FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED BARNADIVANE WIND FARM & SUBSTATION, CO. CORK

VOLUME 2 - MAIN EIAR
CHAPTER 5 - BIODIVERSITY

Prepared for:

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5. BIODIVERSITY

5.1 Introduction

This chapter has been prepared to describe the existing ecological environment of the study area and examines the potential effects that the Proposed Project (described in Chapter 2) may have on the ecology: biodiversity, flora and fauna including ornithology. This assessment considers the potential effects with regard to each phase of the development: construction phase, operational phase and decommissioning phase. Appropriate mitigation measures are described to avoid, reduce or offset potential negative impact(s) to an acceptable level. The mitigation measures detailed within this chapter should be read in conjunction with mitigation measures contained in Chapter 6 Soils, Geology & Hydrogeology together with Chapter 7 Hydrology and Water Quality and those contained in the CEMP (Appendix 2.2).

The purpose of the evaluation was to:

- Provide a baseline by undertaking a desktop review of available ecological data for both the receiving environment and greater area, including a review of European sites within the potential zone of influence (ZoI) and NHAs/pNHAs within 15 km of the study area
- Further add to baseline information by undertaking ecological field surveys of the receiving environment including, where required, the Proposed Development
- Identify flora and fauna present within the footprint of all elements of the project so as to identify the receiving environment
- Evaluate the ecological significance of the receiving environment
- Appraise the potential impacts of the project on the ecology of the receiving environment including the Proposed Development.
- Prescribe measures to mitigate the potential negative impact(s) of the Proposed Project on the ecology of the receiving environment.

A detailed summary of the Proposed Project assessed in the EIAR is contained in Chapter 2 - Section 2.3.1 and a description of the development for which consent is sought is contained in Chapter 2 - Section 2.3.2 and 2.3.3.

In summary, the Proposed Project for EIA purposes is made up of the Proposed Development which includes the Proposed Wind Farm and the Proposed Substation, for which planning consent is sought and, other elements of the project for which permission has already been granted which includes enabling works to facilitate the delivery of turbines(enabling TDR works) to site and if necessary an alternative grid connection (AGCR).

Given that the Proposed Wind Farm and Proposed Substation are located in close proximity and fall within the same study area, they will together be called the Proposed Development. As stated above, other elements of the project have already been consented, including the turbine delivery route (referred to in this EIAR as the enabling TDR works) and the alternative grid connection route (referred to in this EIAR as the AGCR) as part of the Carrigarierk Windfarm permission.

An ecological appraisal of the Proposed Project was undertaken by Fehily Timoney and Company (FT) to inform this chapter. The lead author of this chapter is David Daly (FT Ecologist, BSc. Ecology, MSc. Species Identification and Survey Skills). This report was reviewed by Jon Kearney (FT Principal Ecologist; BSc. Applied Ecology MSc. Ecological Management and Biological Conservation).

Habitat surveys and botanical surveys were conducted by Jason Guile (BSc. Marine Biology/ Oceanography, HND Coastal Conservation with Marine Biology) and Chandra Walter (FT Ecologist; BSc. Ecology, MSc. Organic Horticulture).

Ecological walkover surveys and mammal surveys were carried out by David Daly and Kate O'Regan (FT Ecologist: BSc. Zoology, MSc. Marine Biology).

Bat activity and roost surveys were conducted by Greenleaf, primarily Karen Banks (BSc Environment and Development). Deployment of static bat detectors were completed by David Daly and Chandra Walters.

Bird surveys were conducted by Sean Ronayne (FT Ecologist; BSc. Zoology; MSc. Marine Biology; MSc. Ecological Assessment) Barry O'Mahoney (BSc. Zoology, Biochemistry, Microbiology, H.Dip. Education; Nat.Dip. Food Science & Technology; Licensed Bird Ringer) and Aidan Duggan.

Triturus Environmental Ltd. (Ross Macklin; PhD (candidate), B.Sc. (Hons) MCIEEM., MIFM, HDip GIS, PDip IPM) undertook surveys of aquatic ecology in 2022 (riverine habitat surveys, aquatic macroinvertebrate surveys, fish stock assessment, otter survey, white-clawed crayfish surveys, eDNA analysis, macrophytes and aquatic bryophyte survey) as well as the evaluation of the impact of the Proposed Development on aquatic ecology.

Freshwater pearl mussel by Pascal Sweeney (BSc Zoology MSc Zoology) of Sweeny Consultancy.

Background information and biographies of surveys listed above are detailed in Table 5-1:

Table 5-1: Surveyor Biographies

Surveyor	Surveys Completed	Biography
Aidan Duggan	Birds	Aidan has 16 years of experience working as a self-employed field surveyor specialising in bird surveys. As part of this work he has undertaken Vantage Point surveys, Hen Harrier surveys (nest monitoring and winter roost watches), Red Grouse surveys, Merlin Surveys, White tailed Eagle surveys, breeding and wintering wader and wildfowl surveys, common bird census, countryside bird surveys, intertidal bird surveys, as well as transects and hinterland surveys. He has considerable experience conducting bird surveys on wind farms and power grid routes. Aidan has a lifelong interest in Ornithology and was a voting member of the Irish Rare Bird Committee (IRBC) from 1999 to 2005.
Barry O'Mahoney	Birds	Barry is a director of BOM Bird Surveys Limited. He holds a B.Sc. in Zoology, Biochemistry, Microbiology from University College Cork. He has over 15 years' experience in ornithology. He is currently contracted on a variety of monitoring projects including Hen Harrier, waders, wildfowl and gulls. Barry has worked on a range of wind farm projects since 2014. Barry completed ornithology surveys for the Proposed Development.
Chandra Walters	Habitat, botanical and bat	Chandra Walter is an Ecologist working as part of the Energy and Environment Team at Fehily Timoney and Company. Chandra holds a BSc in Ecology from University College Cork and an MSc in Organic Horticulture from University College Cork. (Both First Class Honours). Her degrees focused on nature conservation and included a wide variety of surveying skills, including habitat surveys, bird surveys and insect surveys, research skills and report writing.
David Daly	Mammal and bat. Report author	David Daly is a Project Ecologist working as part of the Energy and Planning Team at Fehily Timoney and Company. He holds a Bachelor of Science (BSc) in Ecology from University College Cork, obtained in 2017, and a Master of Science (MSc) in

Surveyor	Surveys Completed	Biography
		Species Identification and Survey Skills from University of Reading, obtained in 2019. A large portion of his work is focused on the survey and assessment of proposed wind and solar energy development sites, and he has carried out comprehensive reporting on Ecological Appraisals, AA Screening Reports, and Ecological Enhancement Plans. David has carried out numerous habitat surveys, including surveys of woodland, grassland, and peatland habitats, and also qualitative assessments and mapping of the same. He has also carried out numerous mammal surveys including bat, badger, otter, and general mammal surveys. Bird surveys completed by David since joining FT include winter vantage point surveys, Irish Wetland Bird Surveys, hen harrier roost watches and breeding transects
Jason Guile	Habitat and botanical	Jason is a former Senior Project Ecologist at Fehily Timoney & Company. Jason has 10 years' experience in the ecological sector. During this time he has gained a wealth of knowledge and experience providing ecological input into a range of projects from urban planning applications to commercial regeneration sites to large infrastructure schemes, including writing and reviewing technical reports, biodiversity chapters on Environmental Impact Assessment Reports and Appropriate Assessment/ Natura Impact Statement reports. He is an experienced field surveyor with Natural England licenses for bat (Class level 2), great crested newt, and barn owl surveying (Class level 1), along with surveying, photography and handling licenses for bats with the Department of Culture, Heritage and the Gaeltacht (R.O.I); and a certified Surveyor of Japanese Knotweed with the Property Care Association.
Jon Kearney	Report reviewer	Jon is a principal ecologist with Fehily Timoney & Company. Jon is a specialist planner and ecologist with over 17 years' experience in both the UK and Ireland. His skills include an extensive knowledge of planning environmental law and planning requirements for ecology and biodiversity. Jon's experience spans ecology survey techniques and methodology, ornithological surveys, mitigation design, water quality assessment, Appropriate Assessment and Ecological Impact Assessment. Jon has completed ecological assessments, EcIAs, Environmental Impact Assessment Reports (EIAR) and Appropriate Assessments for a wide variety of projects in Ireland and the UK. Jon completed the review of this chapter.
Karen Banks	Bat	Karen is an ecologist with 16 years' experience in the field of ecological assessment. She holds a BSc in Environment and Development from Durham University and is a full member of the Chartered Institute of Ecology and Environmental Management. Karen is an experienced and skilled bat surveyor, first gaining a scientific licence to disturb bats from Natural England, UK in 2008. Karen is trained in bat handling and capture methods and currently holds a bat disturbance licence granted by the NPWS. Karen has undertaken bat survey and assessment for numerous projects, including bridge repair and replacement works, domestic dwelling repair and demolition works, wind farm developments and large-scale infrastructure projects such as flood relief schemes, road developments and pipeline schemes. Karen has also represented Cork County Council as an expert witness for bats at an Oral Hearing.

Surveyor	Surveys Completed	Biography
Kate O'Regan	Mammal	Kate is a graduate ecologist on the Energy and Planning Team at Fehily Timoney and Company. Kate holds a BSc in Zoology and MSc in Marine Biology from University College Cork. She has experience in a wide range of surveys such as habitat, intertidal, subtidal, bird, insect and mammal surveys. She further developed transferrable field skills through volunteer internships. Kate spent two summer seasons as a research volunteer with a sea turtle research organisation in Greece and also completed a three-month internship with ORCA Ireland conducting marine mammals surveys. Kate's MSc thesis involved GPS tagging of lesser-black-backed gulls on the Saltee Islands and most recently she was awarded a SMART Marine Institute Research Vessel bursary to take part in the Celtic Sea herring acoustic monitoring survey. This range of experiences have enabled Kate to develop a diverse variety of research skills, applicable to different survey types.
Pascal Sweeney	Freshwater pearl mussel	Pascal Sweeney of Sweeney Consultancy is a freshwater biologist, specialising in aquatic invertebrates. Following his B.Sc. degree in zoology, he was employed by UCD as a Research Assistant to monitor biological parameters in the Killarney Lakes. This led to a research M.Sc. on nutrient enrichment impacts on lake invertebrates. His current work is focussed mainly on biological water quality assessments and protected species surveys. In 2006, Pascal's understanding of freshwater ecology led to his being appointed by National Parks & Wildlife Service (NPWS) as Rapporteur for The Owenriff Working Group, which was made up of scientific experts and local managers representing NPWS, the Forest Service, Coillte Teoranta, Inland Fisheries Ireland (IFI), Galway County Council, the Environmental Protection Agency (EPA) and the Western River Basin District, and was established to examine causes of significant mortalities of freshwater pearl mussels in the Owenriff River. Pascal Sweeney is issued yearly licences by NPWS for Stage 2 surveys of freshwater pearl mussels throughout the state. Clients for these surveys have included IFI, OPW, Coillte, Irish Rail, Cork CC, Carlow CC, Tipperary CC, Galway CC, as well as several engineering firms planning projects with potential to impact on rivers. Recent major studies undertaken for IRD Duhallow include a 2019-2020 survey of 48km of the upper Munster Blackwater and Owentaraglin Rivers in which over 1,600 mussels were found, most at previously unknown locations for this species, and a 2022 survey of 30km of the River Allow in which close to 1,800 mussels were found. Pascal Sweeney has also given training courses in freshwater pearl mussel surveying to other professional ecologists and NPWS staff.
Ross Macklin	Aquatic	Ross Macklin PhD (candidate), B.Sc. (Hons) MCIEEM., MIFM, HDip GIS, PDip IPM Ross is an aquatic, fisheries and mammalian ecologist with over 17 years' professional experience in Ireland. He is director of Triturus Environmental Ltd. Ross has a BSc in Applied Ecology and diplomas in integrated Pest Management and GIS. He is currently completing his PhD in fisheries ecology. He has considerable experience in a wide range of ecological and environmental projects including EIAR, EcIA, CEMP and AA/NIS reporting, as well as biodiversity, water quality monitoring, invasive species, mammalian surveys and fisheries management. He also has expert identification skills in transitional and freshwater fish, macrophytes, freshwater invertebrates and protected species. His diverse project experience includes work on renewable energy developments, flood relief schemes, road schemes, waste management,

Surveyor	Surveys Completed	Biography
		blueways/greenways, biodiversity projects, non-volant mammal monitoring, fisheries management projects and catchment wide water quality management.
Sean Ronayne	Birds	Seán is a survey ecologist with Fehily Timoney & Company with extensive bird surveying experience. Seán holds a degree (BSc Zoology), and two masters from UCC (MSc Marine Biology + Ecological Assessment). Seán has worked in various ornithological roles both in Ireland and abroad and has been birdwatching for more than 20 years. Two of Seán's dissertations were of an ornithological nature, and he has also published several papers in peer-reviewed journals, most recently on: "An observation of vocal mimicry by Dupont's Lark *Chersophilus duponti* in Catalonia.", published in Revista Catalana d'Ornitologia. Seán is also a very keen sound-recordist and recorded over 200 species of birds in Catalunya, in 2020, about which he is writing a book. Seán is also working to sound record and catalogue all the resident and wintering bird species of Ireland. Sean completed bird surveys at Barnadivane.

5.2 Methodology

5.2.1 Relevant Guidance

The methodology for this appraisal has been devised in consideration of the following relevant guidance published by the Environmental Protection Agency (EPA) including 'Guidelines on the information to be contained in Environmental Impact Statements (2022), reference was also made to the revised draft (August 2017) 'Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)', 'Draft Advice Notes for Preparing Environmental Impact Statements' (EPA, 2015) and 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' (DoHPLG, 2018).

Additional guidance available from the EU such as 'Guidance document on wind energy developments and EU nature legislation' (2020) and 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment' (2013) has also been considered. The appraisal also considers 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine' (Version 1.1) published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2018; updated September 2019).

The Heritage Council publication 'Best Practice Guidance for Habitat Survey and Mapping' (Smith et al., 2011) was used in the completion of habitat surveys and production of habitat mapping.

Relevant guidance published by the National Roads Authority (NRA) such as 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (2009a), and 'Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes' (2008a) have also been followed.

The Inland Fisheries Ireland publication 'Guidelines on protection of fisheries during construction works in and adjacent to waters' (IFI, 2016) has been utilised.

Relevant guidance from Scottish Natural Heritage (SNH)[1] in relation to birds such as 'Recommended bird survey methods to inform impact assessment of onshore windfarms (SNH, 2017), 'Survey Methods for use in assessing the impacts of onshore wind farms on bird communities (SNH, 2010)' and 'Assessing the cumulative impact of onshore wind energy developments (SNH, 2012)' have also been utilised.

The following guidelines in relation to bats were referenced:

- Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (NatureScot 2021)
- Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland (NIEA, 2021)
- Bat Survey Guidelines: Traditional Farm Buildings Scheme (Aughney et al., 2008)
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition). (BCT/Collins, 2016)
- Bat Surveys: Best Practice Guidelines (2nd Edition) (Hundt, 2012)
- Wind Turbine/Wind Farm Development Bat Survey Guidelines (Bat Conservation Ireland, 2012)
- Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (NRA, 2006a)
- Bats and Onshore Wind Turbines – Interim Guidance (3rd Edition) (Carlin, 2014)
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes (NRA, 2006b)
- Bat survey – NIEA Specific Requirements for wind farm (NIEA, 2014)
- Guidelines for Consideration of Bats in Wind Farm Projects (Rodrigues, 2014).
- Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. (Marnell et. al, 2022).

5.2.2 Legislative Context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act 1976, as amended, and the orders and regulations made thereunder, such as the Flora Protection Order (2022).

The Habitats Directive and Birds Directive have been transposed into Irish law, for the purposes of this application for permission by Part XAB of the Planning and Development Act 2000, as inserted. In addition, certain other obligations of the Habitats and Birds Directives have been transposed by the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

The EU Water Framework Directive (2000/60/EC) requires all Member States to protect and improve water quality in all waters in order to achieve good ecological status by 2015 or, at the latest, by 2027. This was transposed into Irish Law by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003). It applies to rivers, lakes, groundwater, and transitional coastal waters. The Directive requires management plans to be prepared on a river basin basis and specifies a structured method for developing these plans.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

[1] Now called NatureScot

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters.

5.2.3 Consultation

The full list of the bodies consulted as part of the Proposed Development assessment are presented in Chapter 4 (EIA Scoping, Consultation and Key Issues).

The following consultees are of relevance in terms of Ecological Impacts Assessment:

- The Development Application Unit (DAU) - NPWS
- Inland Fisheries Ireland
- Birdwatch Ireland
- An Taisce
- Irish Peatland Conservation Council
- Irish Raptor Study Group
- Irish Wildlife Trust (IWT)
- Cork Co. Council.

