock and habitat management measure will improve cover and create foraging opportunities.

5.5.2.3 Mammals (excluding bats)

Overall connectivity between existing woodland and linear features will be retained throughout the operational phase of the proposed development. As detailed at Annex 5.6 re-placement planting of treelines and hedgerows will be undertaken to compensate for length removed during infrastructural felling. Likewise, compensatory measures are proposed to offset loss semi-natural woodland through the enhancement measures in woodland adjacent to the proposed development. Following the implementation of proposed bat feature buffers (see **Section 5.5.2.4**), no further operational phase impacts were identified for mammals; therefore, no specific mitigation measures are required. Mitigation measures aimed at protecting water quality water, as outlined in **Section 5.5.2.1** and detailed in **Annex 3.8**, will avoid likely significant effects on otters foraging through the proposed development site; as well as downstream populations associated with the River Boyne and Blackwater SAC.

5.5.2.4 Bats

The bat survey report in **Annex 5.5** provides a detailed discussion on mitigation measures for bats to avoid likely significant operational phase effects, including collision and barotrauma; as well as indirect effects on foraging and commuting bats due to vegetation removal.

Habitat Management – Bat Feature Buffers

The primary mitigation measure employed to avoid collision and barotrauma in bats relates to the design of the proposed development to avoid features utilised by foraging/commuting bats. As recommended by the Natural England (2014) [250] guidelines, which have been adopted by SNH *et al.* (2019)[251], a 50m separation distance from habitat features used by bats and the blade tips of wind turbines must be maintained as the minimum bat feature buffer. Buffers are provided as the distance from turbine towers to the feature, with the separation distance being dependent on feature heights in relation to turbine dimensions. **Annex 5.5** provides full details of how bat feature buffers have been calculated. Feature heights are taken

250 Natural England (2014). *Bats and onshore wind turbines: Interim Guidance* 3rd Ed. Natural England Technical Information Note TIN051, Natural England, Peterborough

251 Scottish Natural Heritage, Natural England, Natural Resources Wales, Renewable UK, Scottish Power Renewables, Ecotricity Ltd, University of Exeter & Bat Conservation Trust (2019). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*.

as the final (maximum) tree height that would be obtained over the lifetime of the proposed development, i.e. estimated tree heights after 30-years.

For the proposed turbine dimensions (blade length of 81m and hub height of 104m), bat feature buffers of between 83m and 104m from the turbine tower to the feature will be required for low and high features respectively (calculated by applying 3m and 25m feature heights with a lowest rotor swept height of 23m [**Table 22** of **Annex 5.5**]). A 50m separation distance will be achieved for T1, T2, and T3 without any removal of existing features. To implement 50m bat feature buffers, vegetation removal is required at T4, T5, T6, T7, T10 and T11. The proposed felling areas are illustrated in **Figure 5.5**, along with the 83m to 104m bat features buffers to demonstrate that the 50m separation is achievable. Higher resolution maps are provided for each turbine at **Annex 5.5** and in relation to habitat constraints within bat feature buffers at **Annex 5.6**.

The felling plan (**Annex 3.10**) for the proposed development provides for a maximum bat feature buffer of 104m. As blocks of tall trees will remain at or just beyond the outer limits of the proposed bat feature buffers, the full extent of the buffer allowance will be required (at least in parts) to achieve the 50m separation distance between rotor swept areas and adjacent features.

In order to avoid affecting important woodland habitats, bat feature buffers will not impinge into areas recognised as Bracklin Wood at T5, Annex I bog woodland at T10 and oak-birch-hazel woodland at T11. Leaving these areas of woodland will result in features occurring just within the 50m bat feature buffers. These areas of woodland will be retained and additional post-construction monitoring for bats will be undertaken at these locations to determine if the residual habitat feature draws bats towards the rotor swept area.

The area where trees/scrub is cleared to create the bat feature buffers will be rendered as unfavourable for bats as possible, and maintained as such over the lifetime of the proposed development. Felled timber and branches will be removed, with stumps brashed to ground level. Any excess spoil from excavation works during construction, which cannot be accommodated within the proposed spoil deposition areas can be broadcast to cover over any ground stumps and create a more homogeneous surface. To prevent the area scrubbing up, a mowing and/or grazing regime will be implemented as part of the Habitat Management Plan (see **Annex 5.6**).

Habitat Management – Replacement Planting

The design of the proposed development has sought to avoid the removal of treelines, hedgerows and woodland habitats utilised by bats, especially higher value woodlands, insofar as possible. To compensate for the unavoidable loss of bat commuting/foraging habitat, there will be an equivalent area identified as compensatory habitat.

Several locations have been identified where vegetation removal of Local (higher value) importance has the potential to impact on foraging and commuting bats, including:-

- Hedgerow/treeline removal for T2 hardstand and to create gaps in treeline for access tracks, notably between T2 and substation and between T4 and T5;
- Lengths of broadleaf treelines occurring within the bat feature buffers for T4, T5 and T7;

- Bog woodland (non-Annexed) within the bat feature buffers for T10; and
- Older growth broadleaved (beech) woodland for the substation.

Habitat surveys undertaken for the proposed development have calculated that the following areas of Local (higher value) importance will be removed within the proposed development site:-

- 67 m of hedgerow;
- 1,392 m of treeline;
- 1.53 ha of non-Annex I bog woodland; and
- 0.7 ha mixed broadleaved woodland (older growth beech woodland).

As illustrated in **Annex 5.5** (**Appendix 3**), Annex I bog woodland, oak-birch-holly woodland and an area of Bracklin Wood within the proposed bat feature buffers for T10, T11 and T5 respectively, will be retained within the buffers. As detailed in **Section 5.6.1.6**, these areas will be targeted with post-construction monitoring of bat activity.

The removal of vegetation to implement 50 m stand-offs between rotor swept areas and bat features is not anticipated to significantly reduce the edge effects that create habitat features utilised by bats and may actually increase this, in combination with compensatory planting leading to an enhancement of the foraging features within the proposed development site.

Compensation should aim to maximise future woodland, hedgerow and treeline ecological function by specifying an appropriate species mix and replacement locations to maximise connectivity. In the latter case, full consideration must be taken of bat usage of the site. It is, therefore, proposed that compensatory planting of hedgerow/treeline habitat specifically targets areas where connectivity will be affected, including the area around T4, T2 hardstand, NW edge of felling area for substation. Options for replacement locations are provided at **Annex 5.6** and the overall length of candidate target section for re-planting amounts to 2,314m. The Habitat Management Plan (**Annex 5.6**) is not prescriptive in regard and recognises the importance of a degree of flexibility in identifying sections for replanting.

As identified in **Chapter 3**, areas of commercial forestry which have been felled to accommodate the proposed development (infrastructure) will be replaced by replanting at an alternative site in accordance with the Forest Service's published policy on granting felling licences for wind farm developments.

Turbine Control

It is anticipated that implementing bat feature buffers will limit bat activity in the vicinity of turbines and will be effective in reducing the potential for collision risk. However, SNH *et al*. (2019) acknowledge that it is difficult to predict how bat behaviour will change post-construction Therefore, further mitigation informed by post-construction monitoring may be required.

One such option is smart curtailment, whereby turbines identified in high-risk locations by post-construction monitoring are feathered to run at < 2rpm, while optimal flight conditions for bats occurs. Smart curtailment has the potential to limit collision risk for Leisler's bat, in particular, as this species' feeding behaviour is often associated with open areas and therefore may be less responsive to mitigation involving vegetation removal around turbines (although, as detailed at **Annex 5.5**, recorded Leisler's bat activity on the site was generally low, with more activity recorded during spring, at the proposed locations of T4 and T5).

Any requirement for smart curtailment, and the parameters that would influence it, must be guided by a coherent and comprehensive post-construction monitoring methodology, which will clarify the bat usage of the site at turbine locations post-construction, the likely relationship with temporal and weather parameters, and will identify any potential collisions (noting the difficulties highlighted above in predicting how bat usage of the site may change post-construction). However, the pre-construction surveys, including surveys at height and the measurement of weather parameters, do allow for the identification of relationships between bat usage and weather parameters, that will demonstrate how an effective smart curtailment approach, specific to individual turbines, can be implemented. These include:-

- 96.7% of recorded Leisler's bat passes at 50m were at wind speeds of under 7m/s (at 50m);
- 97.9% of recorded Leisler's bat passes at 50m were temperatures of over 8°C (at 50m); and
- 96.0% of recorded Leisler's bat passes occurred at times of zero precipitation.