5.2.3.1 Consultation Responses

See Chapter 4 - EIA Scoping Consultation and Key Issues for full details on consultation.

Development Application Unit (DAU) - NPWS

Consultation with the NPWS began in 2013, when winter bird surveys were being scoped for the site, when the local NPWS ranger was consulted in relation to species of conservation concern in the area. These consultations continued through 2014, with written consultation for the AA Screening and the EIA being undertaken during the summer of 2014.

NPWS was consulted as part of a data request, which was returned on received 15th November 2022.

NPWS were again consulted in December 2022 as part of Scoping for EIAR. A response was received on 03rd February 2023. Impacts to peatland habitats, hedgerows, scrub and grassland habitats, alien invasive species, watercourses and wetlands, ornithology (notably hen harrier), bats and marsh fritillary were highlighted. See full Scoping Response in Appendix 4.1

Inland Fisheries Ireland (IFI)

Consultation with IFI was undertaken in June 2014. IFI responded to the consultation letter, dated June 2014, setting out the issues which the organisation considered relevant for the development to consider during the EIA process.

IFI were again consulted in December 2022 as part of Scoping for EIAR. A response was received on 19th December 2023. IFI stated that the dominant threat to fisheries should the development proceed is the potential for the escapement of suspended solids, and provided mitigation measures to be adopted as planning conditions. See full Scoping Response in Appendix 4.1.

Their concerns relate specifically to ensuring that the release of sediment and other pollutants to local watercourses is adequately controlled and that any new watercourse crossings are designed appropriately with regard to the passage of fish. Comments raised in the response have been dealt with throughout the EIAR.

Cork County Council

A pre-planning meeting was held with Cork County Council in relation to the Proposed Development. This meeting, held with Ms. Melissa Walsh, Senior Executive Planner, Cork County Council, on 16 July 2014, was in relation to the Proposed Wind Farm development, as well as in relation to the Proposed substation (which is the subject of a separate planning application, reference 14/00557).

At the meeting, the planning history of the site, the proposed changes to the permitted development and the rationale for these changes were discussed. The potential for reduced impacts on the surrounding environment, as a result of these changes were also discussed.

An EIA scoping report was tabled, and discussed, with reference made to the need to consult with relevant parties.

Cork County Council were again consulted in December 2022 as part of Scoping for EIAR. The receipt of email was acknowledged but no further response was received.

5.2.4 Desktop Study

Designated Nature Conservation Sites

European sites within the potential ZoI (Zone of Influence) of the Proposed Development namely Special Areas of Conservation (SACs)[2] and Special Protection Areas (SPAs) for birds were identified as part of this ecological assessment using in-house GIS analysis of the site layout and up to date NPWS geospatial data. These designated sites are described in section 5.3.1. A separate Natura Impact Statement (NIS) was prepared to allow the Competent Authority to ascertain if the Proposed Project (either alone or in-combination with other plans or projects) will adversely affect the integrity of a European site.

Nationally designated sites within 15km of this project, such as Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) have been identified.

Other categories of designated site such as nature reserves, RAMSAR sites and wildfowl sanctuaries were also searched for during the desktop study.

Rare or Protected Flora and Fauna

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the site's natural environment.

Records available on the NPWS and the National Biodiversity Data Centre websites were reviewed, in addition to records of rare/sensitive species within the 10km grid squares overlapped by a 5km buffer surrounding the study area obtained by request from NPWS (received 15th November 2022).

[2] Note: At present many SACs in Ireland are currently 'candidate' SACs and referred to as cSACs. The relevant Statutory Instruments for the SACs in Ireland have not yet been made, however, these "candidate" sites must still be afforded the same level of protection as if they were SACs in accordance with the Habitats Directive.

Other data sources include 'Ireland's Wetlands and their Waterbirds: Status and Distribution' (Crowe 2005), the 'Atlas of Wintering Birds in Britain and Ireland' (Lack, 1986), the 'Atlas of Breeding Birds in Britain and Ireland' (Sharrock, 1976),the 'Breeding and Winter Birds of Britain and Ireland Bird Atlas 2007-11' (Balmar et al., 2013), and The European Breeding Bird Atlas (EBBA2) https://ebba2.info/.

Botanical species were assessed in accordance with their occurrence on the Flora Protection Order 2022 and the 'Ireland Red List No. 10: Vascular Plants' (Wyse et al., 2016).

Other sources included:

- Cork County Development Plan 2022-2028;
- OSI Aerial photography and 1:50000 mapping;
- NPWS website (mapviewer; Article 17 mapping; FPO Bryophyte viewer);
- EIAR Biodiversity chapters for nearby development (accessed via EIA Portal);
- National Biodiversity Data Centre (NBDC) website and data obtained on 09/11/2022,03/02/2023;
- Birdwatch Ireland – Bird Sensitivity to Wind Energy mapping (accessed via NBDC);
- Teagasc Soil area maps;
- Geological Survey Ireland (GSI) area maps;
- OPW drainage maps;
- EPA website datasets (soil, surface water quality, ground water quality, designated sites);
- IFI website & guidance documents;
- Botanical Society of Britain and Ireland online maps and data.

Bats

A desk-based review of habitat availability in the environs of the Proposed Development, and the available bat data was used to inform the scope of the bat surveys required. As recommended by both BCI (2012), NatureScot (2021) and NIEA (2021), the area covered by the desk-based review was extended to 10 km surrounding the Proposed Development site. The desk-based study included:

- Reviewing distances from closest European sites designated for bats (the only bat SACs in Ireland are for lesser horseshoe bat *Rhinolophus hipposideros*).
- Examining aerial imagery and 6-inch maps to identify potential bat foraging and roosting habitats.
- Lundy et al. (2011) provides a high-level assessment of potential habitat suitability for different species of bat occurring in Ireland.
- Review of data = results of Biodiversity Maps report for the 10-km squares covering the site [R66 & R67], including species recorded and known roosting sites.

5.2.5 Field Assessment

The study areas used for different disciplines and different survey types within study areas relative to specific project elements are detailed below in Table 5-2.

Table 5-2: Definition of Study Areas

Discipline/ Survey	Proposed Development
Habitat, Botanical, and Invasive Species	Habitat survey study area (see Figure 5-10), as well as AGCR and TDR (results discussed in Section 5.6.4.5
Mammals	
General Mammals	150m buffer[3] around the footprint of the development.
Otter	Survey points on watercourses draining the Proposed Development and surrounding area
Bats	Proposed Development site land ownership boundary plus 275m buffer
Avifauna	
VP Surveys	VP viewsheds and 500m turbine buffer. Note 'study area' refers specifically to 500m turbine buffer.
Transect Surveys (breeding and wintering) and breeding wader surveys	500m turbine buffer.
Hinterland surveys	10km turbine buffer. Note - referred to as 'wider study area'
Aquatic Ecology	Survey points on all freshwater watercourses which could be affected directly or indirectly by the Proposed Development.
Freshwater pearl mussel	Survey points on watercourses draining the Proposed Development and surrounding area.

5.2.5.1 Habitats

This section details the habitat surveys carried out at the Proposed Development Site. The principal aim of the field survey was to identify and map habitats and their component plant species within the study area encompassing the Proposed Development site.

A Habitat Survey was undertaken as part of the site walkover survey on 12th July 2022. The methodology used during this survey was based on the Heritage Council's Best Practice Guidance for Habitat Survey and Mapping (2011). The classification of habitats recorded during the field survey is based on '*A Guide to Habitats in Ireland*' (Fossitt, 2000). The Guide to Habitats in Ireland classifies habitats according to a hierarchical framework with Level 1 habitats representing broad habitat groups, Level 2 representing habitat subgroups and Level 3 representing individual habitat types. The habitat survey focused on identifying habitats to Level 3 of the Guide to Habitats in Ireland. All other records of interest (e.g., invasive plant species) were also marked on field maps and locations were recorded using GPS handheld units.

[3] Based on maximum buffering distance recommended for Badger in NRA's 'Guidelines for the treatment of badgers prior to the construction of national road schemes'.

The annotation of vegetation occurring within sites was undertaken using the DAFOR scale. This scale refers to plant species in terms of dominance, abundance, frequency, occasional and rare (DAFOR). Scientific and common names for vascular plants follow Parnell and Curtis (2012) and Blamey et al., (1996), respectively., while mosses and liverworts nomenclature follows 'Mosses and Liverworts of Britain and Ireland - a field guide' (British Bryological Society, 2010).

In addition to habitat identification, each habitat was assessed for its ecological significance, based on the NRA Guidelines for Ecological Impact Assessment of National Road Projects (NRA, 2009a) and the CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2018), see Section 5.2.6 below.

Habitat boundaries and associated attribute data were mapped using desk-based GIS software, namely ArcGIS 10.4.1, which was also used to calculate habitat areas and lengths.

5.2.5.2 Mammals

Mammal surveys at the Proposed Development were undertaken on 10th November 2022. During surveys the footprint of the development was surveyed for signs of mammal activity; this included the footprint of vegetation clearance and earthworks, as well as a buffering distance of 150m from all proposed infrastructure, which encompassed 50m beyond the extent of the proposed bat vegetation clearance buffers.

Sightings, tracks or signs (including droppings, resting places, burrows and setts) of mammals occurring within, or in the vicinity, of the site footprint were recorded using field notes and/or handheld GPS units subsequently digitised using ArcGIS.

The mammal survey also included a drey search within the conifer plantation of the Proposed Development study area identified above.

The presence of otter at each aquatic survey site was determined through the recording of otter signs within 150m of each survey site (Appendix 5-4).

Surveys were undertaken in accordance with the NRA's (2009b) 'Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes' and the JNCC's (2004) 'Common Standards Monitoring Guidance for Mammals'.

Trail cameras were placed throughout the site at locations with potential for mammal activity to be detected. Locations were selected to provide coverage of the site. The locations of trail cameras are listed below in and shown in Table 5-3:

Table 5-3: Trail camera deployment details

ID	Location (ITM)	Deployment Period	Habitat
1	533949, 563720	10/11/22 to 24/11/22	Hedgerow/ drainage ditch
2	533799, 563184	10/11/22 to 24/11/22	Wet grassland
3	533706, 562381	10/11/22 to 24/11/22	Hedgerow

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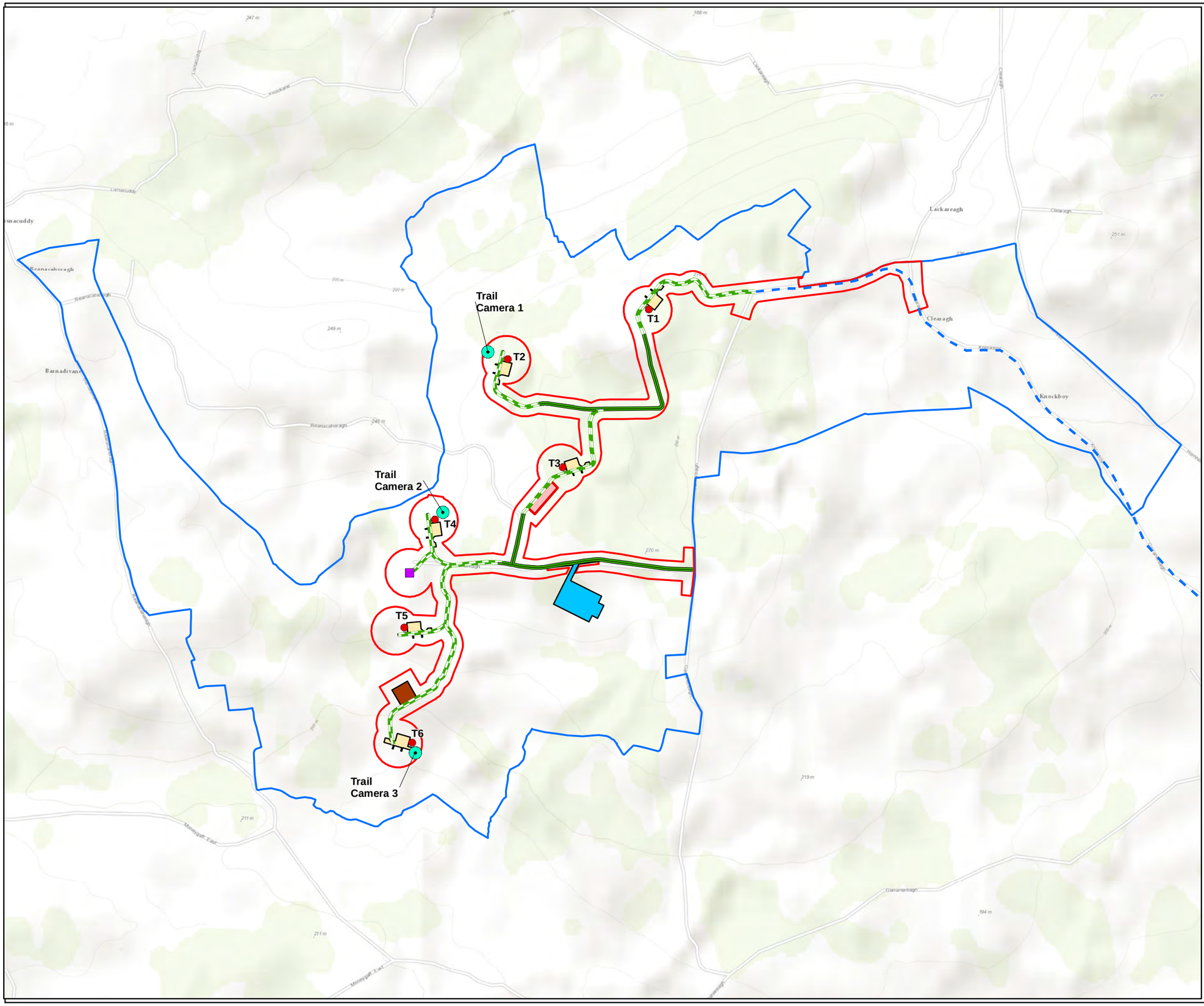

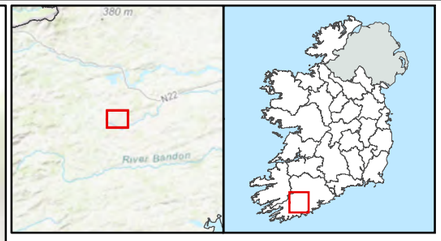

Legend

- Lands in control of Applicant
- Development Planning Boundary
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Tracks-Existing
- Tracks-Proposed
- Turbine Delivery Route
- Trail Camera Locations

TITLE:	Trail Camera Locations		
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork		
FIGURE NO:	5.1		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:12500	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

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N W E S

0 0.25 0.5 1 Kilometers

5.2.5.3 Bats

Bat surveys have been completed within the study area (Proposed Development site land ownership boundary plus 275m buffer) during the years 2021 and 2022. The surveys encompassed preliminary roost assessments, summer roost, focused on buildings and tree inspections, activity surveys (transects) and static detector surveys. A full account of the methodologies for bat surveys undertaken within the Proposed Development study area are provided in the Bat Roost Survey Report (Appendix 5.1). The following summarises the bat survey methodology for the Proposed Wind Farm.

These surveys followed the specific guidelines set out by the Bat Conservation Trust in Bat Surveys: Good Practice Guidelines (Hundt, 2012 and Collins, 2016). The locations of static detectors and methodology for static detector surveys followed the requirements of 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation' (NatureScot; 2021).

Preliminary Ecological Appraisal

A walkover survey of areas identified as potential roosting habitats during the desk top study were undertaken in June 2021. Roosting habitat was assessed using the criteria outlined in Table 5-4:

Table 5-4: Potential suitability of habitats for bats (Collins,2016)

Suitability	Description of Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only- the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due	Continuous, high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge.

Suitability	Description of Roosting Habitats	Commuting and Foraging Habitats
	to their size, shelter, protection, conditions and surrounding habitat.	High quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

Bat Roost Inspection Survey

See Appendix 5.1 for Detailed Roost Survey Report.

Trees

Inspections of the exterior of trees were undertaken on 28th March 2022 to look for features that bats could use for roosting (Potential Roost Features, or PRFs) from ground level. The aim of the surveys was to determine the actual or potential presence of bats and the need for further survey and/or mitigation. Tree inspections and identification of PRFs had regard to the guidance document 'A Guide to Identification and Assessment for Tree-Care and Ecology Professionals' (Bat Tree Habitat Key, 2018).

Inspections of each potential tree roost within the study area were undertaken. The inspections were carried out in daylight hours from ground level, and information was compiled on the tree, PRFs and evidence of bats. All trees surveyed were numbered and marked on a map and a description of each PRF observed was recorded. PRFs that may be used by bats include:

- Rot holes;
- Hazard beams;
- Other horizontal or vertical cracks or splits (e.g. frost cracks) in stems or branches;
- Lifting bark;
- Knotholes arising from naturally shed branches or branches previously pruned back to the branch collar;
- Man-made holes (e.g. flush cuts) or cavities created by branches tearing out from parent stems;
- Cankers in which cavities have developed;
- Other hollows or cavities;
- Double leaders forming compression forks with included bark and potential cavities;
- Gaps between overlapping stems or branches;
- Partially detached ivy with stem diameters in excess of 50mm; and
- Bat or bird boxes.