Recorded Leisler's bat activity on the site was generally low, with more activity recorded during spring, at the proposed locations of T4 and T5 (which may be related to Leisler's bats feeding over forestry prior to setting up maternity roosts for example)

Information such as that detailed above, together with information on temporal usage of the site at specific turbine locations post-construction (including usage over the season and over night-time periods within specific seasons), can be utilised to provide a highly effective mitigation approach by smart curtailment by implementing curtailment during the periods and environmental parameters that are known to be preferred by at risk-species.

Section 5.6.1.6 outlines the proposed post-construction monitoring strategy for adoption once the proposed wind farm becomes operational. Over the first three years of operation a combination of data will be collected from:-

- bat activity monitoring (seasonal deployment of static bat detectors) including continuous monitoring at height (if feasible);
- fatality search around turbines; and
- deployment of a fully automated weather station with 3G connectivity

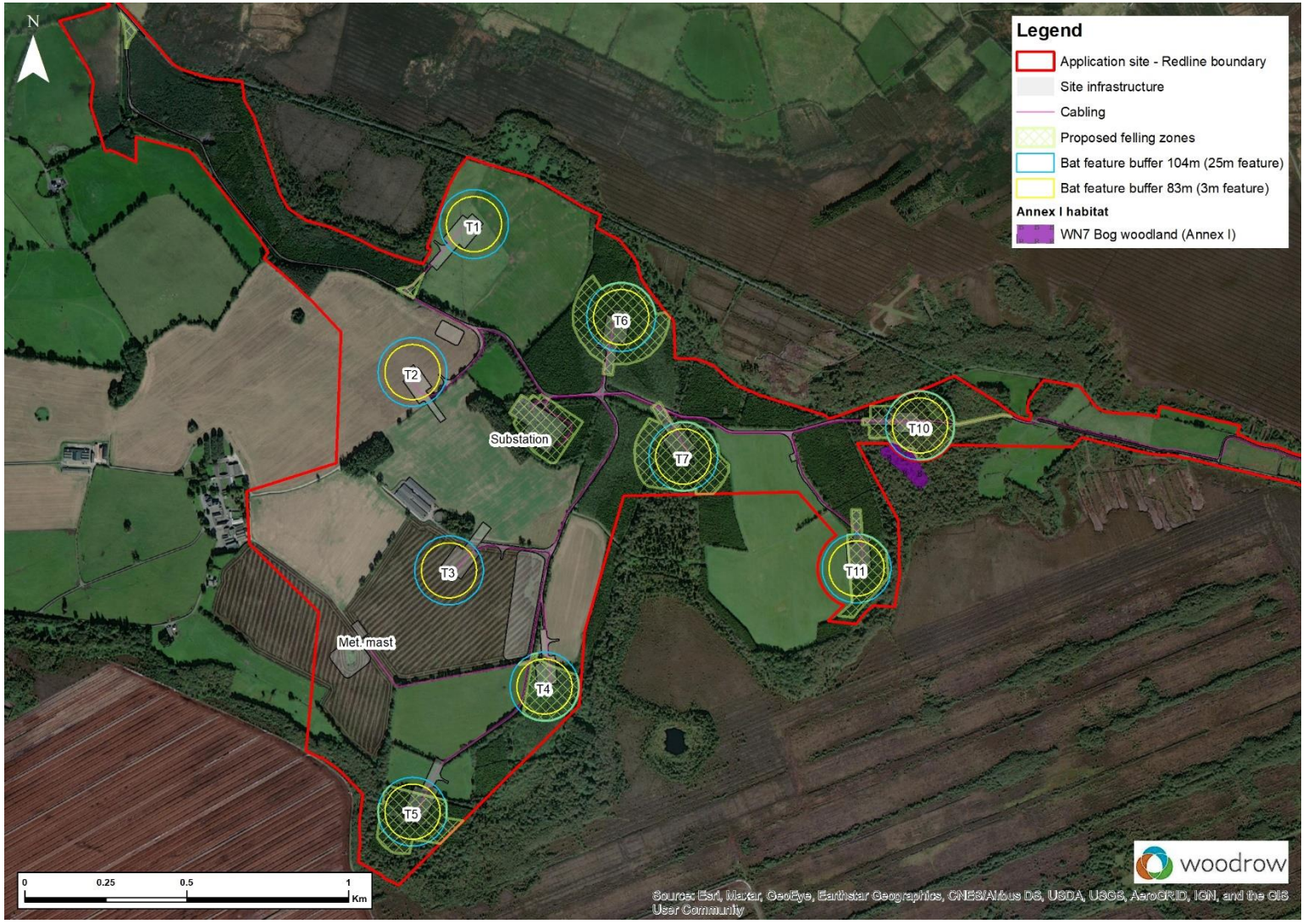

Figure 5.5: Range of turbine to feature buffers and proposed felling areas

5.5.3 Decommissioning Phase

The implementation of similar mitigation measures, as detailed for the construction phase, will ensure that no likely significant effects occur.

5.6 Monitoring Measures

5.6.1.1 Pre-Construction Ecological Monitoring

In order to avoid accidental disturbance to the resting places of protected mammals including badgers, otters, red squirrels and pine martens; construction activities will be preceded by an ecological walkover survey of the proposed works corridor, including the grid connection route and bat feature buffers.

Likewise, as outlined in **Section 5.5.1.6**, in order to limit accidental disturbance to bat roosts during construction; prior to works commencing trees within the works corridor previously assessed as supporting moderate to high PRFs will be re-assessed. Initially this will involve a ground level visual assessment, which will be followed up by inspections under licence and re-entry/emergence surveys, as required.

As detailed in **Section 5.5.1.4**, construction works conducted during the bird breeding season will require pre-construction nesting bird surveys to avoid disturbance breeding birds. If nests are identified ongoing monitoring will be implemented to ensure protection measures (exclusion zone buffers) are implemented and to determine when works can proceed, once the breeding attempted is completed.

5.6.1.2 Water Quality Monitoring

In order to verify the efficacy of pollution prevention and mitigation measures during construction, water quality monitoring will be undertaken in accordance with the proposals enclosed at **Annex 3.8**.

5.6.1.3 Monitoring of Annex I Bog Woodland

Given the presence of Annex 1 habitats within the vicinity of the proposed development, it is deemed to be prudent to undertake monitoring to ensure that construction activities do not adversely impact on the quantity or quality of this habitat.

Prior to construction, eight permanent quadrats (10x10m squares) will be set up within the area of Annex I bog woodland between T10 and T11 for long-term vegetation monitoring. To ensure quadrates can be relocated on subsequent visits, accurate grid references will be taken and marked. Quadrats will be distributed through the habitat to sample central areas and areas around the edge of the bog woodland.

Baseline conditions will be established pre-construction and for each quadrat:-

- Photographs will be taken to visually document any changes in site conditions over time;
- Vegetation type will be recorded;
- All species present will be listed, together with an indication species abundance, both in terms of % cover and rating on the DOMIN scale;
- The presence of both positive and negative indicator species for the habitat type will be noted;
- Other factors including peat depth, vegetation height, ground conditions and management will be recorded; and

- Assessment criteria for bog woodland will follow those detailed in Cross & Lynn (2013)[252].

During the construction phase, surveys will be repeated to ensure that the habitat is not impacted by construction works, especially by any drainage in the vicinity of T10 and the access track leading to T11.

Post-construction surveys will be undertaken in Years 1, 2, 3, 5 and 10.

Surveys will be undertaken by a suitably qualified botanist and at the optimal time of year for surveying bog woodland.

5.6.1.4 Monitoring of Bat Feature Buffers

The aim for bat feature buffers around turbines is to ensure that habitats are as featureless as possible to discourage foraging bats, as well as potential prey species for kestrels. Initially this will require regular monitoring in Years 1, 2 & 3 to ensure vegetation clearance measures and ongoing management result in the desired habitat conditions. Once the optimal conditions have been created (after Year 3) the habitat will continue to be maintained in this manner.

5.6.1.5 Bird Monitoring

Ornithological monitoring surveys will commence at the commencement of construction and will continue, post-construction, in Years 1, 2, 3, 4, 5, 10 &15.

Surveys will be conducted, in accordance with SNH guidance[253], by a suitably experienced ornithologist and will include the following:-

- Vantage point surveys;
- Wider area breeding raptors surveys;
- Breeding season surveys of 500m turbine buffer; and
- Fatality monitoring (to be conducted conjunction with bat fatality monitoring.

Prior to the commencement of development, a post-construction ornithological monitoring plan, and associated reporting requirements, will be agreed with the Planning Authority.