Signs of a bat roost (excluding the actual presence of bats), include:

- Smoothing of internal crevices;
- Bat droppings in, around or below a PRF;
- Odour emanating from a PRF;
- Audible squeaking at dusk or in warm weather; and
- Staining below the PRF.

It should be noted that bats or bat droppings are the only conclusive evidence of a roost, and many roosts have no external signs. Trees were categorised according to the highest suitability PRF present in line with Collins (2016).

Structures

Buildings within the Proposed Development area for bats were subject to a visual inspection for evidence of, and potential for, bats in August 2021. The exterior of the structures was visually assessed for potential bat access points and evidence of bat activity using binoculars, a high-powered torch and an endoscope (Explorer Premium 8803 with 9mm camera). Features such as crevices and small gaps in the bridge or building structure, such as between the brick or stonework, beneath roofing material, at eaves and around window frames which had potential as bat access points into the buildings were inspected. Evidence that these features/ access points were actively being used by bats includes staining within the gaps, urine staining and bat droppings. Indicators that potential access points are not actively used by bats include general detritus and cobwebs within the access point. A note of potential features used by bats was made where present.

Where possible, internal inspections of these structures were undertaken. Where it was not possible to complete internal inspections, emergence roost surveys were completed, see section below. Internal inspections involved looking for features that may be suitable for roosting bats, such as joints and crevices in wood, holes or crevices between stonework in the walls and searching for bat droppings, urine stains and feeding signs on the floor.

Emergence Roost Survey

Dusk surveys of structures within the study area for bats that were identified as being of moderate to high potential for bats, or which could not be fully assessed during the roost inspection surveys were undertaken between 27th and 31st August 2021. The purpose of the surveys was to watch and listen for bats exiting from bat roosts to determine the presence or absence of bats at the time of survey. The dusk emergence surveys commenced approximately 15 minutes before sunset and ended approximately 90 minutes after sunset. The survey was undertaken in suitable weather conditions (avoiding periods of very heavy rain, strong winds (> Beaufort Force 5), mists and dusk temperatures below (12°C)). Two operatives surveyed the structures.

Anabat Walkabout detectors were utilised for the survey, which record bat echolocation calls directly on to an internal SD memory card.

Each time a bat is detected, an individual time-stamped (date and time to the second) file is recorded. Data were then downloaded and all recordings were analysed using the Anabat Insight spectrogram sound analysis software Version 2.0.1.

Bat Activity/Transect Surveys

Transects of bat favourable habitats within the study area were walked and activity recorded using an Anabat Walkabout detectors. Transects were undertaken between August and September 2022 (Table 5-5).

Surveys targeted a range of foraging and commuting habitats present within the study area, those associated with linear features such as roadside margins, woodland plantation edges, hedgerows, treelines and waterbodies. Full details of transects are shown in Table 5-5 and Figure 5-2 below.

Bat activity is governed by the activity of their insect prey and insect abundance is in turn governed by weather conditions and climate. Insects, and therefore bats, are unlikely to be present at temperatures below 7°C or during periods of strong winds or heavy rainfall so surveying in such conditions is not possible. All field surveys were undertaken within the active bat season and during good weather conditions (dry conditions and temperature at 8°C and greater).

Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (Anabat Insight spectrogram sound analysis software Version 1.9.7).

Table 5-5: Bat activity survey details

Transect	Date	Start Time	End Time
1	25/08/2022	20.30	22.35
2	25/06/2022	19.40	21.40

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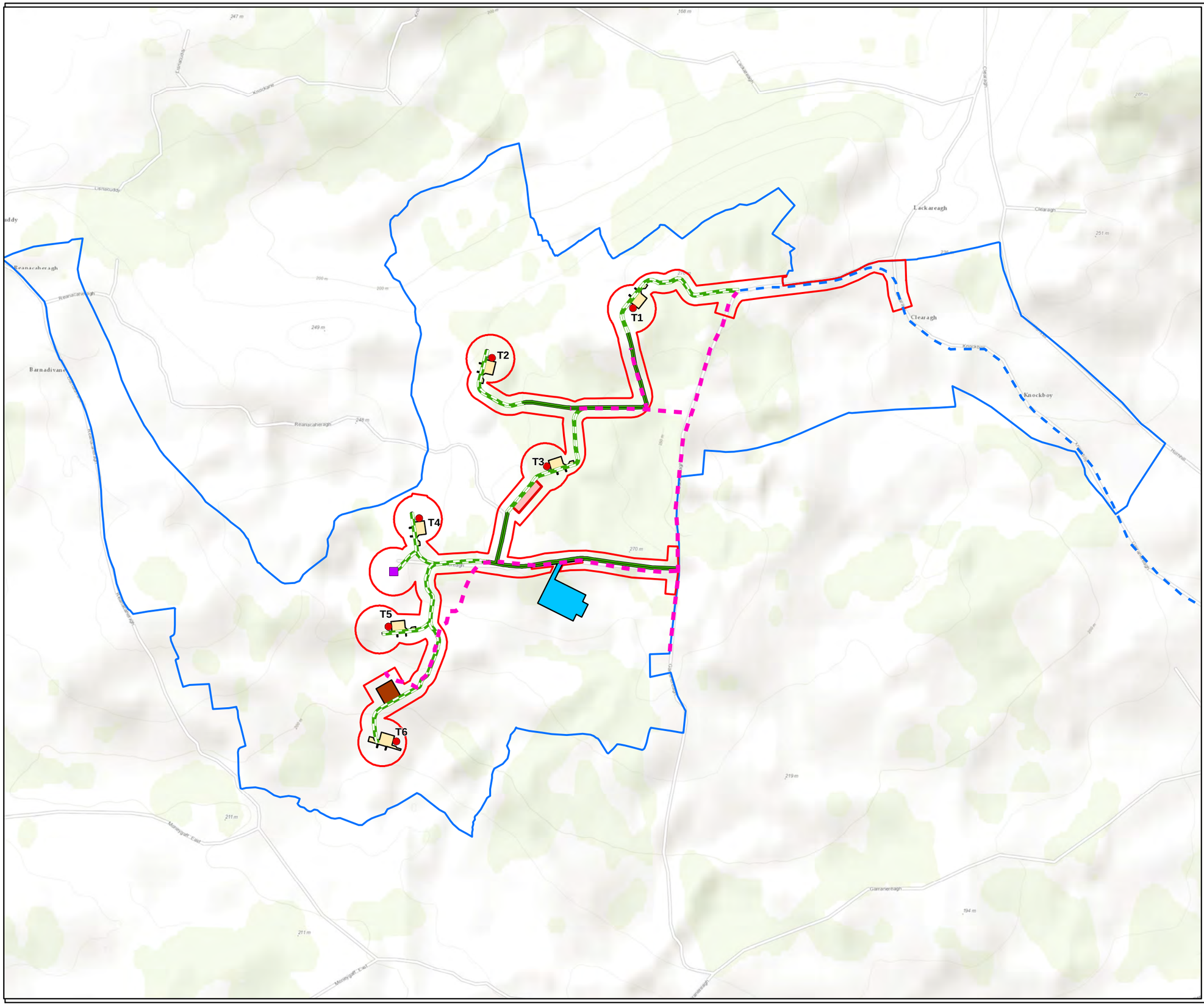

Legend

- Development Planning Boundary
- Lands in control of Applicant
- Proposed Substation
- Turbine Hardstandings
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Tracks-Existing
- Tracks-Proposed
- Turbine Delivery Route
- Bat Transect

N W E S

0 0.25 0.5 1 Kilometers

TITLE:	Bat Activity Transects		
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork		
FIGURE NO:	5.2		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:12500	**REVISION:**	0
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Static Detector Surveys

Passive Static Bat Surveys involve leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger. This results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

Song Meter SM4BAT Full spectrum bat recorders use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro-SD cards depending on the model) and downloaded for analysis. Full spectrum bat recorders were utilised for all of the static surveys as recommended in the revised NatureScot (2021) guidelines. These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats.

Per NatureScot (2021) guidance, static units (Song Meter SM4BAT and Song Meter Mini) were programmed to commence half an hour before sunset and finish half an hour after sunrise to ensure that bat species that emerge early in the evening and return to roosts late are recorded. Detectors were left out for a minimum of 10 consecutive nights in 2021 and 20 consecutive nights in 2022 across three survey periods: spring (April-May), summer (June-mid-August) and autumn (mid-August-October). See Table 5-6 below for further details.

NatureScot (2021) guidance states that "Detectors should be placed at all known turbine locations at wind farms containing less than ten proposed turbines. Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments".

At key-holed woodland/plantation sites (and other proposals involving extensive habitat alteration), pre-application survey data may not represent the situation post-construction, as the habitat available for bats will change following construction. Automated survey locations should therefore also include open areas including existing nearby rides/clearings in the forestry, to provide an indication of how bats may adapt to and use the new habitat created through turbine construction.

The data was analysed with Kaleidoscope 5.4.8 software (Bats of Europe 5.2.1).

The location of the static detectors is presented in Table 5-6 and Figure 5-3 below.

Table 5-6: Details of static detector deployment

				2021						2022					
Static Detector ID.	Habitat types at static location	Closest turbine number (final design)	Habitat types at turbine location	Spring		Summer		Autumn		Spring		Summer		Autumn	
				Start Date	No.of nights deployed	Start Date	No.of nights deployed	Start Date	No.of nights deployed	Start Date	No.of nights deployed	Start Date	No.of nights deployed[4]	Start Date	No.of nights deployed
BV1	Hedgerow adjacent to agricultural grassland	T1	Improved agricultural grassland	22/05/21	25	02/07/21	15	20/88/21	11	09/05/22	23	22/06/22	21	15/08/22	21
BV2	Stream adjacent to wet grassland/ roadside along treeline (2021)	T2	Improved agricultural grassland	22/05/21	25	02/07/21	15	20/08/21	11	09/05/22	23	22/06/22	21	15/08/22	21
BV3	Hedgerow adjacent to drainage ditch/ agricultural land	T3	Improved agricultural grassland	22/05/21	25	02/07/21	15	20/08/21	11	09/05/22	23	22/06/22	21	15/08/22	21

[4] Note that data will be recorded for the morning on the date of collection. Thus, if a detector was left out on 09/05/2022 and collected on 20/05/2022, the detector will have been left out for a total of 11 complete nights. However, there will be 12 unique dates where data was (potentially) recorded.

				2021						2022					
Static Detector ID.	Habitat types at static location	Closest turbine number (final design)	Habitat types at turbine location	Spring		Summer		Autumn		Spring		Summer		Autumn	
				Start Date	No.of nights deployed	Start Date	No.of nights deployed	Start Date	No.of nights deployed	Start Date	No.of nights deployed	Start Date	No.of nights deployed[4]	Start Date	No.of nights deployed
BV4	Wet grassland	T4	Wet grassland	22/05/21	25	02/07/21	15	20/08/21	11	09/05/22	23	22/06/22	21	15/08/22	21
BV5	Hedgerow adjacent to agricultural grassland/ Improved grassland (2021)	T5	Improved agricultural grassland	22/05/21	25	02/07/21	15	20/08/21	11	09/05/22	23	-	Detector fault - No recordings	15/08/22	43
BV6	Hedgerow adjacent to agricultural grassland/ Scrub and wet grassland (2021)	T6	Agricultural land and scrub	22/05/21	25	-	Detector fault - No recordings	20/08/21	11	-	Detector fault - No recordings	22/06/22	21	15/08/22	43
B2Extra	Hedgerow adjacent to agricultural grassland/ farm buildings (2021)	T3	Improved agricultural grassland	22/05/21	25	02/07/21	15	20/088/21	11	N/A	N/A	N/A	N/A	N/A	N/A

Static Detector Survey Analysis

All recordings were made in full spectrum, retaining all amplitude and harmonic information from the original bat call for subsequent analysis. Bat calls were analysed using Kaleidoscope Pro (5.4.8) Software. All files were split to a maximum duration of 15 seconds and automatically identified to species level, or genus level as appropriate, using auto-ID bat classifiers (Bats of Europe 5.2.1).

In order to determine appropriate quality assurance a randomly generated 10% sample of the files were manually checked (including noise and noID files).

The data was then entered into Ecobat and a report was subsequently generated. Ecobat is an online tool which makes assessments of bat activity levels by comparing data entered by the user with bat survey information from similar areas at the same time of year. Specifically, a median bat activity level is calculated which corresponds to a bat activity category (Table 5-7).

An individual bat can pass a particular feature on several occasions while foraging. It is therefore not possible to estimate the number of individual bats. In accordance with best practice guidance (Collins, 2016) an activity index is used; calculated from bat records per hour which allows analysis of bat activity to estimate abundance and/ or activity. The calculation is as follows:

BAI (Bat Activity Index) = Total number of bat records / number of hours of recording:

Table 5-7: Median percentile range and corresponding bat activity category

Percentile	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

The Ecobat analysis reports are presented in EIAR Appendix 5.2.

Survey and Analysis Limitations

- It is not always possible to identify a bat call to species level due to the recorded call not being clear. Recorded files from automated detectors may contain only fragments of a call, or the bat may be calling from a distance (from the detector) in which case it may not be clear enough to assign the call to a specific species. In these cases, the call has been assigned to genus level for the survey results;
- Some caution must be taken when comparing activity levels between species, as bias can be shown towards those species with 'louder' or 'lower frequency' echolocation calls.

For example, Nyctalus species have louder and low frequency echolocation calls which carry further than the quieter and more broad-band brown long-eared bat echolocation calls;

- A bat contact is defined as a single detector file which contains at least one bat call. Multiple contacts at any given detector location do not necessarily indicate the presence of more than one bat and should therefore be interpreted as a level of activity rather than the number of bats recorded;
- For the purposes of this analysis, if more than one species was present within the recorded files the prominent species was identified as the species for the Ecobat analysis;

- Guidelines in the use of Ecobat recommend a Reference Range of 200+ files of bat data to be confident in the relative activity level. The reference range is the stratified dataset of bat results recorded in the same region, at the same time of year, by which percentile outputs can be generated. This comprises all records of nightly bat activity across Ireland. Although there is an increased uptake in the use of Ecobat in Ireland, some of the reference ranges remain below 200, therefore the results are more conservative.
- Static location BV6 2021 had no recordings during the summer period due a fault with the detector. The detectors were place at turbine locations for three rounds in in 2021 and 2022, with an additional location in 2021, gathering more than the recommended number of nights per season across the two years.
- Static location BV5 2022 had no recordings during the summer period due a fault with the detector. The detector was deployed for a double effort (40+ nights) in the autumn period to make up for lost summer data. The detectors were place at turbine locations for three rounds in 2021 and 2022, with an additional location in 2021, gathering more than the recommended number of nights per season across the two years.
- Static location BV6 2022 had no recordings during the spring period due a fault with the detector. The detector was deployed for a double effort (40+ nights) in the autumn period to make up for lost spring data. The detectors were place at turbine locations for three rounds in 2021 and 2022, with an additional location in 2021, gathering more than the recommended number of nights per season across the two years.