5.6.1.6 Bat Monitoring

A three-year post-construction monitoring programme is proposed for bats (SNH *et al*. 2019), with monitoring in Years 1, 2 & 3. Monitoring is designed to evaluate the success bat feature buffers at reducing bat activity levels in the vicinity of turbines. As detailed at **Annex 5.5,** post construction monitoring will involve bat activity surveys and fatality monitoring, which incorporates turbine searches along with monitoring of scavenger removal rates and searcher efficiency to generate estimates of 'real' rate of bat fatalities for the site.

Bat activity surveys will be undertaken in Years 1, 2 & 3 and will include:-

- 3 no. seasonal deployments of static bat detectors deployed for a minimum of 10-nights in compliant weather conditions. Detectors will be deployed at each

252 Cross, J. & Lynn, D. (2013). Results of a monitoring survey of bog woodland. *Irish Wildlife Manuals*, No. 69. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

253 Scottish Natural Heritage (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms.

turbine location, with additional units used to gather activity data from the edge of bat feature buffers. The initial focus of the secondary detectors will be to monitor activity at T5, T10 and T11, targeting woodland edge that will be retained within bat feature buffers. Deployments will be set out to cover the following periods:-
  - early May and mid-June;
  - mid-June and mid-August;
  - early September;
- A continuously recording bat detector will be deployed on the meteorological mast to simultaneously monitor bat activity at ground level (c. 2m) and at height (c. 50m); and
- A fully automated weather station with 3G connectivity will be deployed to generate rainfall, wind speed and temperature data on a real-time basis. This can be supplemented or replaced with wind speed data collected from wind turbines and on-site metrological mast.

Fatality monitoring will be undertaken in Years 1, 2 & 3 and will include:-

- Searches within 65m of each turbine to detect any fatalities (and possibly injured bats) due to collisions/barotrauma events with operational turbines. Currently, there are no standardised methodologies for monitoring of wind farm collisions in Ireland. In the absence of a detailed methodology, a search area of 65m has been selected as studies monitoring collision have found that the core radius around turbines, where the majority of collision casualties fall, is within 50m of turbines (Johnson et al. 2003 & Arnett 2006). This is comparable to the 100x100m suggested by SNH et al. (2019), however it is important to note that flying objects struck by turbines can be thrown and/or blown considerably further. Some monitoring regimes employ search radius equal to the height of the turbines, while for other studies, the area is extended to encompass the maximum theoretical throw distance - approximately 1.5 x the turbine height to tip. Applying this to turbines with max. a tip height is 185 m, would generate a very large, and unnecessary, search (r = 278 m).

In Year 1, searches will be conducted at all turbines, with a higher search frequency implemented at turbines where bat feature buffer are required, namely T4, T5, T6, T7, T10 and T11. Lower search frequencies will be employed at T1, T2 and T3. Turbines requiring searches in Years 2 and 3 will be determined by the bat activity levels recorded across the site in Year 1.

High search frequencies will involve daily searches at selected turbines (T4, T5, T6, T7, T10, T11), with searches conducted on alternate days for turbines where lower search frequencies are required (T1, T2, T3). Search periods of 10-connective days or 5-alternate days (over 10-days) will be undertaken. The following search periods will be employed in Year 1:-

- Spring (May to early June): two search periods of 10 days;
- Summer (July): one search period of 10 days; and
- Early Autumn (Aug/Sep): two search periods of 10 days

3 no. of the search periods will be timed to overlap with the deployment of static bat detectors for a minimum of 5 nights at the high search frequency turbines.

During the flight period for bats, searches will be undertaken using an appropriately trained dog team. All dog teams will have detection rates tested and scored. Given

the diminutive stature of bats, detection rates using human searchers are notably unreliable. Trained wildlife detection dogs have been shown to be significantly more effective than humans in detecting fatalities from collision, especially in detection of bat carcasses.

Searches will commence at dawn and the first turbine to be searched on a given survey day will be rotated over the search period/season. The commencement of searches at dawn is done to limit scavenging of any causalities from the preceding night, by diurnal species like hooded crow.

Baited wildlife trip cameras will be deployed during each of the 5 no. 10-day search periods to determine scavenger species and how quickly carcasses are removed. A total of 6 no. cameras will be used for each deployment. To emulate bat carcasses, dark coloured mice carcases with be used to bait the camera traps.

Post-construction bat monitoring reports will be submitted annually, based on coverage of an active bat season. The Year 3 report will constitute a full review of bat activity on the site, with reference to baseline conditions, and will make recommendations regarding the implementation of turbine curtailment.

5.7 Residual Effects

Residual effects are those which are likely to occur even following the implementation of mitigation measures. **Table 5.29** provides an overview of likely significant effects for important ecological features, summaries proposed mitigation measures required to control against the significant effects identified and then lists any residual effects which may occur following the implementation of mitigation measures. In summary the following (unmitigated) likely significant effects were identified:

- Deterioration in water quality for:-
  - Two downstream Natura 2000 sites, including the River Boyne and Blackwater SAC and SPA, with likely significant effects on the following QIs: salmon, river lamprey, otter and kingfisher;
  - Downstream aquatic ecology of Local (higher value) Importance, including onsite drainage ditches and channelised stream;
- Habitat loss and alteration for:-
  - [WD1] Mixed broad-leaved woodland (non-plantation);
  - Mosaic of Non-Annex I [WN1]/[WN7] Oak-birch-holly woodland & Bog woodland;
  - [WN7] Annex I Bog woodland;
  - [WL2] Treelines and [WL1] Hedgerows;
  - Breeding assemblage of birds;
  - Resting places of protected mammal;
  - Roosting, foraging and commuting bats;
- Construction related direct/indirect disturbance for:-
  - Breeding assemblage of birds, with specific effects of low significance on local breeding populations of woodcock, kestrel, lapwing and a range of red/amber listed breeding passerine, especially those nesting in woodland/scrub;
  - Badger setts, in particularly a maternity set adjacent to the substation;
  - Bat roosts;
- Collision risk for:-
  - Locally sensitive bird populations of kestrel, and possibly woodcock and swift;
  - Bats including Leisler's bat and pipistrelle species;
- Operational disturbance for:-
  - Local breeding population of woodcock.

Mitigation measures are proposed in **Section 5.5** to provide robust and effective protection to important ecological features likely to be affected by the proposed development in the absence of mitigation. As set out in **Table 5.29**, any residual effects are outlined after taking account of the mitigation proposed**.** For the likely significant effects assessed, application of the proposed mitigation measures in full will limit residual effects to negligible/not significant.

The exceptions being a level uncertainty pertaining to the efficacy of mitigation to limit the effects of collision risk on the local kestrel population, resulting in residual effects of very low significance. Uncertainty arises from the combination of mitigation/compensation measures to limit foraging opportunities around turbines and offsetting turbine mediated mortality through provision of nest boxes, as these have not been tested for this species in the context of an Irish wind farm development. Residual effects of very low significancy also remain for breeding woodcock, due to a data deficiency for national breeding population estimates and uncertainty around

the displacement effect/collision risk posed by the proposed development, especially if assessed in combination with the proposed neighbouring wind farm, which has proposed turbines for Lisclogher Bog. Importantly, for both kestrel and woodcock the significance of the population effect are assessed on local populations and the collision risk/displacement effects on national populations would be negligible. Residual effects of very low significancy also remain for swift.

Similarly, for high collision risk bat species (Leisler's bat, Nathusius', common and soprano pipistrelle), while it is anticipated potential collision risk will be sufficiently reduced through implementing bat feature buffers around turbines, it is acknowledged predicting bat behaviour post-construction is problematic and further remedial mitigation measures may be required. Therefore, for local populations of these species there are residual effects of low significance. As detailed in **Annex 5.5**, a programme of post-construction monitoring of bat activity is proposed and this will inform requirements for any further remedial mitigation. With this measure in place any residual effects can be reduced to not significant.

5.8 Statement of Significance

Assuming that the mitigation measures referred to in this chapter are adopted in full, there are not likely to be any residual significant effects on important ecological features, beyond those on the local kestrel population of very low significance due collision risk.

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Designated sites receptors					
River Boyne and River Blackwater SAC Qualifying Interest(s) River lamprey Atlantic salmon Otter International Importance (NRA, 2009) NOTE: The NIS (Woodrow, 2021) determined that there were no source-receptor pathways with QI habitats Alkaline fen and that it was highly unlikely for there to be any perceptible effects on Alluvial forests	Construction	Direct: None Secondary: Deterioration in water quality caused by entry of pollutants or suspended solids into drains - short-term effects.	N/A Significant	See mitigation measures summarised in Section 5.5.1.1 based on those detailed in Chapter 7 and the outline CEMP at Annex 3.8, including implementation of a 50m buffer zone, best practice guidelines and a SuDS	Not significant
	Operational	Direct: None Secondary: Potential for short-term deterioration in water quality due to felling for bat buffers, with potential for deterioration over the longer term due to poorly designed, engineered and/or constructed wind farm infrastructure resulting in increased runoff and sedimentation.	N/A Significant	See mitigation measures detailed in Chapter 7 and at Annex 3.8	Not significant
	Decommissioning	Direct: None Secondary: As described for construction phase; however, less excavation works required and reduced risk of pollution, as limited use of building materials - cement/concrete in particular.	N/A Significant	The implementation of similar mitigation measures, as detailed for the construction phase, will ensure that no likely significant effects occur	Not significant
River Boyne and River Blackwater SPA Qualifying Interest(s) Kingfisher International Importance (NRA, 2019)	Construction	Direct: None Secondary: Deterioration in water quality caused by entry of pollutants or suspended solids into drains – short-term effects impacting on prey availability for kingfisher – considered unlikely (but possibly) due to downstream dilution effect.	N/A Significant	See mitigation measures summarised in Section 5.5.1.1 based on those detailed in Chapter 7 and the outline CEMP at Annex 3.8, including implementation of a 50m buffer zone, best practice guidelines and a SuDS	Not Significant
	Operational	Direct: None Secondary: Potential for short-term deterioration in water quality due to felling for turbine buffers, with potential for deterioration over the longer term due to poorly designed, engineered and/or constructed wind farm infrastructure resulting in increased runoff and sedimentation.	N/A Significant	See mitigation measures detailed in Chapter 7 and at Annex 3.8	Not significant
	Decommissioning	Direct: None Secondary: As described for construction phase; however, less excavation works required and reduced risk of pollution, as limited use of building materials - cement/concrete in particular.	N/A **Significant**	The implementation of similar mitigation measures, as detailed for the construction phase, will ensure that no likely significant effects occur	Not significant
Freshwater ecosystems					
Watercourses and associated downstream ecology	Construction	Direct: None – no viable streams in the proposed development site (All classified as FW4: drainage ditches, with main watercourse a modified (channelised) streams. Secondary: Potential for short-term downstream impacts effecting water quality in two Natura 2000 sites - River Boyne and River Blackwater SAC and SPA, including the following QIs: River lamprey, Atlantic salmon, otter and kingfisher. Also, potential for important non-QIs to occur downstream including white-clawed crayfish	Not Significant Significant	See mitigation measures summarised in Section 5.5.1.1 based on those detailed in Chapter 7 and the outline CEMP at Annex 3.8, including implementation of a 50m buffer zone, best practice guidelines and a SuDS	Not significant
	Operational	Direct: None	N/A	See mitigation measures detailed in Chapter 7 and at Annex 3.8	Not significant

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
QIs of SAC/SPA: International importance White-clawed crayfish: County (Regional) Importance Other aquatic features: Local (higher) Importance (NRA, 2009)		Secondary: Potential for short-term deterioration in water quality due to felling for turbine buffers, with potential for deterioration over the longer term due to poorly designed, engineered and/or constructed wind farm infrastructure resulting in increased runoff and sedimentation.	Significant		
	Decommissioning	Direct: None Secondary: As described for construction phase; however, less excavation works required and reduced risk of pollution, as limited use of building materials - cement/concrete in particular	N/A	The implementation of similar mitigation measures, as detailed for the construction phase, will ensure that no likely significant effects occur	Not significant
Habitat receptors					
[FW4] Drainage ditches/ channels Local (higher) Importance (NRA, 2009) Note: The main channel through the proposed development site is considered as a 1st to 3rd order stream by the EPA (EPA code-name: 07B45-Bolandstown). Due to limited size and modified nature (highly channelised) it has been classified as FW4, as opposed to FW2 (Depositing/lowland river)	Construction	Direct: Already highly modified channels, with no viability for Important Ecological Features (salmon, lamprey or crayfish), therefore ecological effects of installing culverts for drain crossings and track construction adjacent to watercourses is considered imperceptible Secondary: Potential for short-term sedimentation of aquatic habitats within local drainage channels and toxic effects on aquatic organisms from hydrocarbons/cement leachate	Not Significant Significant	See mitigation measures summarised in Section 5.5.1.1 based on those detailed in Chapter 7 and the outline CEMP at Annex 3.8, including implementation of a 50m buffer zone, best practice guidelines and a SuDS.	Not significant
	Operational	Direct: None Secondary: Potential for short-term deterioration in water quality due to felling for bat buffers, with potential for deterioration over the longer term due to poorly designed, engineered and/or constructed wind farm infrastructure resulting in increased runoff and sedimentation	N/A Significant	See mitigation measures detailed in Chapter 7 and at Annex 3.8	Not significant
	Decommissioning	Direct: None Secondary: As described for construction phase; however, less excavation works required and reduced risk of pollution, as limited use of building materials - cement/concrete in particular	N/A Significant	The implementation of similar mitigation measures, as detailed for the construction phase, will ensure that no likely significant effects occur	Not significant
[WD1] Mixed broad-leaved woodland (non-plantation) Local (higher) Importance (CIEEM, 2018 updated 2019)	Construction	Direct: During construction c. 0.70ha will be removed to construct the substation Secondary: Spread of invasive species	Significant N/A	Embedded mitigation – minimised land take through design phase avoidance of Local (higher) Importance woodland habitats As detailed in the HMP (Annex 5.6) enhancement measures to offset habitat loss, including control of non-native cherry laurel Best practice measures limiting risk of introducing and spreading non-native invasive species	Not significant
	Operational	Direct: None Secondary: None	N/A N/A	Ongoing monitoring of enhancement areas and control of non-native cherry laurel, as detailed in the HMP (Annex 5.6)	None
	Decommissioning	Direct: None Secondary: None	N/A	Proposal largely avoided mixed broadleaved woodland, therefore anticipated that there will be no potential impacts	None
Mosaic of natural/ semi-natural woodland	Construction	Direct: Felling of non-Annex bog woodland required at T10 and along eastern exit for grid connection route will result in loss of 1.54ha. Non-Annex I bog woodland at T10 is not within Bracklin Wood/Lisclohgher Bog, therefore classed as Local (Higher Value)	Significant Significant	Embedded mitigation – minimised land take through design phase avoidance of Local (higher) Importance woodland habitats and those of County (Regional) Importance within Bracklin Wood and Liclogher Bog.	None

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Non-Annex I [WN1] Oak-birch-holly woodland & [WN7] Bog woodland In Bracklin Wood/Lisclogher Bog (WCC-BAP): County (Regional) Importance Not in Bracklin Wood/Lisclogher Bog: Local (higher) Importance (CIEEM, 2018 updated 2019)		and was also found to be relatively heavily infected with invasive cherry laurel. If not avoided implementation of bat feature buffers requires a max. take of 0.19ha Oak-birch-holly-woodland at T11 in Lisclogher Bog/Bracklin Wood Secondary: Spread of invasive species		As detailed in the HMP (Annex 5.6), enhancement measures to offset habitat loss, including control of non-native cherry laurel Best practice measures limiting risk of introducing and spreading non-native invasive species	
	Operational	Direct: None Secondary: Spread of invasive species	N/A Significant	Ongoing monitoring of enhancement areas and control of non-native cherry laurel, as detailed in the HMP (Annex 5.6)	Not Significant
	Decommissioning	Direct: None Secondary: None	N/A	Proposal largely avoided these woodlands; therefore, it is anticipated that there will be no potential impacts	None
[WN7] Annex I *Bog woodland County (Regional) Importance (CIEEM, 2018 updated 2019)	Construction	Direct: Unless retained - bat feature buffer at T10 requires removal of c. 0.18ha Secondary: Spread of invasive species. Smothering of understory by washout of sediment from adjacent construction site Alteration of drainage adjacent bog woodland at T10/T11	Significant Significant	Design phase avoidance - retain area of Annex I bog woodland within proposed bat feature buffer at T10 – requires additional monitoring for bat activity Best practice measures limiting risk of introducing and spreading non-native invasive species Control measures to limit surface runoff – summarised in Section 5.5.1.1 based on those detailed in Chapter 7 and the outline CEMP at Annex 3.8 No new drainage in area between T10 and T11, that will impact on water table levels	Not Significant
	Operational	Direct: None Secondary: Spread of invasive species. Smothering of understory by washout of sediment from adjacent felling areas. Alteration in levels of water table.	N/A Significant	As detailed at Annex 5.6, this area of bog woodland will be within a habitat enhancement area that will include control of non-native cherry laurel, monitoring of water table and ongoing habitat monitoring	Not Significant
	Decommissioning	Direct: None Secondary: None	N/A	Proposal largely avoided Annex I bog woodland, therefore anticipated that there will be no potential impacts	N/A
[WL1] Hedgerows and [WL2] Treeline	Construction	Direct: Infrastructural felling and ground clearance works will result in the removal of treelines (1,371m) and hedgerows (70m) Secondary: Compaction from heavy machinery/spoil storage/weight from floating roads and excavation works adjacent to treelines/hedgerows can negatively impact roots, potentially weaking plants, making them susceptible to disease. Dust generated during construction activity can result in suppression of foliage on plants surrounding the site. Spread of invasive species	Significant Significant	Design phase avoidance – the amount of hedgerow/treeline removal required was minimised. Proposed access tracks have been designed to utilise existing tracks where available. New sections of tracks target areas of agricultural land and commercial plantations where root distribution will already have been impacted by ground works (e.g. ploughing). In addition, tracks will only impact on one side of hedgerow/ treeline. Along new section of track T4/T5 and T11 a 5 m Root Protection Area will be implemented where excavation works will be limited. Best practice measures limiting risk of introducing and spreading non-native invasive species During dry weather events, dust generated on site will be managed through the use of a dust suppression bowsers	Not Significant