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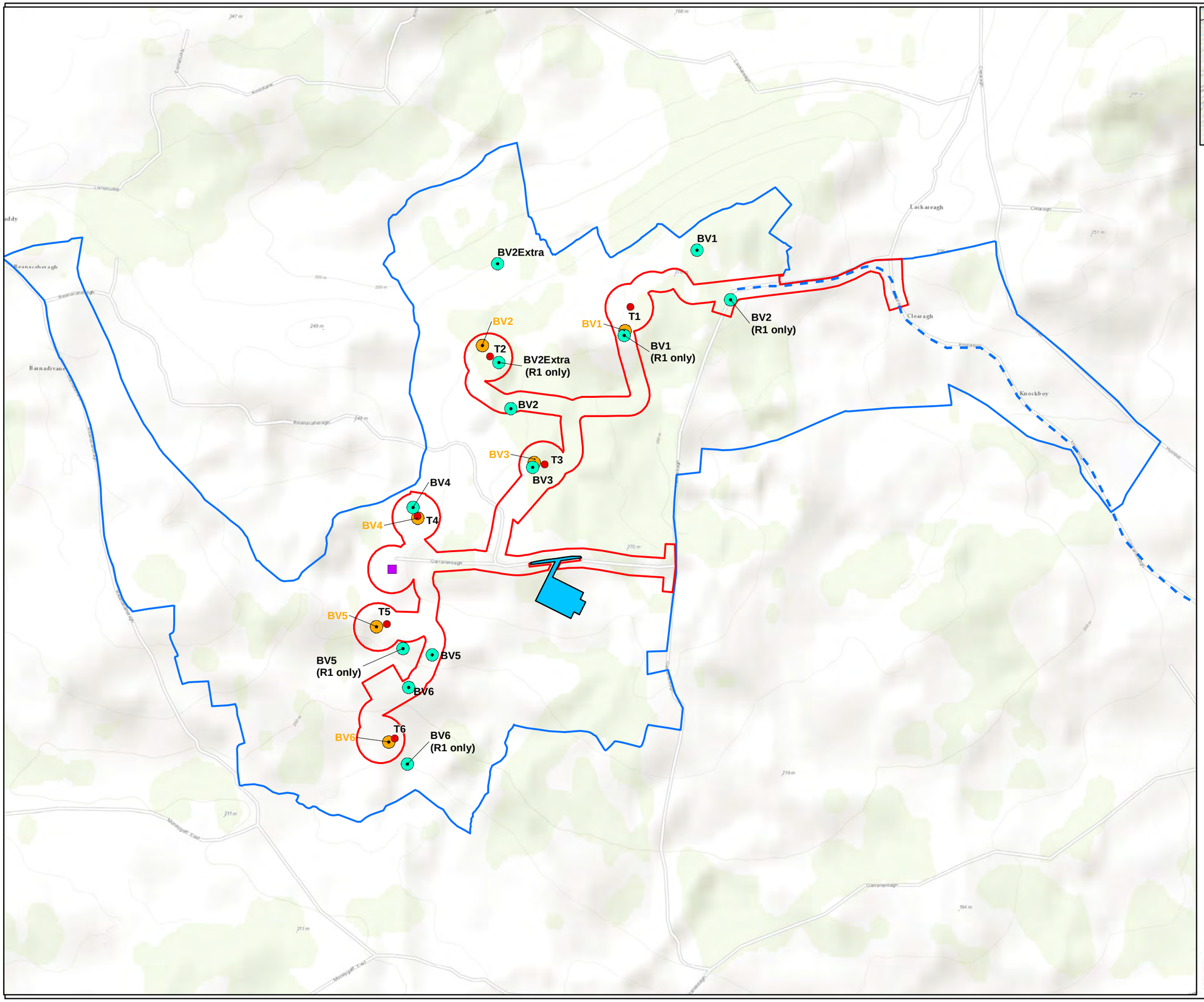

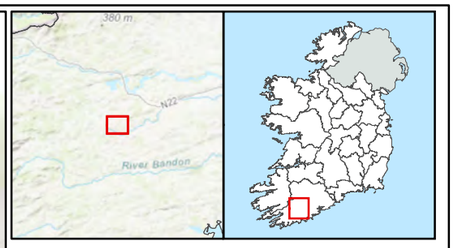

Legend

- Development Planning Boundary
- Lands in control of Applicant
- Proposed Substation
- Proposed Met Mast
- Proposed Turbine Layout
- Turbine Delivery Route

Static Detector Locations

Year

- 2021
- 2022

N W E S

0 0.25 0.5 1 Kilometers

TITLE: Static Detector Locations			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	5.3		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:12500	**REVISION:**	0
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5.2.5.4 Avifauna

Study Areas

The study area for flight activity surveys strictly refers to the 500m turbine buffers, while the vantage point viewsheds were also encompassed. The study areas for breeding waders and general breeding birds encompassed the 500m turbine buffer. Hinterland sites, i.e. Breeding raptor surveys and Wintering waterbird (I-WeBS) surveys encompassed a 10 km buffer around the proposed turbine locations.

Target Species

Target species are those identified as being at risk from displacement effects caused by wind farm developments or from collision with turbines. Target species for which flight-line data was captured included the following species groups:

- Waders;
- Wildfowl (ducks, geese and swans);
- Other waterbirds (including cormorants, divers, grebes, herons, rails, crakes and gulls);
- Raptors and owls;
- Any species listed on Annex I of the Birds Directive;
- Any species listed as Red on the BoCCI 2020-26 (Gilbert et al., 2021).

Overview of methods of current surveys

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

Field surveys were undertaken to gather detailed information on bird distribution and flight activity in order to predict the potential effects of a wind farm development on birds. The field surveys comprised two main elements; vantage point (VP) watches and targeted distribution and abundance surveys which comprised:

- VP watches undertaken over two years at two VPs (winter 2020/21, winter 2021/22, summer 2021, summer 2022);
- Transect surveys (winter 2020/21, winter 2021/22, summer 2021, summer 2022);
- Breeding Wader Surveys (summer 2021, summer 2022);
- Hinterland Surveys - Hen Harrier Breeding & Roosting and Breeding & Wintering waterbird surveys (winter 2020/21, winter 2021/22, summer 2021, summer 2022).

Vantage Point (VP) Watches/ Flight Activity Surveys

The overall aim of these surveys was to quantify the level of flight activity and distribution over the flight activity survey area and to determine bird usage of the site. The flight activity survey area was taken to be that area encompassing the potential development area and 500m beyond the development boundary as potential collision risk, habitat loss and displacement could affect birds outside the proposal site. Thus, the flight activity area was considerably larger than that required by SNH (2017) guidance, which states that the flight activity survey area should correspond to 500m circular buffers drawn around the location of each proposed turbine. Vantage points are ideally located on elevated areas, or other areas, which provide clear views over the survey area. Achieving maximum visibility over as much of the site as possible is important for these surveys.

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

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

With regards to the Proposed Development, VP locations were selected to provide maximum site coverage. Factors which limited selection of VP locations included the undulating typography of the landscape.

The survey effort across all VP locations exceeded the recommended amount stated in SNH (2017) guidance. The Irish Transverse Mercator (ITM) grid co-ordinate locations of each VP are provided in Table 5-8, below. Figures showing the location of each VP and the viewsheds from each VP in order to show the extent of site coverage are provided in Figure 5-4. Full details on individual VP surveys including survey dates, times and weather conditions can be found in Appendix 5.3.

Table 5-8: Spatial visual coverage of 500m buffer and collision risk zone (CRZ) overall survey effort

Vantage Point (VP)	ITM Grid Co-ordinates	Turbine number(s) covered in viewshed
VP1	533330, 561973	T2, T3, T4, T5, T6
VP2	534900, 563900	T1, T2, T3, T4, T5, T6

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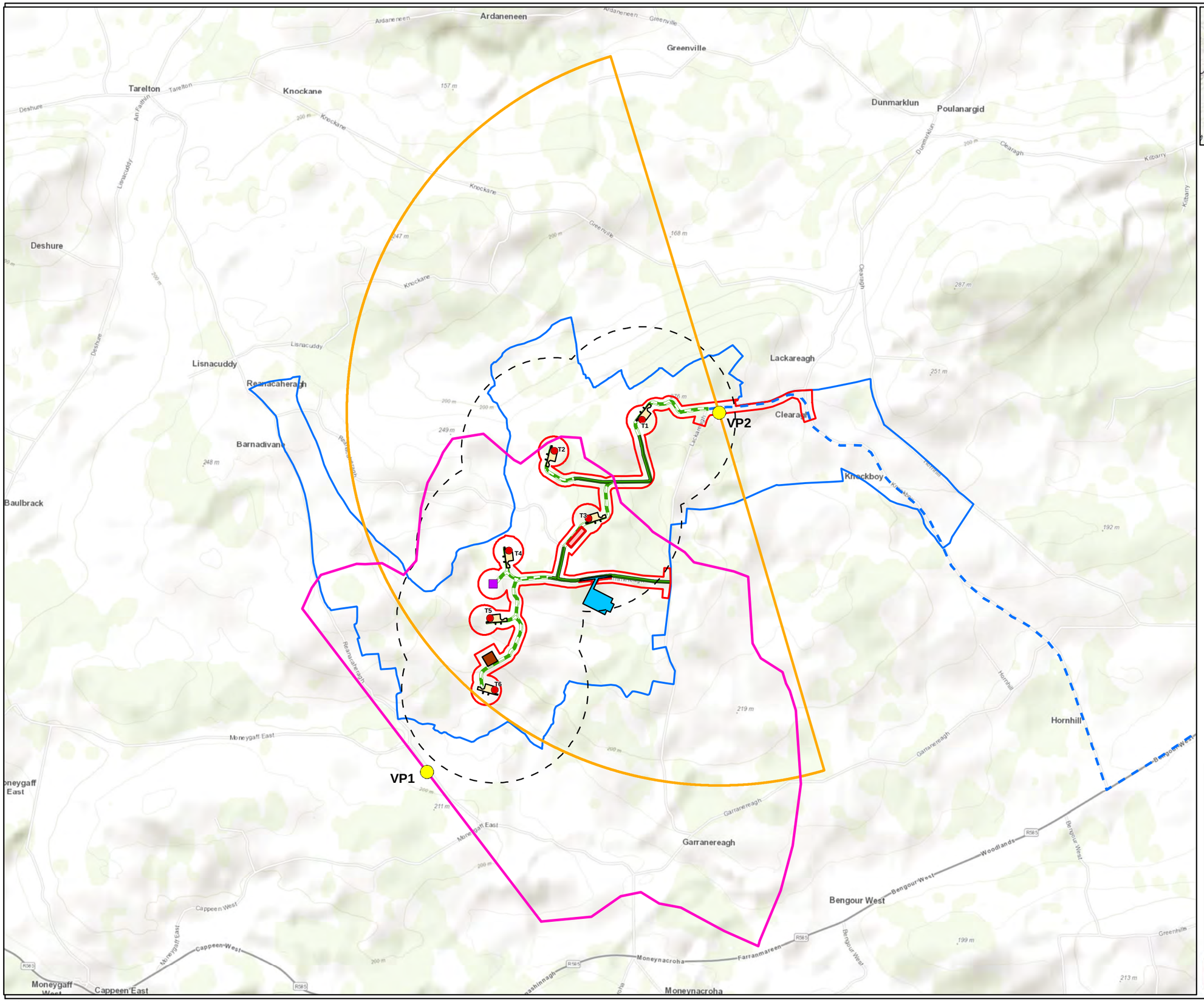

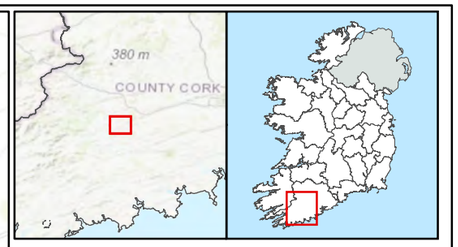

Legend

- Development Planning Boundary
- Lands in control of Applicant
- Proposed Substation
- Turbine Hardstandings
- Turbines 500m Buffer
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Turbine Delivery Route
- Tracks-Existing
- Tracks-Proposed
- Viewpoints

Viewsheds

Name

- VP1 Viewshed
- VP2 Viewshed

N W E S

0 0.25 0.5 1 Kilometers

TITLE: Vantage Point Locations			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	5.4		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:20000	**REVISION:**	0
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Hinterland Surveys

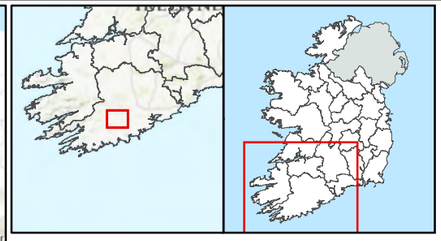
The methodology used for wetland sites during the winter hinterland surveys followed I-WeBS (Irish Wetland Bird Survey) methodology (Lewis et al, 2019), whereby each location was surveyed for the duration necessary to identify and obtain a count for all target species present. The same approach was adapted for non-wetland sites. A hinterland survey for raptors was conducted in accordance with Raptors: a field guide to survey and monitoring (Hardey et al. 2013) to assess Hen Harrier and other raptor activity over the winter and breeding periods in the greater surroundings. Surveys for Hen Harrier breeding and roosting sites were also carried out within 5km of the Proposed Development, fulfilling and exceeding the requirement set out in SNH Guidance (2017). The surveys were carried out in suitable habitats for birds (woodland, wetland, peatland, etc) in the area surrounding the Proposed Development site. While hinterland surveys included potential breeding wader habitat during summer 2021 and 2022 seasons, the same approach used for winter surveys was employed (each location was surveyed for the duration necessary to identify and obtain a count for all target species present).

Hinterland surveys comprised of a total of 11 HVPs within 10 km from the Proposed Development site over the survey period. These sites were chosen as they had suitable habitat for target species such as raptors, geese, swans, waterbirds and waders. Surveys were carried out each month throughout the survey period starting in October 2020 and ending in September 2022. Wading birds, waterfowl and raptors were monitored using short VP watches (of between 1hr and 2hr duration). Consultations were held with local birdwatchers on recent data and sightings. Sightings of birds were also recorded for birds seen in the Barnadivane area within 2km radius of the site, within 5km radius of the site and within 10km radius of the site. These surveys are detailed in Table 5-9.

Table 5-9: Wider area breeding raptor survey locations

HVPs	Location	Distance from site
1	Castlelack Lake	13.8 km
2	Castlemoor	9 km
3	Desert Bridge	9.7 km
4	Inishcarra Reservoir	6.3 km
5	Kilmicheal/ Mid Cork Quarries	5 km
6	Murragh Lake	9.3 km
7	River Bandon SAC	9.5 km
8	Sullane Delta	7 km
9	The Gearagh	7.5 km
10	Toon Flats	8 km
11	Warren's Court	3.5 km
12	Barnadivane 2km radius of boundary	
13	Barnadivane 5km radius of boundary	
14	Barnadivane 10km radius of boundary	

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-5_Survey_Area_for_Hinterland_Sites_A3.mxd



Legend

- Development Planning Boundary
- Lands in control of Applicant
- Proposed Substation
- Turbines 2km Buffer
- Turbine Delivery Route
- Proposed Turbine Layout
- Hinterland Sites

The Gearagh IWeBS
Sullane Delta IWeBS
Inishcarra Reservoirs IWeBS
Toon Flats
Warren's Court
Castlemoor
Midcork / Kilmichael Quarry
Murragh Lake
Desert Bridge IWeBS
Bandon River IWeBS
Castlelack / Castlelact Lake

TITLE:	Survey Area for Hinterland Sites
PROJECT:	Barnadivane Wind Farm and Substation, Co. Cork
FIGURE NO:	5.5
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.
SCALE:	1:75000
REVISION:	0
DATE:	27/02/2023
PAGE SIZE:	A3

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Cork | Dublin | Carlow
www.fehilytimoney.ie

N W E S
0 2.5 5 10 Kilometers

Breeding Bird Surveys

For general breeding birds the method utilised was based on the existing British Trust for Ornithology (BTO) Breeding Bird Survey (BBS or CBS; Bibby et al, 2000). The study area for this survey comprised a total of two no. c. 1 km transects which were selected and centred on different habitats present within the subject sites. Birds were counted over two rounds over the summer seasons 2021 and 2022 to coincide with the early breeding season in April and the later part of the breeding season in June.

Surveyors recorded all birds seen or heard as they walked methodically along the transect routes. Birds were noted in four distance categories, measured at right angles to the transect line (within 25 m, between 25 m-100 m and over 100 m from the transect line) and those seen in flight only. Recording birds in distance bands gives a measure of bird detectability and allows relative population densities to be estimated if required (BTO, 2018).

Winter site walkovers

Over the winter seasons 2020/2021 and 2021/2022, general bird transect surveys were carried out at the same two transects as the breeding bird surveys in three rounds per season with one visit to each transect per round.

Surveyors recorded all birds seen or heard as they walked methodically along the transect routes. Birds were noted in four distance categories, measured at right angles to the transect line (within 25 m, between 25 m-100 m and over 100 m from the transect line) and those seen in flight only. Recording birds in distance bands gives a measure of bird detectability and allows relative population densities to be estimated if required (BTO, 2018). Table 5-10 details survey dates for breeding and non breeding transect visits.

See the Ornithology Report (Appendix 5.3) for mapping of transect routes.

Table 5-10: Breeding and Non-breeding season site walkover survey effort

Transect Visit Dates	
Breeding	**Non-breeding**
11/04/2021	01/12/2022
10/06/2021	11/12/20 and 21/12/20
24/04/2022	04/02/2021
11/06/2022	10/11/2021 and 02/11/2021
	19/01/2022 and 12/01/2022
	02/03/2022 and 21/03/2022

Breeding Wader Survey

Surveys to assess the presence of the breeding waders and woodcock species were conducted in between April and July in 2021 and 2022 with surveys conducted every month during this period. A number of methods were combined from published literature including Bibby et al, (2000), Gilbert et al, (1998), O'Brien & Wilson (2011) and SNH 2017 to estimate numbers of target species breeding within this envelope. This survey utilised transects walked through suitable habitat within 3 hours of dusk. A total of two no. ca. 1km transects were selected in the survey area. Count units were predefined for each target species and included in the method statement provided to surveyors.