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
				As detailed at Annex 5.6, compensatory measures required to offset loss, including planting of an equivalent length of treeline/hedgerow within the proposed development site	
Local (higher) Importance (CIEEM, 2018 updated 2019)	Operational	Direct: None Secondary: None	N/A N/A	As detailed at Annex 5.6, implementation of compensatory planting will be monitored over the operational phase	None
	Decommissioning	Direct: None Secondary: None	N/A	A Decommissioning Plan including details of any reinstatement works required for hedgerow/treeline conservation	None
Avian receptors					
Hen harrier Wintering v. occasionally recorded (3 observations, all in 3rd winter) High sensitivity (Percival, 2003)	Construction	Direct: None Secondary: Potential for a level of one-off disturbance events: Negligible – temporary, short-term	N/A Not significant	None required	None
	Operational	Direct: Very low usage results in low collision risk - negligible effect Secondary: Potential for micro displacement effects (< 250m), however low usage – negligible effect	Not significant Not significant	None required Post-construction surveys will monitor bird usage of the area	None
	Decommissioning	Direct: None Secondary: Potential for a low level of one-off disturbance events: Negligible – temporary, short-term	N/A Not significant	None required	None
Woodcock breeding 3-4 breeding territories Medium sensitivity (Percival, 2003) Note: non-breeding (wintering) population is not rated	Construction	Direct: Inappropriately monitored/phased construction works, specifically clearance of woodland and scrub to facilitate site infrastructure, turbulence buffers and bat feature buffers has the potential to result in destruction of nests and precocious young. Temporary - short-term effect with a low-level population effect (1-5%) Secondary: Construction activities in close proximity to nesting birds has the potential to result in displacement and contribute to nest failure. Temporary - short-term effect with a low-level population effect (1-5%). Loss of woodland/scrub habitat has the potential to displace breeding territories, with a long-term effect	Low significance Low significance	Project design avoided best quality woodland/scrub for woodcock and areas supporting old growth, semi-natural woodlands will be retained were possible. Vegetation removal/site clearance works will not be undertaken from 1st March to 31st August. Ideally, all areas of potential nesting cover within the works corridor/felling areas will be removed or made unsuitable prior to the onset of the breeding season in all years of construction. Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	Not Significant
	Operational	Direct: The magnitude of effect from collision with turbines is unknown and was assessed on a precautionary basis at the local population level (c. 80 territories), as having the potential for a long-term low-level population effect (1-5%). Secondary: The magnitude of effect displacement of breeding woodcock due to operational wind turbines is unknown and was assessed on a precautionary basis at the local population (c. 80 territories), as having the potential for long-term, low-level population effect (1-5%). Loss of woodland/scrub habitat, although considered lower quality for woodcock (commercial plantations) has the potential to displace breeding territories, with a long-term effect.	Low significance Low significance	Post-construction surveys will monitor bird usage of the area Enhancement of woodland habitats – see Annex 5.6 Replacement planting is required for infrastructural felling of commercial plantations. Over the medium to long term this will offset loss of woodland/scrub habitats.	**Very low significance on local population**

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
	Decommissioning	Direct: Highly unlikely, as woodland/scrub clearance not required. Secondary: Highly unlikely, as works will not be in areas of woodland/scrub.	N/A	None required	None
Golden plover Wintering Typically, < 100birds occurring periodically (max. flock 520 birds – on pasage) Medium sensitivity (Percival, 2003)	Construction	Direct: None – no breeding sites Secondary: Potential for construction works to displace wintering/passage flocks occasionally utilising tillage within the proposed development site. Relatively low numbers, typically < 100 birds (max. 520 birds), with magnitude of effect on National population considered negligible, as the periodic usage indicates that the birds are no reliant on the proposed development site and that there are alternatives in the wider area. The magnitude of the effect on the local population was considered low to moderate (Low significance)	N/A Not significant	None required	None
	Operational	Direct: Predicted collision risk (weighted and applying a highly precautionary avoidance rate of 98%) was 129 collisions over 30 years. Based on predicted collisions (4.3 collision/annum) the additional annual mortality on the regional/local population (1,400 to 2,000 birds) is estimated to have a negligible to very low effect adding an 0.80 to 1.14% to annual mortality on the local population. Therefore, the magnitude of effect on the wintering golden plover population from potential collisions is considered negligible (< 1% population effect) even at the local/regional scale. Secondary: Golden plover are considered relatively tolerant of operational turbines and for the proposed development site, if there is a displacement effect (e.g. c. 200 m), then there is still a substantial area of potentially suitable habitat adjacent to the wind farm. The magnitude of effect on National population was considered negligible. The magnitude of the effect on the local population was considered low to moderate (Low significance.)	Not significant Not significant	None required Post-construction surveys will monitor bird usage of the area.	None
	Decommissioning	Direct: None Secondary: As for construction, potential for a low level of disturbance events. Negligible – temporary, short-term.	N/A Not significant	None required	None
Lapwing breeding Only 1 pair in 2019, no breeding in 2020 or 2021 Medium sensitivity (Percival, 2003)	Construction	Direct: If the breeding the site in the vicinity of T3, (or similar open habitats at T1 and T2) is occupied, there is potential for inappropriately monitored/phased construction works occurring during the breeding season to result in direct disturbance to nesting lapwing nests and precocious young. Declining wader population prompted a precautionary assessment despite sub-optimal habitat conditions within the proposed development site, due to crop rotations. Therefore, the magnitude of effect was heighted from negligible to low. Secondary: Construction activities in close proximity to nesting birds have the potential to result in displacement and contribute	Low significance Low significance	If works are scheduled to commence in February, a pre-construction visit will be required to monitor potential lapwing breeding sites in the tillage fields surrounding T2 and T3, as this species can be present on territories early in the season (late-February/early March). A precautionary exclusion zone buffer of 200 m is suggested for breeding lapwing, which can be revised upwards or downwards based on professional judgement of the site ECoW (ornithologist), with consideration given to the behaviour of the any pairs present and the nature of the works being undertaken.	Not Significant

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
		to nest failure. As above a precautionary approach was applied and the magnitude of effect was heighted from negligible to low.			
	Operational	Direct: Predicted breeding season collision risk (weighted and applying avoidance rate of 98%) was 0.6 collisions over 30 years. Based on predicted collisions (0.02 collision/annum) the additional annual mortality on the national breeding population (2,000 pairs) would have an imperceptible effect adding an estimated 0.002 to annual breeding lapwing mortality.	Not significant	None required Post-construction surveys will monitor bird usage of the area.	None
		Secondary: There is potential for the operational wind farm to displace one pair of lapwings; however, this species to generally considered relatively tolerant of turbines and displacement effects. Birds have been found breeding within 100 m of turbines. Therefore, magnitude of effect considered negligible	Not significant		
	Decommissioning	Direct: Potential for birds breeding adjacent to decommissioning works to be directly impacted inappropriately monitored/phased works. Applying a precautionary assessment magnitude of effect was heighted from negligible to low effect which is Temporary - short-term	Low significance	If works are scheduled to commence in February, a pre-construction visit will be required to monitor for potential lapwing breeding sites. A precautionary buffer of 200 m is suggested for lapwing, which can be revised upwards or downwards based on professional judgement of the site ornithologist, with consideration given to the behaviour of the any pairs present and the nature of the works being undertaken.	Not Significant
		Secondary: Decommissioning activities in close proximity to nesting birds have the potential to result in displacement and contribute to nest failure. As above a precautionary approach was applied and the magnitude of effect was heighted from negligible to low	Low significance		
Snipe breeding & wintering Small numbers breed on southern bog (> 400 m from turbines and works). Winter snipe recorded throughout proposed development site, highest density of use on southern bog Medium sensitivity (Percival, 2003)	Construction	Direct: No potential for direct impacts. Snipe breeding distribution removed (> 400 m) from proposed works corridor and suitable habitats avoided.	N/A	None required Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	None
		Secondary: No displacement effects anticipated for breeding snipe, as suitable habitat beyond 400 m from works corridor. Winter snipe potentially displaced by construction activities can re-locate to adjacent to suitable habitat. Temporary – short-term effect of negligible magnitude on local population of wintering snipe	Not significant		
	Operational	Direct: While acknowledging the inherent uncertainties surrounding predicted collision rates and population estimates for snipe, the magnitude of effect at the population level for predicted collisions is negligible (Predicted collision risk of 0.4 birds over 30 years).	Not significant	None required Post-construction surveys will monitor bird usage of the area	None
		Secondary: Potential for displacement of breeding/wintering birds consider unlikely, as core snipe areas location > 400 m from proposed turbines. Loss of any substantial areas of breeding/wintering habitat are not anticipated and clearance of plantations for bat feature buffers will increase potential snipe habitat within the proposed development site. Magnitude of effect negligible	Not significant		

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
	Decommissioning	Direct: Snipe breeding distribution is removed (> 400 m) from decommissioning activities. No potential for direct impacts	N/A	None required	None
		Secondary: Decommissioning works could result in displacement of wintering snipe, with birds re-locating to nearby suitable habitat. Temporary – short-term effect of negligible magnitude on local population of wintering snipe	Not significant	Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	
Kestrel breeding & wintering Pair nesting in wider area just beyond 500 m turbine buffer, regularly hunting through site, through the year Medium sensitivity (Percival, 2003)	Construction	Direct: Potential for pair to occupy nest within works corridor during to construction works. Inappropriately monitored/phased construction works, specifically clearance of woodland to facilitate site infrastructure and turbine buffers has the potential to result in destruction of a nest and chicks. The pair would be displaced to an alternative nest site, with a short-term effect of negligible magnitude on the national population (Not significant). However, the magnitude of effect on the local population was assessed as low	Low significance	Vegetation removal/site clearance works will not be undertaken from 1st March to 31st August. Ideally, all areas of potential nesting cover within the works corridor/felling areas will be removed or made unsuitable prior to the onset of the breeding season in all years of construction. Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary. A discretionary 100 m exclusion zone is suggested, as kestrel exhibit a level of tolerance to human related disturbance (e.g. regularly nest in active quarries).	Not significant
		Secondary: Construction activities may have a localised effect, displacing individuals foraging though the area. If the pair currently nesting beyond the 500 m turbine buffer shifted nesting location closer to the works corridor, there is potential for indirect disturbance to breeding birds. However, in consideration of kestrels being relatively tolerant to certain kinds of human disturbance, the discreet nature of the proposed construction works within the wider landscape and the availability of alternative foraging areas/nesting sites, as well as the temporary – short term nature of the proposed construction works, potential secondary impacts on foraging/breeding kestrels are considered of negligible magnitude	Not significant		
	Operational	Direct: Based on observed flight activity within the 500 m turbine buffer, the collision risk (weighted and applying avoidance rate) was predicted to be 6.7 collisions over 30 years, equivalent to 1 bird every 4.5 years. Despite declining numbers, kestrel remain a common and widespread raptor in Ireland and at the national population level the magnitude of effect would be considered negligible (Not significant). If considering the magnitude of the effect on local kestrel populations (e.g. 6 birds within 10 km) then the magnitude would be assessed as moderate (c. 6-20% of local population affected).	Low significance	Mitigation measures required to limit kestrel foraging activity around turbines. This will be achieved through habitat management targeted at reducing prey availability in an area of 80-100 m around turbines. Even with mitigation in place, compensatory measures are required to secure kestrel productivity in the area and offset the potential negative effects of direct impacts. Nest boxes will be provided beyond the 500 m turbine buffer. Post-construction surveys will monitor bird usage of the area, including a turbine search, scavenger removal trials and searcher efficiency tests to determine collision rates the site. This can be combined with bat fatality searches and should incorporate searches around fledging time.	**Very low significance on local population**
		Secondary: Foraging and probably breeding kestrel do not appear to be suffer displacement effects from operational turbines, which combined with flight behaviour may explain the higher levels of collisions associated with this species.	N/A		
	Decommissioning	Direct: Highly unlikely, as woodland/scrub clearance not required	N/A	None required	None
		Secondary: Highly unlikely, to impact on breeding bird as work areas will be removed from areas of woodland/scrub. Potential for Temporary - short-term displacement of foraging kestrel of negligible magnitude	Not significant	Works commencing in March to August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers.	

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Barn owl breeding & wintering Breeding site within c. 1.5 km of turbines buffer. Owls occasionally recorded foraging through the proposed development site Medium sensitivity (Percival, 2003)	Construction	Direct: No suitable nest sites identified within 500 m turbine buffer – no potential for direct impacts Secondary: No potential for indirect disturbance to breeding owls. Site usage by foraging birds was periodic and the nocturnal nature of this species means that potential disturbance events due to construction activities are considered unlikely and if occasionally occurring the magnitude of effect is considered negligible.	N/A Not significant	None required Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	None
	Operational	Direct: Collisions are reported for this species; however, it is generally considered that the low-level flight behaviour of barn owls (typically < 3-4 m) limits collision risk with larger turbines and for this site the usage of the 500 m turbine buffer was low. Therefore, the magnitude of effect was considered Negligible Secondary: Foraging and breeding barns owl are reported as relatively tolerant of human disturbance, with successfully breeding report within a number of wind farm sites. Indirect disturbance to breeding birds is highly unlikely and any potential for displacement effect on foraging birds is considered to be of negligible magnitude	Not significant Not significant	None required Post-construction surveys will monitor bird usage of the area.	None
	Decommissioning	Direct: Highly unlikely, as woodland/scrub clearance not required Secondary: Highly unlikely to impact on breeding birds as work areas will be removed from areas of woodland/scrub. Works conducting during the day are highly unlikely to impact on nocturnally foraging owls.	N/A	None required Works commencing in March to August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers.	None
Swift Foraging Closest breeding sites > 5 km away, with small numbers (up to 12 birds) periodically foraging – mainly detect over southern bog Medium sensitivity (Percival, 2003)	Construction	Direct: None – no breeding sites Secondary: None – small numbers foraging high unlikely to be displaced by construction activity	N/A	None required	None
	Operational	Direct: Swifts are emerging as a species at risk from collisions with turbines. Periodic usage of the proposed development site by relatively low number was judged to only have the potential for negligible magnitude of effect on the national and regional breeding populations (< 1%). However, taking a precautionary approach a low rate of turbine mediated mortality is considered likely to have a negligible to low magnitude effect on the local breeding population (very low to low significance). Secondary: Swifts are habituated to urban settings and man-made structures. Therefore, it is considered unlikely that operational turbines will have any displacement effects. Conversely, this species (along with hirundines) may be actively drawn towards turbines to glean insects that are attached to/more active around turbine towers and hardstands.	National & regional – Not significant Locally – Very low to low significance N/A	Post-construction surveys will monitor bird usage of the area.	**Very low significance on local population**
	Decommissioning	Direct: None Secondary: None	N/A	None required	None