5.2.5.5 Aquatic Ecology

The following section summarises the methodology of aquatic surveys carried out for the Proposed Wind Farm. The full report is included in Appendix 5-4.

Surveys to inform the aquatic ecology assessment were completed in 2022. The surveys included walkover surveys, fish stock assessment (electro-fishing), white-clawed crayfish survey, otter survey, eDNA analysis, biology water quality, macrophyte and aquatic bryophyte surveys, Annex I surveys and invasive species surveys.

Strict biosecurity measures were followed during all fieldwork, see Section 2.10 of Appendix 5-4(IFI, 2010).

Selection of Watercourses for Appraisal

All watercourses/water bodies that could be affected directly (i.e., within the site) or indirectly (i.e hydrologically connected to the site) were considered as part of the current appraisal. Aquatic surveys were completed on all watercourses draining the Proposed Development.

A total of 11 sites were surveyed. The purpose of these surveys is to provide baseline information and can also be used for monitoring during the construction of the Proposed Development. The location of the sites is given in Table 5-11 and shown in Figure 5-6. Surveys were completed at each site to evaluate the of biological water quality, fisheries value, aquatic habitat value, and presence of rare/protected/notable aquatic species at each site. Aquatic survey sites were present on the Cummer River (EPA code: 19C02), Clearagh Stream (19C64), River Bride [Cork] (19B04), Moneygaff East Stream (19F09) and Barnadivane Stream (19B22). The n=11 aquatic survey sites were located within the Lee[Cork]_SC_030 and Lee[Cork]_SC_050 river sub-catchments.

All watercourses selected for survey were visited during the August 2022. All watercourses which would be affected by proposed crossings were assessed.

Table 5-11: Location of the aquatic ecology sites assessed for the Proposed Development

Site No.	Catchment	Sub-catchment	Watercourse Name	EPA Code	X (ITM)	Y (ITM)
A1	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_030	Cummer River	19C02	534472	564764
A2	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_030	Clearagh Stream	19C64	535506	564531
A3	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_030	Cummer River	19C02	535311	565896
A4	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_030	Cummer River	19C02	535346	567245
A5*	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_030	Cummer River	19C02	538941	567084
B1	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_050	River Bride [Cork]	19B04	533173	562259
B2	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_050	Moneygaff East Stream	19F09	533455	562476
B3	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_050	Barnadivane Stream	19B22	533994	562217

Site No.	Catchment	Sub-catchment	Watercourse Name	EPA Code	X (ITM)	Y (ITM)
B4	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_050	River Bride [Cork]	19B04	534607	561454
B5	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_050	River Bride [Cork]	19B04	538342	562962
B6*	Lee, Cork Harbour and Youghal Bay	Lee[Cork]_SC_050	River Bride [Cork]	19B04	541813	564722

* eDNA sampling sites, most downstream sampling point for each watercourse (Cummer and Bride), and therefore cover all of those sites upstream

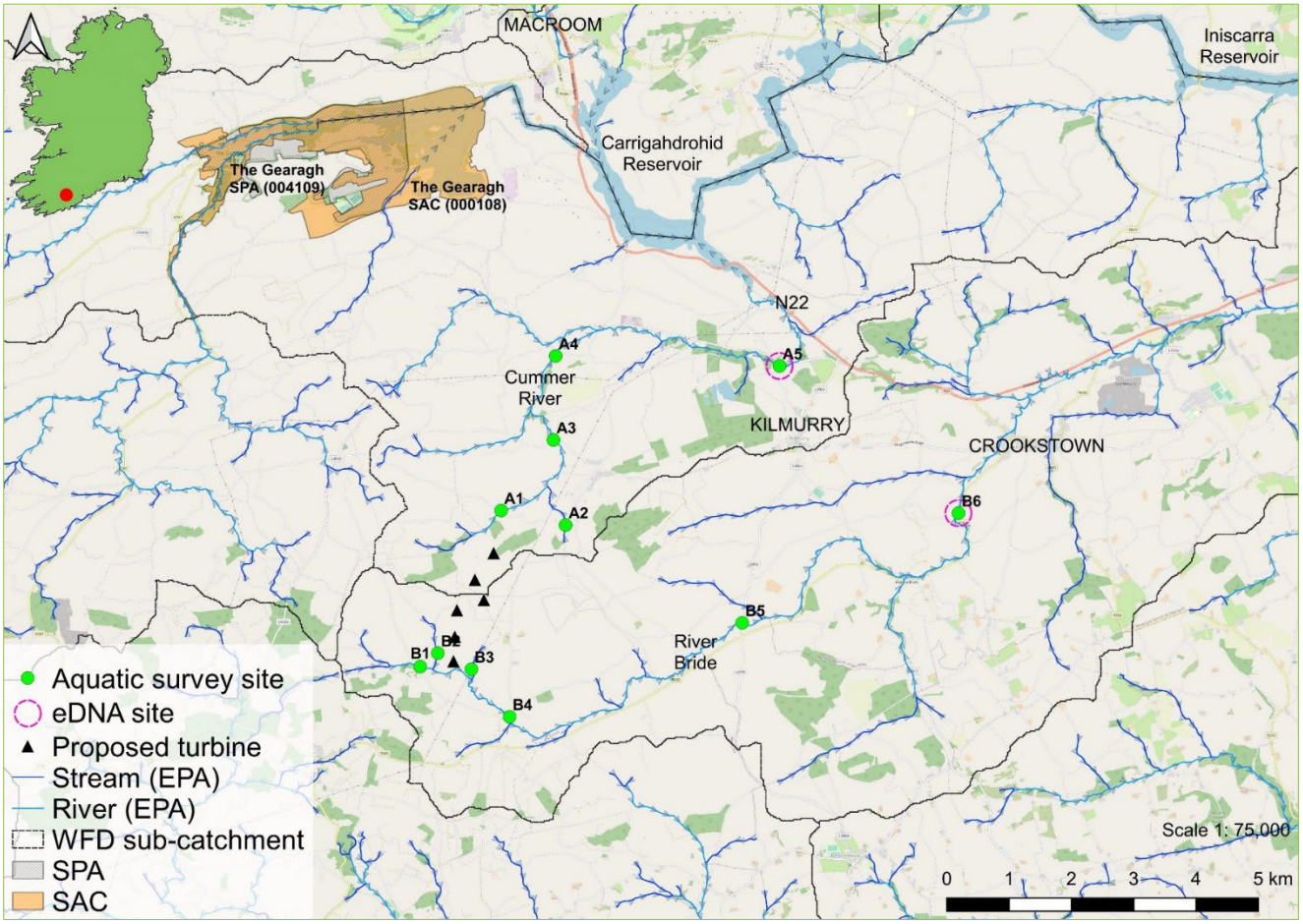


Figure 5-6: Aquatic Ecology Survey Sites

Aquatic Habitat Surveys

Habitat Surveys were carried out on the entire study area. Survey Site locations are illustrated in Figure 5-6. The survey was completed with reference to the Environment Agency's "River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003" (EA, 2003) and "A Guide to Habitats in Ireland" (Fossitt, 2000). River habitat types as well as flora and vegetation were characterised at each survey site.

All sites were assessed in terms of:

- Physical watercourse/waterbody characteristics (i.e. width, depth etc.) including associated evidence of historical drainage;
- Substrate type, listing substrate fractions in order of dominance (i.e. bedrock, boulder, cobble, gravel, sand, silt etc.);
- Flow type by proportion of riffle, glide and pool in the sampling area;
- An appraisal of the macrophyte and aquatic bryophyte community at each site;
- Riparian vegetation composition.

Fish stock assessment (electro-fishing)

A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish sites. following notification to Inland Fisheries Ireland, under the conditions of a Department of the Environment, Climate and Communications (DECC) licence. Electro-fishing was undertaken at all riverine survey sites, n=11. Furthermore, a fisheries habitat appraisal of the aquatic survey sites (Figure 5-6) was undertaken to establish their importance for salmonid, lamprey, European eel and other fish species. The baseline assessment also considered the quality of spawning, nursery and holding habitat for salmonids and lamprey within the vicinity of the survey sites.

White-clawed crayfish survey

White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken at the aquatic survey sites in August 2022 under a National Parks and Wildlife (NPWS) open licence (no. C31/2022), as prescribed by Sections 9, 23 and 34 of the Wildlife Act (1976-2021), to capture and release crayfish to their site of capture, under condition no. 6 of the licence. As per Inland Fisheries Ireland recommendations, the crayfish sampling started at the uppermost site(s) of the development catchment/sub-catchments in the survey area to minimise the risk of transfer invasive propagules (including crayfish plague) in an upstream direction.

Hand-searching of instream refugia and sweep netting was undertaken according to Reynolds et al. (2010). An appraisal of white-clawed crayfish habitat at each site was conducted based on physical channel attributes, water chemistry and incidental records in mustelid spraint. Additionally, a desktop review of crayfish records within the wider Proposed Development survey area was completed, NPWS records obtained by request (received 15/11/2022).

Otter Survey

The presence of otter (*Lutra lutra*) at each aquatic survey site was determined through the recording of otter signs within 150m of each survey site. Notes on the age and location (ITM coordinates) were made for each otter sign recorded, in addition to the quantity and visible constituents of spraint (i.e. remains of fish, crustaceans, molluscs etc.).

eDNA analysis

To validate habitat suitability appraisal and to detect potentially cryptically low populations of freshwater pearl mussel within the study area, n=2 composite water samples were collected from the River Bride and Cummer River and analysed for freshwater pearl mussel eDNA given the absence of known records for pearl mussel in these catchments. This would validate presence or absence given that no data was available on the status of pearl mussel in these rivers. The water samples were collected at sites strategically chosen to maximise longitudinal (instream) coverage within the catchment (i.e. facilitating a greater likelihood of species detection).

In accordance with best practice, a composite (500ml) water sample was collected from the sampling point, maximising the geographic spread at the site (20 x 25ml samples at each site), thus increasing the chance of detecting the target species' DNA. The composite sample was filtered on site using a sterile proprietary eDNA sampling kit. The fixed sample was stored at room temperature and sent to the laboratory for analysis with 48 hours of collection. A total of n=12 qPCR replicates were analysed for the site. Given the high sensitivity of eDNA analysis, a single positive qPCR replicate is considered as proof of the species' presence (termed qPCR No Threshold, or qPCR NT). Whilst an eDNA approach is not currently quantitative, the detection of the target species' DNA indicates the presence of the species at and or upstream of the sampling point.

Biological Water Quality - Aquatic Macroinvertebrate Surveys

The riverine survey sites (n=11) were assessed for biological water quality through Q-sampling in. All samples were taken with a standard kick sampling hand net (250mm width, 500µm mesh size) from areas of riffle/glide utilising a 2-minute kick sample, as per Environmental Protection Authority (EPA) methodology (Feeley et al., 2020). Large cobble was also washed at each site for 1-minute (where present) to collect attached macro-invertebrates (as per Feeley et al., 2020). Samples were elutriated and fixed in 70% ethanol for subsequent laboratory identification. Samples were converted to Q-ratings as per Toner et al. (2005) and assigned to WFD status classes. Any rare invertebrate species were identified from the NPWS Red List publications for beetles (Foster et al., 2009), mayflies (Kelly-Quinn & Regan, 2012), stoneflies (Feeley et al., 2020) and other relevant taxa (i.e. Byrne et al., 2009; Nelson et al., 2011).

Macroinvertebrates provide an estimation of the current health of the waterbody and the type of substrate. They are divided into 5 categories (A, B, C, D, E – "A" being the most sensitive and "E" being the most tolerant). A desk study was completed and used resources such as the NBDC species maps to identify if any rare/protected species have been recorded in the area. All samples of invertebrates were combined for each site and live sorted on the riverbank and fixed in ethanol for subsequent laboratory identification. The relative abundance of macroinvertebrates was recorded on-site at each site. Further identification was undertaken in the laboratory using a stereoscope at the water status was determined, see Table 5-12:

Table 5-12: Relationship between Q-value and ecological status for macroinvertebrates

Q Value*	WFD Status	Pollution	Condition**
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

* These values are based primarily on the relative proportions of pollution sensitive to tolerant macroinvertebrates (the young stages of insects primarily but also snails, worms, shrimps etc.) resident at a river site.

** "Condition" refers to the likelihood of interference with beneficial or potential beneficial uses]

Macrophytes and Aquatic Bryophytes Surveys

Surveys of the macrophyte and aquatic bryophyte community were conducted by instream wading at each of the n=11 riverine sites, with specimens collected (by hand, sweep nets or via grapnel) for on-site identification. An assessment of the aquatic vegetation community helped to identify any rare macrophyte species (Flora Protection Order 2022 or Wyse-Jackson et al., 2016), invasive species, or habitats corresponding to the Annex I habitats, e.g., 'Water courses of plain to montane levels, with submerged or floating vegetation of the *Ranunculion fluitantis* and *Callitricho-Batrachion* (low water level during summer) or aquatic mosses [3260]' (more commonly referred to as 'floating river vegetation').

Freshwater Pearl Mussel Surveys

Prior to fieldwork for freshwater pearl mussel (FPM) being undertaken, satellite images were viewed to assess the terrain and bankside cover for the habitat most likely to support FPM.

Observations of other species and groups were recorded during ecological walkovers, and any incidental observations of other species made during surveys were recorded. As FPM require high dissolved oxygen levels and virtually silt-free conditions for the maintenance of a viable population, recent biological water quality results, available on the EPA website (https://epawebapp.epa.ie/qvalue/webusers/) were viewed. Previous records of FPM in the Rivers Cummer and Bride were sought via a Protected Species Data Request to the National Parks and Wildlife Service (received 15/11/2022).Field surveys were undertaken on 29th September 2022. Based on satellite imagery, past water quality records and accessibility, sections of the Cummer down to Warrenscourt Forest Park and sections of the Bride down to the tributary confluence at the eastern corner of Knocknaneirk townland were surveyed in detail (see Appendix 5.5 for survey locations). Grid reference of photographs were recorded using a hand-held GPS device and photographs were taken with a digital camera. The habitat quality for freshwater pearl mussels was visually assessed, based on the criteria outlined by Hastie et al. (2000) and by Skinner et al. (2003). Substrate type, degree of siltation, type of bankside vegetation and degree of shading were noted, as these factors influence the suitability of the habitat for FPM. As FPM are dependent on salmonids, particularly salmon for their life cycle, the habitat quality for salmonids was assessed, based on the criteria outlined by Kennedy (1984), Crisp (2000), Hendry et al. (2003) and by Bardonnet and Baglinière (2000) for the physical instream requirements of these species for spawning, nursery and adult habitat. Direct visual observations of fish in the stream were also recorded. Licensed surveys (Licence No C56/2022) were carried out in accordance with the standard methodology (Anon 2004), by viewing the riverbed with a bathyscope while wading.

5.2.5.6 Other species

Observations of other species and groups were recorded during ecological walkovers, and any incidental observations of other species made during surveys were recorded.

5.2.6 Ecological Resource Evaluation

The value of the ecological resources/receptors at the subject site was evaluated using the ecological evaluation guidance given in the NRA guidance on assessment of ecological impacts of National Road Schemes (NRA, 2009a). This guidance provides ratings for resources based primarily on geographic context and allows for resources at International, National, County and Local (higher and lower value) levels. The CIEEM guidance (CIEEM, 2019) refer to key ecological receptors as those ecological features which are evaluated as Local Importance or higher and are likely to be affected significantly by the Proposed Development. The features that were evaluated as being of Local Importance (and higher in this study were selected as key ecological features and the effect to be significance on each of these features was assessed. Key ecological receptors (for assessment) are those deemed to be above the Site Importance evaluation. Evaluation criteria are outlined below in Table 5-13.

Table 5-13: Ecological resource evaluation criteria

NRA (2009a)	CIEEM (2018)	Defining Criteria
International Importance	International and European	• 'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA), candidate Special Area of Conservation (cSAC) or proposed Special Protection Area (pSPA). • Sites that fulfil the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network. • Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive.[5] • Resident or regularly occurring populations (assessed to be important at the national level)[6] of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive. • Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). • World Heritage Site (Convention for the Protection of World Cultural and Natural Heritage, 1972). • Biosphere Reserve (UNESCO Man and The Biosphere Programme). • Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). • Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). • Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. • Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).[7]
National Importance	National	• Site designated or proposed as a Natural Heritage Area (NHA). • Statutory Nature Reserve. • Refuge for Fauna and Flora protected under the Wildlife Acts. • National Park. • Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA) • Statutory Nature Reserve

[5] See Articles 3 and 10 of the Habitats Directive

[6] t is suggested that, in general, 1% of the national population of such species qualifies as an internationally important population. However, a smaller population may qualify as internationally important where the population forms a critical part of a wider population or the species is at a critical phase of its life cycle.