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Red listed passerines Redwing (wintering) Grey wagtail (Occasional, non-breeding) Meadow pipit (breeding/wintering) Yellowhammer (1 pair) Medium sensitivity (Percival, 2003)	Construction	Direct: There is potential for inappropriately time ground works/vegetation removal to result in the direct disturbance of nesting red listed species. However, all breeding activity (meadow pipit, grey wagtail, yellowhammer) was found to be removed from the works corridor. Therefore, magnitude of effects was assessed as negligible. Secondary: There is potential for disturbance from construction works to impact on birds nesting adjacent works corridor. Likewise, there is potential for displacement of wintering birds like redwing due to construction related disturbance and removal of food bearing shrubs. Hedgerows/treelines removal results in loss of potential nesting habitat for yellowhammer. Deterioration of water quality has the potential to impact on prey availability for riverine species like grey wagtail. Based on availability of alternative nesting/foraging habitats in the wider area and the baseline identifying breeding distribution beyond the works corridor, it is considered that any indirect impacts on red listed passerine will be negligible.	Not significant Not significant	None required Vegetation removal/site clearance works will not be undertaken from 1st March to 31st August. Ideally, all areas of potential nesting cover within the works corridor/felling areas will be removed or made unsuitable prior to the onset of the breeding season in all years of construction. Works commencing in March to August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers. Measures will be in place to protect downstream water quality from silt laden surface runoff and other potential contaminants like hydrocarbons and cement wash out – see Section 5.5.1.1 Enhancement measures – create nesting holes for grey wagtails at cross points over the main drains, e.g. stonework around culverts.	None
	Operational	Direct: There is potential for passerines to collide with turbines. However, it is generally considered that high fecundity means that the effect is negligible at the population level. Secondary: Potential for displacement of redwing due to felling operations to create bat feature buffers. Vegetation clearance around turbines is likely to create foraging habitat for certain species, like meadow pipit and yellowhammer. Studies have shown that meadow pipit breeding densities can increase around turbines. Overall magnitude of effects considered negligible	Not significant Not significant	None required	None
	Decommissioning	Direct: Potential for birds breeding adjacent to decommissioning works to be directly impacted by inappropriately monitored/phased works. Magnitude of effect is considered negligible: Temporary -short-term Secondary: Decommissioning activities in close proximity to nesting birds have the potential to result in displacement and contribute to nest failure. Magnitude of effect is considered negligible: Temporary -short-term	Not significant Not significant	None required Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	None
Medium sensitivity (Percival, 2003) target species – occurring at low densities: Low usage of site by non-breeding birds, including: Little egret	Construction	Direct: Non-breeding birds, therefore no potential for direct impacts Secondary: For these species, based on the sporadic utilisation of the area over the non-breeding season, it can be assumed that there is potential for a level of one-off disturbance events during construction that may result in the displacement of intermittently commuting/foraging birds to another area. However, the size of the works corridor relative to foraging habitat available in the wider area, combined with low bird usage, means that any potential displacement effects on commuting/foraging birds	N/A Not significant	None required	None

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
(1 obs. 55 secs) Whopper swan (2 obs. 192 secs) Greenland white-fronted goose (1 obs. 42 birds, 18,900 secs) Merlin (5 obs. 0 secs) Peregrine (2 obs. 220 secs) Barn owl (see above) (obs. = observations, secs. = flight seconds at collision risk height)		caused by disturbance during construction is considered to be negligible.			
	Operational	Direct: Collison risk at the levels for recorded usage was considered negligible for all these species. Collison risk modelling was only conducted for white-fronted goose, as this was the only species generating enough flight time to analysis, however this was just 1 observation of flock of 42 birds. The predicted collision rate (weighted and applying an avoidance rate of 98%) was 0.2 collisions over 30 years, equivalent to 1 bird every 169 years. This considered well below background mortality for this species.	Not significant	None required	None
		Secondary: Operational turbines may result in a level of one-off disturbance; however low usage means the magnitude of effect for all these species in negligible	Not significant		
	Decommissioning	Direct/Secondary: None	N/A	None required	None
Amber listed passerines Seven breeding species: Goldcrest Willow warbler Skylark Spotted flycatcher Starling Linnet Greenfinch Low sensitivity (Percival, 2003)	Construction	Direct/secondary: There is potential for inappropriately time ground works/vegetation removal to result in the direct disturbance of nesting amber listed species – especially woodland/scrub nesting species. Likewise, construction works generates disturbance that can displace breeding birds. A precautionary assessment of *low* magnitude of effects (1-5%) on *low* sensitivity receptors returns an impact of *very low significance*	Very low significance	Vegetation removal/site clearance works will not be undertaken from 1st March to 31st August. Ideally, all areas of potential nesting cover within the works corridor/felling areas will be removed or made unsuitable prior to the onset of the breeding season in all years of construction. Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	Not significant
	Operational	Direct: There is potential for passerines to collide with turbines. However, it is generally considered that high fecundity means that the effect is negligible at the population level.	Not significant	None required	None
		Secondary: None identified for species and location	N/A		
	Decommissioning	Direct: Potential for birds breeding adjacent to decommissioning works to be directly impacted by inappropriately monitored/phased works. Magnitude of effect is considered negligible: Temporary -short-term	Not significant	None required Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	None
		Secondary: Decommissioning activities in close proximity to nesting birds have the potential to result in displacement and contribute to nest failure. Magnitude of effect is considered negligible: Temporary -short-term	Not significant		
Mallard & Teal	Construction	Direct/secondary: Core area of usage Bracklin Lough removed from works corridor – no significant effects anticipated	Not significant	None required	None

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Breeding & wintering Low sensitivity species (Percival, 2003)	Operational	Direct: Collision risk for teal was considered close to nil (only 367 seconds of flight time was recorded within the collision risk zone), no collision risk model was run for this species. The predicted collision risk (weighted and applying an avoidance rate 98%) for mallard was predicted to be 0.4 collisions over 30 years, equivalent to 1 bird every 70 years, which is exceptionally and not significant Secondary: None identified	Not significant N/A	None required	None
	Decommissioning	Direct/secondary: No significant effects anticipated	N/A	None required	None
Non-breeding Low sensitivity (Percival, 2003) target species – occurring at low densities Cormorant Mute swan Goshawk Black-headed gull	Construction	Direct: None Secondary: For these species, based on the sporadic utilisation of the area over the non-breeding season, it can be assumed that there is potential for a level of one-off disturbance events during construction that may result in the displacement of intermittently commuting/foraging birds to another area. However, the size of the works corridor relative to foraging habitat available in the wider area, combined with low bird usage, means that any potential displacement effects on commuting/foraging birds caused by disturbance during construction is considered to be negligible.	N/A Not significant	None required	
	Operational	Direct: Of these species only lesser black-backed gull generated enough flight time in the collision risk zone to run a collision risk model. The predicted collision rate (weighted and applying an avoidance rate of 98%) for lesser black-backed gulls was exceptionally low at 0.18 collisions over 30 years, equivalent to 1 bird every 168 years. Effects were assessed as negligible for all species. Secondary: None	Not significant N/A	None required	None
	Decommissioning	Direct/secondary: No significant effects anticipated	N/A	None required	None
Green listed target species – raptors Buzzard Sparrowhawk	Construction	Direct/secondary: Both species nest in woodland/treelines within the proposed development site, therefore could be directly/indirectly impacted by construction works. However, as green listed species both have unrated conservation importance (Percival, 2003) and therefore disturbance effects are assessed as negligible.	Not significant	None required Breeding sites will be protected by breeding seasonal restriction on vegetation removal/site clearance and by pre-construction walkover surveys.	None
	Operational	Direct: For buzzard predicted collision risk (weighted and applying avoidance rate) was estimated to be relatively high at 10.8 collisions over 30 years, equivalent to 1 bird every 2.7 years. Sparrowhawk predicted collision risk (weighted and applying avoidance rate) was significantly lower than buzzard, estimated to be 0.43 collisions over 30 years, equivalent to 1 bird every 70 years. Both species have unrated conservation importance (Percival, 2003) and therefore direct effects are assessed as negligible.	Not significant Not significant	None required	None