[7] Note that such waters are designated based on these waters' capabilities of supporting salmon (*Salmo salar*), trout (*Salmo trutta*), char (*Salvelinus*) and whitefish (*Coregonus*).

NRA (2009a)	CIEEM (2018)	Defining Criteria
		• 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)[8] of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. • Site containing 'viable areas'[9] of the habitat types listed in Annex I of the Habitats Directive.
County Importance	County (or other local authority-wide area)	• Area of Special Amenity[10]. • Area subject to a Tree Preservation Order. • Area of High Amenity, or equivalent, designated under the County Development Plan. • Resident or regularly occurring populations (assessed to be important at the County level)[11] of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. • Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. • County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP[12], if this has been prepared. • Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. • Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
N/A	River Basin District	• Hydrological Catchment Area • Connectivity to downstream waterbodies

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

[9] 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 (for example, as a result of climatic variation).

[10] It should be noted that whilst areas such as Areas of Special Amenity, areas subject to a Tree Preservation Order and Areas of High Amenity are often designated on the basis of their ecological value, they may also be designated for other reasons, such as their amenity or recreational value. Therefore, it should not be automatically assumed that such sites are of County importance from an ecological perspective.

[11] 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.

[12] BAP: Biodiversity Action Plan.

NRA (2009a)	CIEEM (2018)	Defining Criteria
N/A	Estuarine system/ coastal cell	• Estuary of river system or shoreline
Local Importance (Higher Value)	Local	• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared • Resident or regularly occurring populations (assessed to be important at the Local level)[13] of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list • Sites containing semi natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower Value)	Site	• Sites containing small areas of semi natural habitat that are of some local importance for wildlife • Sites or features containing non-native species that are of some importance in maintaining habitat links.

5.2.6.1 Avifauna Receptor Evaluation

Avifauna resources are to be initially evaluated as to whether they constitute key receptors for the assessment following NRA guidance as outlined in Table 5-13 previously. For the purposes of impact assessment, a receptor 'importance value' or sensitivity, following published guidance as in Percival (2007), SNH (2014, 2017) and literature review of published information on birds and wind farms (Pearce-Higgins J. L., 2009; Pearce-Higgins J. S., 2012; Drewitt A. L., 2006; Drewitt and Langston, 2008 and Masden, 2009) is calculated. Where provided receptor values from Percival (2007) are below those recommended in guidance within the Irish context (NRA, 2009a); then the evaluation has been increased in line with the recommended Irish evaluation as a precautionary principle. Table 5-14 illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors.

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

Table 5-14: Avifauna receptor evaluation criteria

Sensitivity of Key Receptor	Percival 2007 Criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
Very High	Species is cited interest of SPA.	International Importance.	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive	Species is cited interest of SPA.
High	Species present in Internationally important numbers.	National Importance	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list	Species present in Internationally important numbers.
Medium	Other non-cited species which contribute to integrity of SPA.	County Importance	Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive
Low	Ecologically sensitive species (<300 breeding pairs in UK) and less common birds of prey.	Local Importance (High Value)	County important populations of species.	Other non-cited species which contribute to integrity of SPA.
Negligible	Species listed on Annex 1 of the EU Birds Directive.	Local Importance (Low Value)	Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.	Ecologically sensitive species (<300 breeding pairs nationally) and less common birds of prey.

5.2.6.2 Aquatic Receptor Evaluation

The evaluation of impact significance is a combined function of the value of the affected feature (its ecological importance), the type of impact and the magnitude of the impact. It is therefore necessary to identify the value of ecological features within the study area in order to evaluate the significance and magnitude of possible impacts. Ecological features are assessed on a scale ranging from international-national-county-local. The local scale is approximately equivalent to one 10km square but can be operationally defined to reflect the character of the area of interest. This The evaluation of aquatic ecological receptors contained within this report uses the geographic scale and criteria defined in the 'Guidelines for Assessment of Ecological Impacts of National Road Schemes' (NRA, 2009a).

5.2.7 Assessing Effect Significance

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

Table 5-15 to Table 5-20outline the EPA evaluation criteria utilised in this appraisal of the Environmental Factor, Biodiversity. These criteria are included in the Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, 2022.

Table 5-15: Probability of effects (EPA, 2022)

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

Table 5-16: Quality of Effects (EPA, 2022)

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

Table 5-17: Significance of Effects (EPA, 2022)

Significance of Effect	Description
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences

Significance of Effect	Description
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 5-18: Duration of Effects (EPA, 2022)

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

Table 5-19: Types of Effects (EPA, 2022)

Type of Effect	Description
Effect/Impact	A change resulting from the implementation of a project
Likely Effects	The effects that are specifically predicted to take place – based on an understanding of the interaction of the Proposed Project and the receiving environment.
Indirect Effects (a.k.a. secondary effects)	Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway
Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
'Do Nothing' Effects	The environment as it would be in the future should the subject project not be carried out.
'Worst Case' Effects	The effects arising from a project in the case where mitigation measures substantially fail
Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.

Type of Effect	Description
Reversible Effects	Effects that can be undone, for example through remediation or restoration
Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect
Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SOx and NOx to produce smog).

Table 5-20: Definition of terms - source, pathway, receptor (EPA, 2022)

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

Assessment of Effect Type and Magnitude

Assessment of effects takes into account construction, operational and decommissioning effects with reference to the potential for direct, indirect and cumulative effects. The assessment also takes account of any residual effects that may persist following the implementation of any mitigation or best practice design.

The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects takes into account the magnitude of effects affecting populations.

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

The criteria outlined in Table 5-21 below has been developed by Percival (2003) to determine the magnitude of potential effects on a species. Methodology for assessing sites outside of European Sites (i.e., SPAs) state 'the test of significance of an impact will be whether the wind farm impact is causing a significant change to the population its range or distribution' (Percival, 2003). It is important to consider availability of alternative habitat elsewhere during this assessment (Percival, 2003).

Table 5-21: Determination of Magnitude Effects (Percival, 2003)

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

The significance of potential effects is assessed by cross tabulating the magnitude of effects and bird sensitivity to predict significance of each potential effect. Population status, distribution and trends of potentially affected species such as migratory winter birds should be taken into consideration when undertaking the assessment. Significant ratings are interpreted as follows, **very low** and **low** should not normally be of concern however normal design care should be undertaken to minimise effects, **medium** represents a potentially significant effect that requires careful individual assessment, while **very high** and **high** represents a highly significant effect on bird populations. A significance matrix table, combining magnitude and sensitivity to assess overall significance is presented in Table 5-23.

Table 5-22: Significance matric: combining magnitude and sensitivity to assess significance (Percival, 2003)

Significance		Sensitivity			
		Very High	High	Medium	Low
Magnitude	**Very High**	Very High	Very High	High	Medium
	High	Very High	Very High	Medium	Low
	Medium	Very High	High	Low	Very Low
	Low	Medium	Low	Low	Very Low
	Negligible	Low	Very Low	Very Low	Very Low

5.3 Description of Existing Environment

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

5.3.1 Designated Sites

Defining the Zone of Influence

The potential zone of influence (ZoI) for the Proposed Development is defined by an initial search area of 15 km which was selected on the basis of national guidance which relates to plans (DEHLG, 2010) (adopted here on a precautionary basis to provide a wide initial search radius), in addition to any sites further afield with potential ecological links (i.e., hydrological links or mobile species). The ZoI is then refined further based on the potential impacts associated with the Proposed Development and the conservation interests of individual sites (source-pathway-receptor/SPR analysis). All sites identified in the initial search are detailed here.

Sites of International Importance

Candidate Special Areas of Conservation (SACs)

Candidate Special Areas of Conservation (SACs) are protected under the European Union (EU) 'Habitats Directive' (92/43/EEC), as implemented in Ireland by S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011.

Two SACs (the Gearagh SAC and the Bandon River SAC) were identified within 15km of the Proposed Development., However neither of these two sites are hydrologically connected to the Proposed Development, therefore both are not deemed to be within the potential Zone of Influence (ZoI) of the Proposed Development. See Table 5-24 for details.

The full NPWS site synopses for designated areas are available on www.npws.ie.

Special Protection Areas (SPAs)

Special Protection Areas (SPAs) are designated under the EU Birds Directive (2009/147/EC) ('The Birds Directive').

Two SPAs (the Gearagh SPA and the Mullaghanish to Musheramore Mountains SPA) were identified within 15km of the Proposed Development, however only the Gearagh SPA was deemed to be within the potential Zone of Influence (ZoI) of the Proposed Development study area. See Table 5-23 for details.

The full NPWS site synopses for designated areas are available on www.npws.ie.

An Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) have been completed in order to appraise the likely significant effects of the Proposed Development either alone or in combination with other plans or projects on European Sites (cSACs and SPAs); these accompany this planning application.

Sites of National Importance

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

While the Wildlife (Amendment) Act 2000 has been passed into law, pNHAs will not have legal protection until the consultative process with landowners has been completed; this process is currently ongoing. However, for the purposes of this assessment they have been considered as fully designated sites.

Nine pNHAs were identified within 15km of the Proposed Development, however only two of these, the Gearagh pNHA and Lough GAl pNHA, were deemed to be within the potential ZoI of the Proposed Development (Table 5-25). No NHAs or pNHAs beyond the initial search radius of 15 km were identified as falling within the potential ZoI.

Within these sites, one pNHA overlaps two European sites (The Gearagh SAC and The Gearagh SPA). This site is not hydrologically connected to the Proposed Development but is within the foraging range for mallard and coot. The impacts of the Proposed Development are considered in the NIS, Appendix 5.6, which concluded: 'The Proposed Development will not have any adverse effect on the integrity the Gearagh SPA in light of the site's conservation objectives and status.'

Figure 5-7 and Figure 5-8 show the location of the designated sites in relation to the proposed turbine locations. The closest European site to the Proposed Development is the Gearagh SAC (located c. 5.9 km from the nearest proposed turbine); see Table 5-24 for details. The closest (national) designated site to the Proposed Development is Boylegrove Wood pNHA (located c. 6.1 km from the nearest proposed turbine). See Table 5-24 for more information.

Table 5-23: Summary of European Sites within the potential ZoI of the Proposed Development

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	In Potential ZoI?
The Gearagh SAC	000108	• Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation [3270] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • Otter (*Lutra lutra*) [1355]	5.9	No - not hydrologically connected, within same catchment but the Proposed Development is connected to the River Lee via a separate tributary that joins the Lee downstream of the Gearagh.
The Gearagh SPA	004109	• Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Mallard (*Anas platyrhynchos*) [A053] • Coot (*Fulica atra*) [A125] • Wetland and Waterbirds [A999]	6	Yes - in the core foraging range for SCIs[14]
Bandon River SAC	002171	• Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]	10.1	No - not hydrologically connected

[14] Assessing Connectivity with Special Protection Areas (SPAs) (SNH 2016) https://www.nature.scot/doc/assessing-connectivity-special-protection-areas (Accessed 03/02/2023)

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	In Potential ZoI?
		• Freshwater Pearl Mussel (*Margaritifera margaritifera*) [1029] • Brook Lamprey (*Lampetra planeri*) [1096]		
Mullaghanish to Musheramore Mountains SPA	004162	Hen Harrier (*Circus cyaneus*) [A082]	13.9	No - outside Hen Harrier max range - 10km[15]

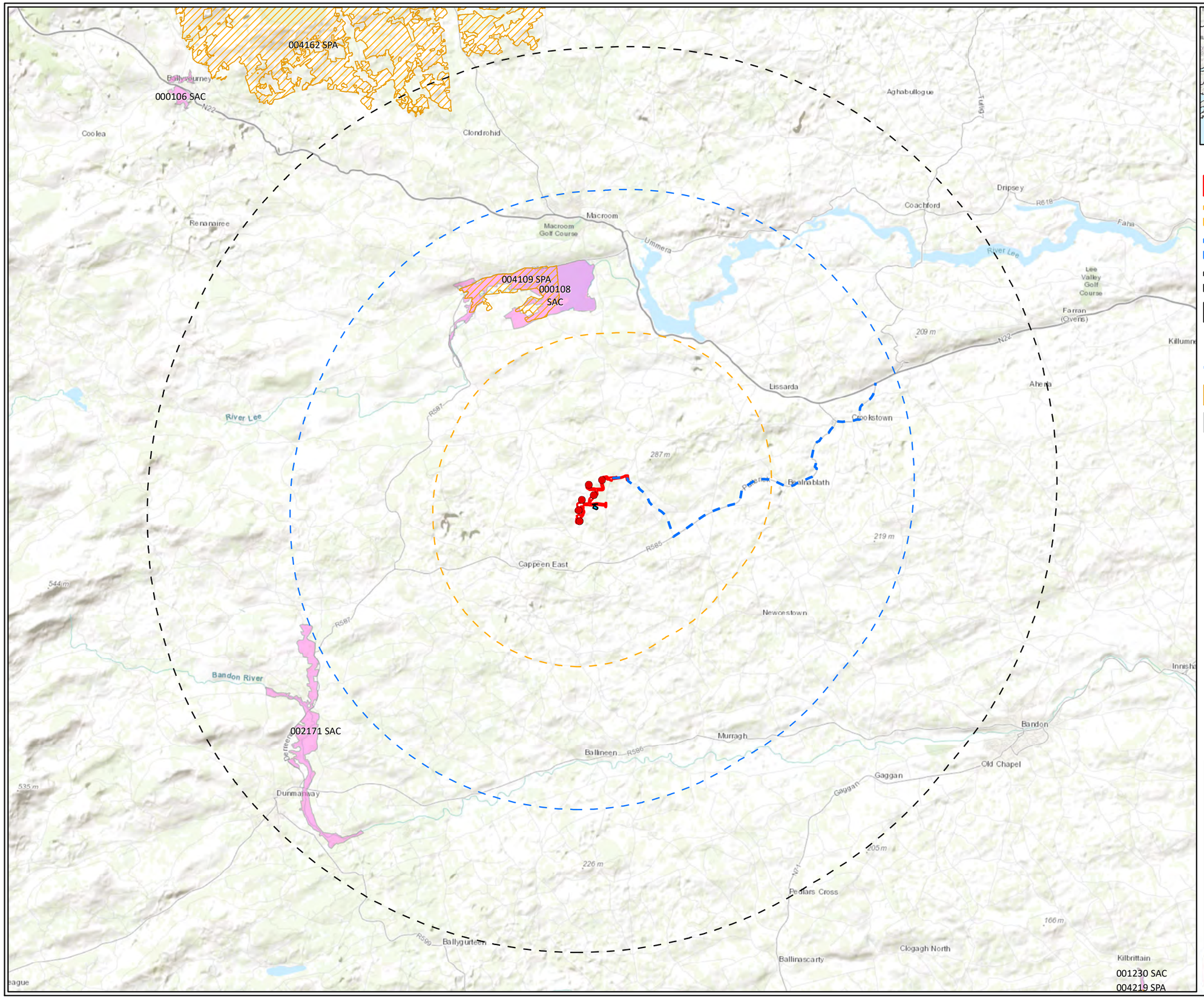
[15] Assessing Connectivity with Special Protection Areas (SPAs) (SNH 2016) https://www.nature.scot/doc/assessing-connectivity-special-protection-areas (Accessed 03/02/2023)

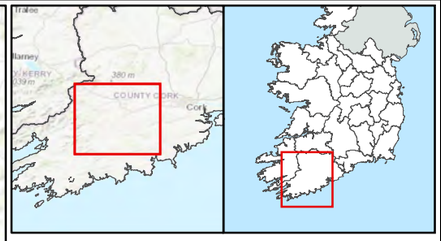
Table 5-24: Summary of (p)NHAs and NHAs within the potential ZoI of the Proposed Development

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	In Potential ZoI?
Boylegrove Wood pNHA	001854	• Sessile Oak woodland	5.8	No - not hydrologically connected to the terrestrial habitats
The Gearagh pNHA	000108	• Sessile Oak woodland • Water courses of plain to montane levels • Rivers with muddy banks • Alluvial forests • Otter • Wetland and waterbirds	6.1	Yes - not hydrologically connected, within same catchment but the Proposed Development is connected to the River Lee via a separate tributary that joins the Lee downstream of the Gearagh. However, within the core foraging range for mallard and coot.
Lough Allua pNHA	001065	• River and lake • Heath communities • Acid woodland	10.2	No - not hydrologically connected
Killaneer House Glen pNHA	001062	• Hazel/ ash wood • Oak wood	6.4	No - not hydrologically connected to the terrestrial habitats.
Prohus Wood pNHA	001248	• Birch, oak and holly woodland	12.3	No - not hydrologically connected to the terrestrial habitats.
Bandon Valley South Of Dunmanway pNHA	001035	• Water courses of plain to montane level • Alluvial forests • Freshwater pearl mussel	13.3	No - not hydrologically connected to the aquatic

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	In Potential ZoI?
		• Brook lamprey		habitats or connectivity for mobile aquatic species.
Lough Gal pNHA	001067	• Lake and fen • Waterfalls • Marsh • Wildfowl, ducks, geese and swans	12	Yes - not hydrologically connected to the aquatic habitats. However, within the potential core foraging range of wildfowl, ducks, geese and swans.
Bandon Valley West Of Bandon pNHA	001034	• River valley • Oak woodland • Wintering waders and duck • Otter	13.6	No - not hydrologically connected to the aquatic habitats or connectivity for mobile aquatic species. Outside core foraging range of wintering waders and duck.
Glashgarriff River pNHA	001055	• Wooded river valley • Waterfalls • Killarney fern • Otter • Badger	14.1	No - not hydrologically connected to the aquatic habitats. Due to separation distance, populations of mobile species within the pNHA are not likely to be associated with the Proposed Development.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-7_European Sites within ZOI_A3.mxd





Legend

- Development Planning Boundary
- Development Planning Boundary - 5km Buffer Zone
- Development Planning Boundary - 10km Buffer Zone
- Development Planning Boundary - 15km Buffer Zone
- Proposed Substation
- Proposed Turbine Layout
- Turbine Delivery Route
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)

N W E S

0 2.5 5 10 Kilometers

TITLE: European Sites within the Zone of Influence (ZoI)			
PROJECT: Barnadivane Wind Farm, Co.Cork			
FIGURE NO:	5.7		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:130000	**REVISION:**	0
DATE:	22/02/2023	**PAGE SIZE:**	A3

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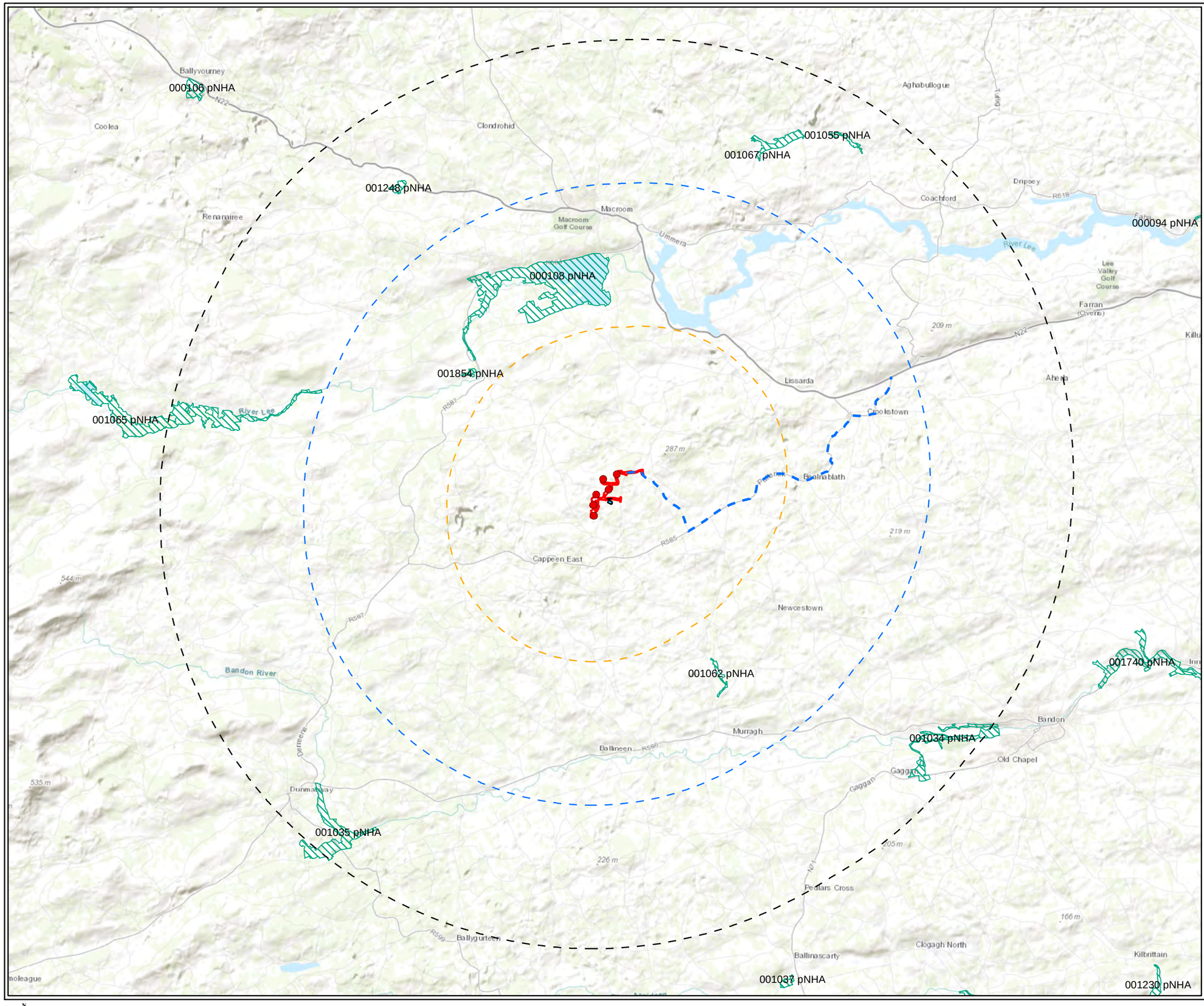
Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-8_NHA's within ZOI_A3.mxd



TITLE:
NHAs and pNHAs within the Zone of Influence (ZoI)

PROJECT:
Barnadivane Wind Farm, Co.Cork

FIGURE NO:	5.8		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:130000	**REVISION:**	0
DATE:	22/02/2023	**PAGE SIZE:**	A3

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Other Designated Sites

Nature Reserves

No nature reserves are present within 15km of the Proposed Development. The closest Nature Reserve is St. Gobnet's Wood, c. 20km northwest of the Proposed Development.

RAMSAR Sites

The only RAMSAR sites present within 15km of the Proposed Development is The Gearagh, c. 6km = northwest of the Proposed Development. This overlaps the Gearagh SAC and the Gearagh SPA.

Other Sites of Interest

A number of internationally, nationally or county importance wetland sites were identified in the area according to the Wetlands of Ireland dataset, namely Dunmarklun Wet Woodland (c. 2km north), Teerelton Pond South and Teerelton Pond North (c. 4km northwest), Boylegrove Wood pNHA (c. 6km northwest), and Dromkeen Bog NHA - The Gearagh SAC / SPA (c. 6km north).

Of these sites, the Dunmarklun Wet Woodland is downstream of the Proposed Development site., via the Cummer 19 River.

5.3.2 Rare and Protected Flora

The Proposed Development is located within Ordnance Survey National 10 km Grid Square W36. The 10 km grid square was searched for records of plant species through the National Biodiversity Data Centre (NBDC) website (most recent search 03rd February 2023).

This list was then compared to the lists of species protected under the Flora (Protection) Order 2022, the Ireland Red List No. 10 Vascular Plants (Wyse et al., 2016) and the Ireland Red List No. 8 Bryophytes (Lockhart et al., 2012). In addition, data on rare/protected species recorded in 10km grid squares within a 10km radius of the Proposed Development site was obtained from NPWS (received 15/11/2022).

There are two records of rare or protected plant species found within the 10km squares W36 which overlaps the Proposed Development, listed in Table 5-25. There are no suitable habitats for the protected Mudwort (*Limosella aquatica*) onsite, which is found in small pools, especially on limestone, or on wet mud on the margins of lakes and is very local. Brown beak-sedge (*Rhynchospora fusca*) a near threatened species has been recorded within the W36 gird square, there are no suitable habitats onsite, with this species found on bogs, and margins of rivers and lakes.

The NPWS FPO Bryophyte Sites map viewer was also consulted. There are no FPO Bryophyte Sites at or near the proposed site (closest is Mount Gunnery, Co. Cork, c. 13 km southwest).

No flora listed on the FPO or as threatened, vulnerable or endangered on the Irish Red List were recorded during site walkovers.

Table 5-25: Historic records of rare and protected flora within the 10km Grid Squares W36 and (NBDC data) and data supplied by NPWS for grid squares within 10km of the Proposed Development site

Species	Location of Records	Year of Last Record	Survey/Dataset	Conservation Status	Habitat[16]	Result of surveys for Barnadivane
Mudwort (*Limosella aquatica*)	Gearagh (6km from Proposed Development)	2018	Vascular plants: Online Atlas of Vascular Plants 2012 Onwards	Flora (Protection) Order, 2022; vulnerable	Limestone, or on wet mud on the margins of lakes.	Not observed
Brown beak-sedge (*Rhynchospora fusca*)	Gearagh (6km from Proposed Development)	1999	Miscellaneous Rare Plant Records Sept 2013	Near threatened	Wet peaty swamps and waterbody edges	Not observed

[16] Parnell, J: Curtis, T; and Cullen, E. (2012): Webb's an Irish Flora. Hardback, 8th Edn (March 2012), Trinity College Dublin

5.3.3 Invasive Non-native Flora

The invasive species listed in Table 5-26 have been recorded within the 10km grid squares W36 overlapping the Proposed Development, through the National Biodiversity Data Centre (NBDC) website (most recent search 03rd February 2022. A total of six invasive plant species have been historically recorded in the 10km grid square, of which three are listed in Schedule III under Regulations 49 and 50 of the EC (Birds and Natural Habitats) Regulations 2011, which makes it an offence to cause the spread of plant species listed on the Schedule. Only one invasive species was found in the 2km grid squares overlapping the Proposed Development, a Schedule III, high impact species - Japanese knotweed (*Fallopia japonica*).

Table 5-26: Invasive Species within 10km and 2km grid squares overlapping the porposed development

Species	2km	10km	Invasive Impact[17]	Legal Status	Recorded in Study Area
Giant hogweed (*Heracleum mantegazzianum*)	-	W36	High risk	Schedule III	No
Japanese knotweed (*Fallopia japonica*)	W36G	W36	High risk	Schedule III	No
Nuttall's Waterweed (*Elodea nuttallii*)	-	W36	High risk	Schedule III	No
Sycamore (*Acer pseudoplatanus*)	-	W36	Medium	-	No

Invasive species recorded within the study area of the Proposed Development

Himalayan knotweed *Persicaria wallichii*, a Third Schedule medium impact invasive alien plant species, was recorded along the edge of the unnamed local road within the site at the north-eastern boundary near the entrance to farm buildings. Cherry laurel *Prunus laurocerasus* and Sycamore *Acer pseudoplatanus* were also recorded at this location.

Sitka spruce *Picea sitchensis* is present in treelines along farm tracks and field boundaries near T1 and T3 as well as small blocks of conifer plantation near T1.

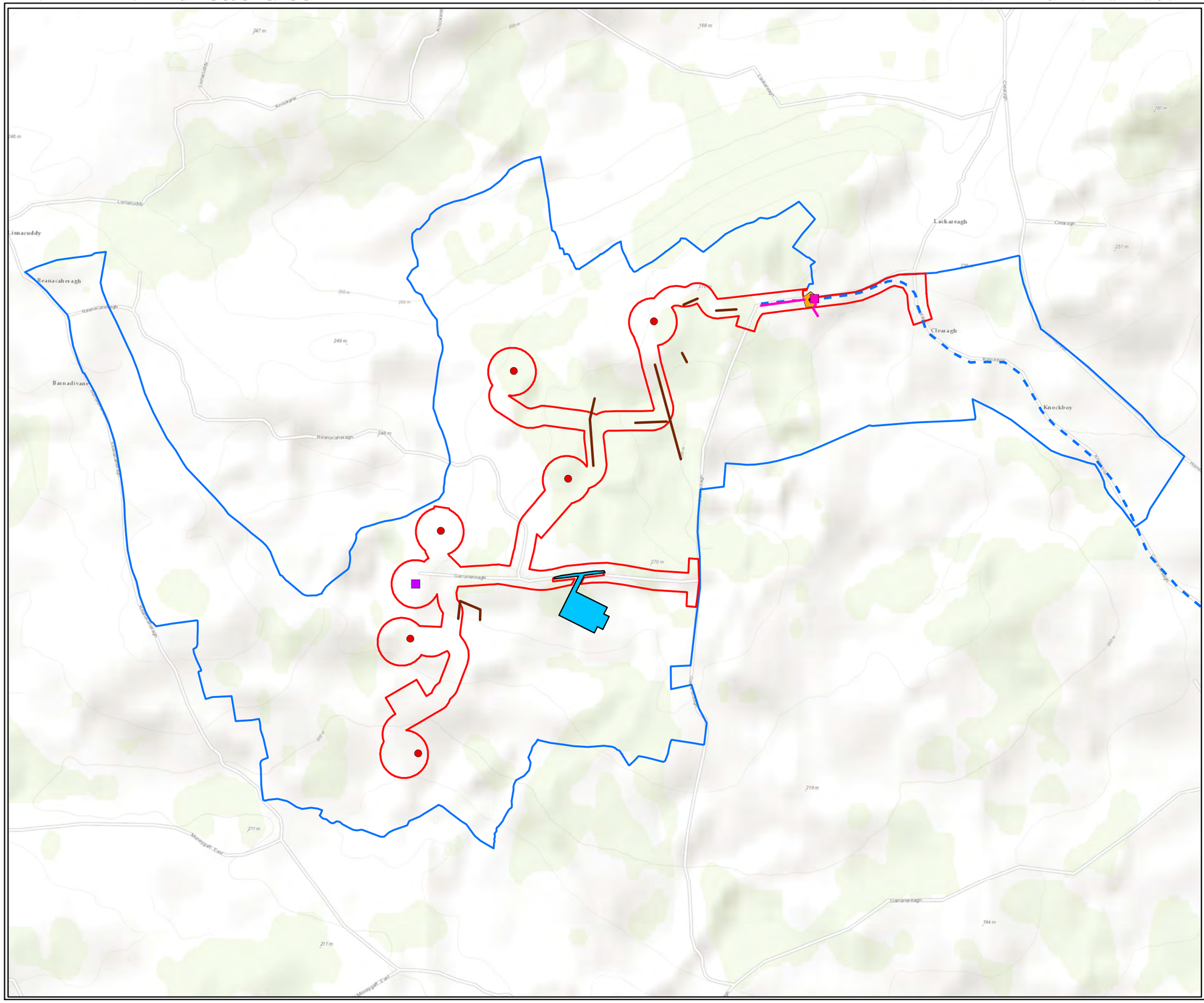
Fuchsia magellanica and New Zealand holly *Olearia macrodonta* are also present in the hedgerow adjacent to T3 (See Figure 5-9).

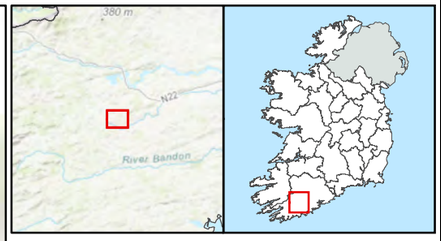
[17] From Nation Biodiversity Data Centre https://species.biodiversityireland.ie/index.php Accessed 03/02/2023

Table 5-27: Invasive & non-native species at the Proposed Development

Species	Invasive Impact	Location
Himalayan knotweed (*Persicaria wallichii*)	Medium - Schedule III	Along unnamed local road to the northeast of the site
Cherry Laurel (*Prunus laurocerasus*)	High	Along unnamed local road to the northeast of the site
Sycamore (*Acer pseudoplatanus*)	Medium	Along unnamed local road to the northeast of the site
Sitka spruce (*Picea sitchensis*)	Low	In tree lines and forestry blocks near T1 and T3
Fuchsia (*Fuchsia magellanica*)	Not assessed	In tree line near T3
New Zealand holly (*Olearia macrodonta*)	Not assessed	In tree line near T3

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-9_Invasive_Species_Site_A3.mxd





Legend

- Development Planning Boundary
- Lands in control of Applicant
- Proposed Substation
- Turbine Delivery Route
- Proposed Met Mast
- Proposed Turbine Layout

Invasive Species

Species

- Sitka spruce
- Sycamore
- Cherry laurel
- Himalayan knotweed

N W E S

0 0.25 0.5 1 Kilometers

TITLE:	Invasive Species recorded during surveys within the site
PROJECT:	Barnadivane Wind Farm, Co.Cork
FIGURE NO:	5.9
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.
SCALE:	1:12500
REVISION:	0
DATE:	22/02/2023
PAGE SIZE:	A3

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5.3.4 Habitats

No Annex I habitats were recorded during site walkovers.

The habitat survey study area supports extensive areas of improved agricultural grassland (GA1) and wet grassland (GS4), with smaller areas of scrub (WS1), conifer plantation (WD4) and buildings and artificial surfaces (BL3). Linear features onsite include hedgerows (WL1), treelines (WL2) drainage ditches (FW4) and first order upland eroding rivers (FW1). The southernmost sections of the study area are drained by Moneygaff_east river while the northern section of the study area is drained by the Cummer 19 river, both eroding upland rivers.