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
		Secondary: Any minor displacement effect due to operational turbines are unrated as assessed as negligible.			
	Decommissioning	Direct: There is no requirement for removal of woodland habitat used by nesting buzzard/sparrow, therefore no direct effects anticipated. Secondary: Both species nest in woodland/treelines within the proposed development site, therefore could be indirectly impacted by decommissioning works. However, as green listed species both have unrated conservation importance (Percival, 2003) and therefore disturbance effects are assessed as negligible.	N/A Not significant	None required Works commencing from 1st March to 31st August inclusive will be preceded by a walkover to identify any nesting/territorial birds and inform the implementation of exclusion zone buffers, as necessary.	None
Terrestrial (non-volant) mammal receptors					
Otter International Importance (NRA, 2009)	Construction	Direct: No holts/layups located in the proposed developed site – limited suitable habitat. Secondary: Low usage of proposed development site - deterioration in water quality caused by entry of pollutants or suspended solids into drains – short-term effects impacting on prey availability	N/A Significant	See mitigation measures summarised in Section 5.5.1.1 based on those detailed in Chapter 7 and the outline CEMP at Annex 3.8, including implementation of a 50m buffer zone, best practice guidelines and a SuDS. Also, pre-construction walkover survey to confirm absence of otter resting places	Not significant
	Operational	Direct: None Secondary: Potential for short-term deterioration in water quality due to felling for turbine buffers, with potential for deterioration over the longer term due to poorly designed, engineered and/or constructed wind farm infrastructure resulting in increased runoff and sedimentation - deterioration in water quality affecting prey availability	N/A Significant	See mitigation measures to protect water quality detailed in Chapter 7 and at Annex 3.8	Not significant
	Decommissioning	Direct: Potential for otter to set up holt/layup in site Secondary: As described for construction phase; however, less excavation works required and reduced risk of pollution, as limited use of building materials - cement/concrete in particular.	Significant Significant	The implementation of similar mitigation measures, as detailed for the construction phase, will ensure that no likely significant effects occur.	Not significant
Badger	Construction	Direct: Several setts were identified in the proposed developed site with the potential for significant effects due to works. Secondary: Limited disturbance to foraging animals due to nocturnal habitats. Vegetation removal will result in loss of cover for setts, however removal of trees will create foraging habitat for this species – effects neutral	Significant Not significant	Design phase avoidance of any setts identified adjacent to substation, T2 hardstand and deposition area. Pre-construction walkover survey to confirm locations of badger resting places. During the breeding season (December to June inclusive), no construction works should be undertaken within 50m of active setts, nor blasting or pile driving within 150m of active setts. Out of the breeding season (July to November, inclusive), the following restrictions will apply: • No heavy machinery should be used within 30m of badger setts (unless carried out under licence); • Lighter machinery (generally wheeled vehicles) should not be used within 20m of a sett entrance; • Light work, such as digging by hand or scrub clearance should not take place within 10m of sett entrances.	Not significant

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Local (higher) Importance (NRA, 2009)					
	Operational	Direct: None Secondary: Considered tolerant of operational wind farms	N/A N/A	None required	None
	Decommissioning	Direct: Several setts were identified in site with the potential for significant effects due to decommissioning works. Secondary: None anticipated	Significant N/A	The implementation of similar mitigation measures, as detailed for the construction phase, will ensure that no likely significant effects occur	None
Pine marten Local (higher) Importance (NRA, 2009)	Construction	Direct: No dens located in the proposed developed site – limited suitable habitat. Secondary: Vegetation removal and construction noise having slight displacement effects on foraging habitat – area not heavily used	N/A Low significance	Avoidance of best quality habitats, including old growth woodland Retain over connectivity throughout site Habitat enhancement measures for woodland habitats and compensatory planting for treelines/hedgerows removed – see Annex 5.6	None
	Operational	Direct: None Secondary: Vegetation removal and construction noise having long-term displacement effects on woodland foraging habitat. Considered tolerant of operational wind farms.	N/A Low significance	As for construction phase	None
	Decommissioning	Direct/secondary: Highly unlikely, as woodland/scrub clearance not required.	N/A	None required - Pre-decommission walkover to identify any mammal resting places.	None
Red squirrel Local (higher) Importance (NRA, 2009)	Construction	Direct: No dreys located in the proposed developed site – limited suitable habitat. Secondary: Vegetation removal and construction noise having slight displacement effects on woodland foraging habitat – area not heavily used	N/A Low significance	Avoidance of best quality habitats, including old growth woodland Retain over connectivity throughout site Habitat enhancement measures for woodland habitats and compensatory planting for treelines/hedgerows removed – see Annex 5.6	None
	Operational	Direct: None Secondary: Vegetation removal having long-term displacement effects on woodland foraging habitat. Considered tolerant of operational wind farms.	N/A Low significance	As for construction phase	None
	Decommissioning	Direct/secondary: Highly unlikely, as woodland/scrub clearance not required.	N/A	None required - Pre-decommission walkover to identify any mammal resting places.	None
Irish hare	Construction	Direct: Hares present in proposed development site - breeding behaviour means direct effects assessed as unlikely	N/A N/A	None required	None

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Local (higher) Importance (NRA, 2009)		Secondary: Limited disturbance to foraging animals due to nocturnal/crepuscular habitats. Vegetation removal (woodland) will create open foraging habitat for this species – effects slight positive			
	Operational	Direct/secondary: None - considered tolerant of operational wind farms	N/A	None required	None
	Decommissioning	Direct/secondary: None anticipated	N/A	None required	None
Bats receptors					
Bat assemblage Local to County Importance (Wray *et al.*, 2010)	Construction	Direct: If PRF become occupied pre-construction there is a risk of significant effects on roosts. Secondary: Vegetation removal in the absence of mitigation will have significant effects on foraging/commuting bats through habitat loss and fragmentation.	Significant Significant	Design phase avoidance of older growth treelines and woodland habitats likely to be utilised by roosting bats Pre-construction roost surveys of PRFs in the works corridor earmark for removal. For occupied roosts surveys will inform derogation license application process. Moderate-to-high PRFs where surveys are inconclusive will be soft felled – see Section 5.5.1.6. Felling plans were designed to retain connectivity through the site and avoid disruption to linear features used by commuting/foraging bats. Compensatory planting, as detailed at Annex 5.6, will ensure like-for-like re-planting of linear features.	Not significant
Common and soprano pipistrelle Regional Importance (Wray *et al.*, 2010)	Operational	Direct: Both species at high risk of collision/barotrauma risk (SNH, *et al*. 2019). Activity recorded at the proposed site was high for common pipistrelles and moderate/high for soprano pipistrelle (Ecobat), resulting gives a risk assessment of high for these species at this site. However, recording activity at height found that relatively few pipistrelles were recorded at 50m suggesting that the species behaviour at this site may limit risk of direct effects. Secondary: Species not consider sensitive to lighting impacts	Significant N/A	For all species identified as high collision risk (SNH *et al*., 2019) - Leisler's bat, Nathusius', common and soprano pipistrelle - Primary mitigation measure to avoid collision risk is the maintenance of 50m separation distances between features and blade tips. Bat feature buffers of 83-104m from turbine towers will be implemented for the proposed development at T4, T5, T6, T7, T10 and T11, depending on residual features heights (up to 25m). To avoid affecting important woodlands of Local (higher value) to County Importance, bat feature buffers will not impinge into selected areas of woodland at T5, T10 and T11 – see Annex 5.6. Additional post-construction monitoring for bats will be undertaken at these locations to determine if the residual habitat feature draws bats into the rotor swept area. It is anticipated that implementing bat feature buffers will limit bat activity in the vicinity of turbines and will be effective in reducing the potential for collision risk. However, as acknowledge by SNH *et al*. (2019), it is difficult to predict how bat behaviour will change post-construction and further mitigation informed by post-construction monitoring may be required. One such option is smart curtailment, whereby turbines identified in high-risk locations by post-construction monitoring are feathered to run at < 2rpm, while optimal flight conditions for bats occurs. Section 5.6.1.6 outlines post-construction monitoring requirements.	Low significance
Nathusius' pipistrelle County Importance (Wray *et al.*, 2010)		Direct: Regularly flies in the open and at heights placing this species at high risk of collision/barotrauma risk (SNH, *et a*l. 2019). Activity recorded at the proposed site was moderate/low (Ecobat), with a slight peak in spring resulting in a medium risk for this species at this site. Secondary: Species not consider sensitive to lighting impacts	Significant N/A		Low significance
Leisler's bat County to Regional Importance (Wray *et al.*, 2010)		Direct: Due to flight behaviour this species is at high risk of collision/barotrauma risk (SNH, *et a*l. 2019). Activity recorded at the proposed site was moderate (Ecobat) resulting in a medium risk for this species at this site. However, there was a strong locational basis to the higher levels of activity recorded, which were associated with Bracklin Lough and T4/T5. In addition, recording at height (50m) found that flight activity was associated with calm, warm and dry conditions. Secondary: Species not consider sensitive to lighting impacts	Significant N/A		Low significance

Important ecological feature Evaluation of Importance	Project phase	Description of impacts	Significance without mitigation	Proposed mitigation/compensation	Residual Effects
Myotis species and Brown long-eared bat County Importance (Wray *et al.*, 2010)		Direct: Direct operational impact is Unlikely for all these species. Secondary: Potential displacement of light sensitive species due to additional lighting, especially around substation	Not significant Very low significance	Installation of additional lighting will be will be keep to a minimum.	Not significant
Bat assemblage Local to County Importance (Wray *et al.*, 2010)	Decommissioning	Direct/secondary: Highly unlikely, as woodland/scrub clearance not required.	N/A	None required	None

Table 5.29: Summary of residual impacts following implementation of proposed mitigation measures