Descriptions of habitats within the habitat study survey area site are provided below and mapped in Figure 5-10. Habitat evaluations are provided in Table 5-44.

Improved Agricultural Grassland (GA1)

The elevated, sloping and well drained fields of the survey study area is made up of extensive areas of improved agricultural grassland which primarily supports cattle grazing. These habitats are typically species poor and include perennial rye grass (*Lolium perenne*) with other grass species , Yorkshire fog (*Holcus lonatus*) sweet-vernal grass (*Anthoxanthum odoratum*) and crested dog tail (*Cynosurus cristatus*) at lower levels. The herb layer is species poor, with white clover (*Trifolium repens*), creeping buttercup (*Ranunculus repens*), broad-leaved dock (*Rumex obtusifolius*), common chickweed (*Stellaria media*), nettle (*Urtica dioica*), ragwort (*Jacobaea vulgaris*), cat's-ear (*Hypochaeris radicata*) and marsh thistle (*Cirsium palustre*) typical. Areas of poorer drainage or localised changes in topography have some soft rush (*Juncus effusus*) and high levels of poaching from cattle, and grades into wet grassland (GS4), described below.

This habitat type is of *Site* importance.

Proposed access tracks, turbine hard standings, temporary construction compound and substation are located within this habitat type.

Wet Grassland (GS4)

This habitat was recorded to the east and the south of the study area, where the fields are poorly drained. This has led to the development of dense tussocky grasses and rushes. Areas of this habitat are heavily poached by cattle grazing.

Wet grassland onsite is characterised by dense soft rush and lesser amounts of Black Bog-rush (*Schoenus nigricans*) with grasses such as Yorkshire fog, sweet-vernal grass, common bent (*Agrostis capillaris*), and perennial rye grass. Accompanying herbs include marsh ragwort (*Jacobaea aquatica*), marsh thistle (*Cirsium palustre*), white clover, knapweed (*Centaurea nigra*), redshank (*Persicaria maculosa*), selfheal (*Prunella vulgaris*), and creeping cinquefoil (*Potentilla reptans*). Gorse (*Ulex europaeus*) and bramble (*Rubus fruticosus*) scrub is beginning to encroach on these GS4 fields from the field margins. The less grazed, wetter areas have higher levels of Bryophyte species, with high cover of common haircap moss (*Polytrichum commune*), heath plait-moss (*Hypnum jutlandicum*) and sphagnum (*Sphagnum palustre*), as well as other typical bog species such as heath spotted orchid (*Dactylorhiza maculata*) cross leaved heath (*Erica tetralix*), bog asphodel (*Narthecium ossifragum*) and cotton grass (*Eriophorum angustifolium*).

This habitat type is of *Local* importance.

Proposed access tracks, turbine hard standings, met mast access track & foundation are located within this habitat type.

Scrub (WS1)

There are areas of scrub within the wet grassland fields and along field boundaries and drainage features. These are formed of dense stands of gorse, bramble and willow (*Salix spp.*). There are signs of recent gorse burning onsite, notably near T06.

This habitat type is of *Local* importance.

Proposed access tracks, turbine hard standings and borrow pits are located within this habitat type.

Conifer plantation (WD4)

There are small patches of conifer plantation in the northern section of the site. These are comprised of single-aged sitka spruce that form a monoculture with a lack of understory species.

This habitat type is of *Site* importance.

Proposed access tracks and are located within this habitat type.

Buildings and artificial structures (BL3)

This habitat type is composed of the existing roads, farm tracks and buildings onsite. The buildings within the footprint of the works are operating farm sheds comprised of concrete, stone and corrugated metal.

This habitat type is of *Site importance*.

Proposed access tracks are located within this habitat type.

Hedgerows (WL1)

Hedgerows onsite vary in composition and form. They are largely of poor biodiversity quality with gaps between shrubs. Some are comprised of predominantly non-native species such as fuchsia and New Zealand holly. Other hedgerows onsite have a higher biodiversity value, forming stockproof field boundaries comprised of native species such as gorse, willow, bramble, bilberry (*Vaccinium myrtillus*) and hawthorn (*Crataegus monogyna*).

This habitat type is of *Local* importance.

Proposed access tracks met mast access track & foundation, turbine hardstanding's, and substation are located within this habitat type.

Treelines (WL2)

This habitat type is largely comprised of single rows of sitka spruce trees along farm tracks. Some sections of native hedgerows have grown into treelines, typically dominated by willows, with elder (*Sambucus nigra)*, hawthorn, bramble and gorse.

This habitat type is of *Local* importance.

Proposed access tracks are located within this habitat type.

Drainage ditches (FW4)

This habitat type is composed of existing field drainage systems throughout the site. The drainage ditches onsite are typically associated with hedgerows, are wet and are vegetated by grass and rush species, soft rush, Yorkshire fog, sweet-vernal grass, and common bent found in the surrounding improved and wet grasslands. Some drainage ditches are culverted where they flow under existing farm tracks, while others flow over the existing tracks and experience high levels of poaching from cattle (notably in the southern section of the site). The drainage ditches onsite drain the sloping fields and flow into upland eroding rivers which connect to downstream waterbodies.

This habitat type is of *Local* importance.

Proposed access tracks are located within this habitat type.

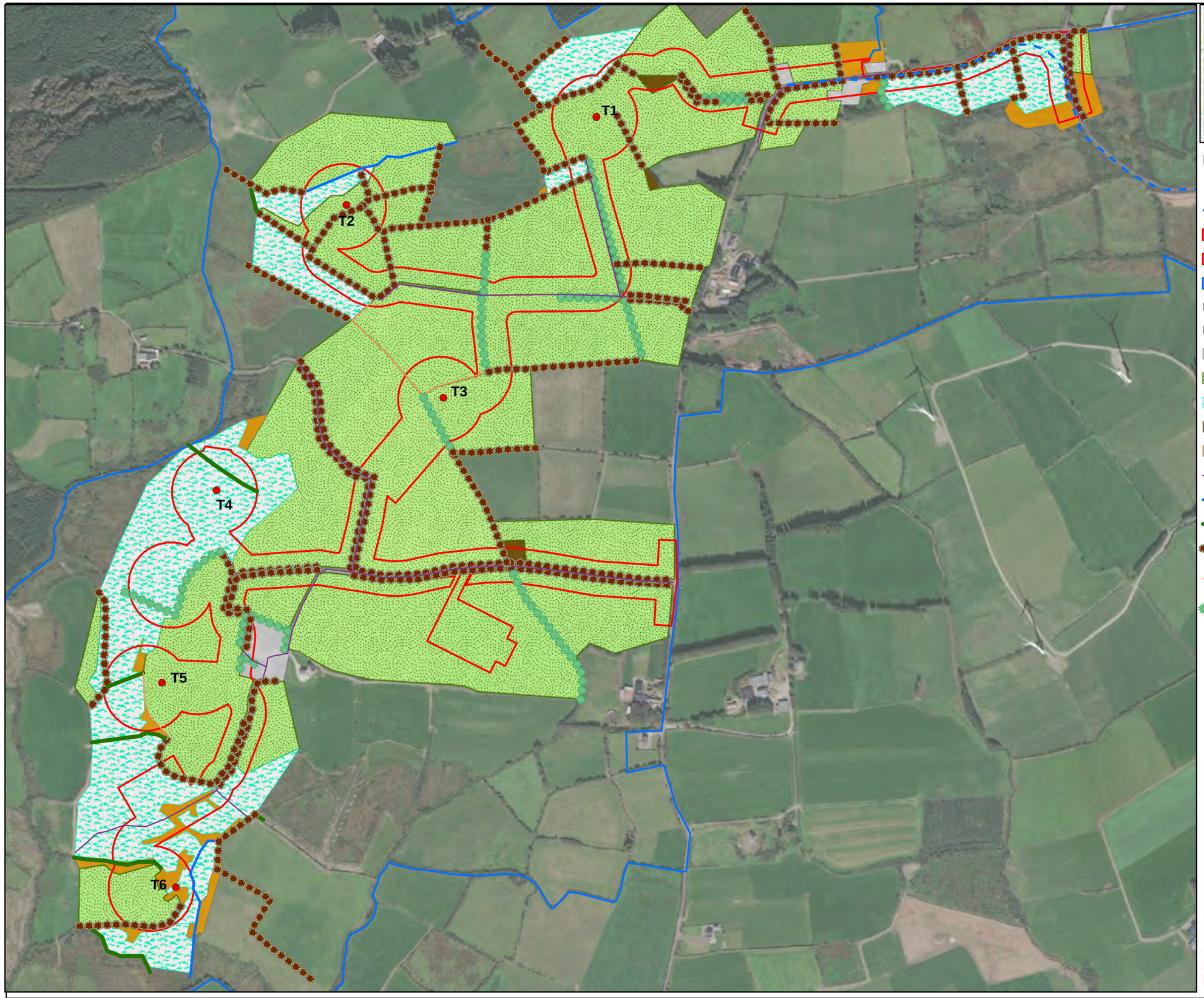
Eroding upland river (FW4)

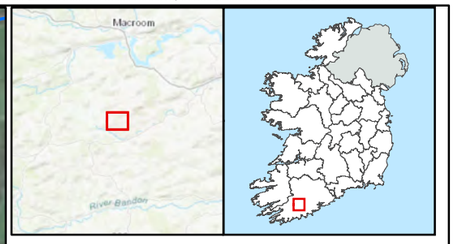
The natural streams that drain the site are found along the site boundaries. These are fast flowing over exposed rock and loose boulders. Willow grows along the banks and the tree canopy completely shades most of the streams. Other species along the streams include gorse, beech (*Fagus sylvatica*), bramble, foxglove (*Digitalis purpurea*), ivy (*Hedra helix*) and creeping buttercup. The EPA Moneygaff_east river flows to the west of the site, an unmapped stream flows to the north of the site which flows into the Cummer 19 river, and an unmapped stream flows to the south of the site which flows into the Bride[Cork] river.

This habitat type is of *Local* importance.

Proposed access tracks are located within this habitat type.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-10_Habitats_Site_A3.mxd





Legend

- Proposed Turbine Layout
- Turbine Delivery Route
- Proposed Substation
- Development Planning Boundary
- Lands in control of Applicant

Habitats

Fossitt Code

- BL3, Buildings and artificial surfaces
- GA1, Improved agricultural grassland
- GS4,Wet grassland
- WD4, Conifer plantation
- WS1, Scrub
- BL3, Buildings and Artificial Surfaces
- FW1, Upland/eroding rivers
- FW4, Drainage Ditches
- WL1, Hedgerows
- WL1/FW4, Hedgerows/Drainage Ditches
- WL2, Treelines

TITLE: Habitats			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	5.10		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:7000	**REVISION:**	0
DATE:	24/02/2023	**PAGE SIZE:**	A3

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5.3.5 Terrestrial Mammals

Desktop Study Rare and Protected Mammals

The mammal species listed in Table 5-28, below have been recorded within the 10 km grid squares (W36) in which the Proposed Development is located. Both NBDC records (accessed 14/11/2022) and NPWS records obtained by request (received 15/11/2022) were consulted as part of the desktop study.

A total of six protected mammal species have been recorded within the 10km grid squares (W36) overlapping the Proposed Development, namely badger (*Meles meles*), pygmy shrew (*Sorex minutus*), red squirrel (*Sciurus vulgaris*), otter (*Lutra lutra*), hedgehog (*Erinaceus europaeus*), and Irish hare (*Lepus timidus subsp. Hibernicus*). Two further native mammal species which are not protected under conservation legislation, red fox (V*ulpes vulpes*), and wood mouse (*Apodemus sylvaticus*) were also recorded in grid square W36.

Of the species listed, only badger has been recorded within a 1km grid square overlapping the Proposed Development.

Desktop Study Invasive Mammal Species

The mammal species listed in Table 5-29 below have been recorded within the 10 km grid squares (W36) in which the Proposed Development is located. Both NBDC records (accessed 24/03/2022) and NPWS records obtained by request (received 15/11/2022) were consulted as part of the desktop study.

A total of six invasive mammal species have been recorded within the 10km grid square W36 overlapping the Proposed Development, namely American mink (*Mustela vison*), bank vole (*Myodes glareolus*), brown rat (*Rattus norvegicus*), European rabbit (*Oryctolagus cuniculus*), house mouse (*Mus musculus*) and sika deer (*Cervus nippon*).

Table 5-28: Historical records of mammal speices within 10km of the Proposed Development (excluding bats)

Species	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
Eurasian Badger (*Meles meles*)	2015	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	Closest records are 1km resolution records from 2004 and 2008 from grid square R3363 and R3563 which overlap the Proposed Development.
Eurasian Pygmy Shrew (*Sorex minutus*)	2018	Mammals of Ireland 2016-2025	Wildlife Acts	Not recorded within 1km of the Proposed Development.
Eurasian Red Squirrel (*Sciurus vulgaris*)	2007	The Irish Squirrel Survey 2007	Wildlife Acts	Not recorded within 1km of the Proposed Development.
European Otter (*Lutra lutra*)	2017	Mammals of Ireland 2016-2025	Wildlife Acts	Not recorded within 1km of the Proposed Development.
European Rabbit (*Oryctolagus cuniculus*)	2015	Atlas of Mammals in Ireland 2010-2015	N/A	Recorded within 10km overlapping the Proposed Development, no further details given in historic records.
Red Fox (*Vulpes vulpes*)	2017	Mammals of Ireland 2016-2025	N/A	Recorded within 10km overlapping the Proposed Development, no further details given in historic records.
West European Hedgehog (*Erinaceus europaeus*)	07/06/2021	Hedgehogs of Ireland	Wildlife Acts	Not recorded within 1km of the Proposed Development.
Wood Mouse (*Apodemus sylvaticus*)	23/07/2018	Mammals of Ireland 2016-2025	Wildlife Acts	Recorded within 10km overlapping the Proposed Development, no further details given in historic records.
Irish Hare (*Lepus timidus subsp. Hibernicus*)	20/02/1990	Badger and Habitats Survey of Ireland	Wildlife Acts	Not recorded within 1km of the Proposed Development.

Table 5-29: Historical records of invasive mammal species within 10km of the Proposed Development

Species	Year of Last Record	Survey/Dataset	Impact	NBDC and NPWS records within the study area
American Mink (*Mustela vison*)	2017	Mammals of Ireland 2016-2025;	High	Not recorded within 1km of the Proposed Development.
Bank Vole (*Myodes glareolus*)	2015	Atlas of Mammals in Ireland 2010-2015	Medium	Not recorded within 1km of the Proposed Development.
Brown Rat (*Rattus norvegicus*)	2011	Atlas of Mammals in Ireland 2010-2015	High	Not recorded within 1km of the Proposed Development.
European Rabbit (*Oryctolagus cuniculus*)	2015	Atlas of Mammals in Ireland 2010-2015	Medium	Not recorded within 1km of the Proposed Development.
House Mouse (*Mus musculus*)	2016	Mammals of Ireland 2016-2025	High	Not recorded within 1km of the Proposed Development.
Sika Deer (*Cervus nippon*)	2008	Deer of Ireland Database	High	Not recorded within 1km of the Proposed Development.

Terrestrial Mammals Survey Results

A total of two mammal species were recorded during surveys at the Proposed Wind Farm site (including the Proposed Substation).

See Table 5-33 for more information. Figure 5-11 shows the location of mammal field signs and direct observations of live/ dead mammals.

This data was obtained during the mammal survey walkover and from trail cameras located in the Proposed Development site as well as incidental records gathered during other ecological surveys. These species, red fox and rabbit, are both of 'Least Concern'.

Other mammal species historically recorded in the area of the study area (NBDC records) but not observed during surveys may also occur; badger, pygmy shrew, red squirrel, otter, hedgehog and hare. Red squirrel could potentially forage and/or breed within the woodlands in the study area and use hedgerows and treelines to commute between dispersed blocks of woodland, however no dreys or feeding signs were recorded during the surveys. While no setts or forms were recorded within the Proposed Development site, badger and hare and could potentially use habitats within the study area for foraging. Pygmy shrew and hedgehog could occur where sufficient vegetated ground cover is available. The adjacent streams and onsite drainage ditches onsite could provide commuting habitat for surrounding otter populations, however they provide negligible foraging habitat. No holts were recorded along FW1 streams or drainage ditches within the Proposed Development.

Species are subject to seasonal fluctuations in population as the availability of food changes throughout the year (Couzens et al 2017). Survey findings may therefore vary temporally according to the natural seasonal cycles of ecosystem (food) productivity.

Table 5-30: Mammal species recorded in the study area and their conservation status (Marnell et al., 2019)

Name	Conservation Status (As per Red List No.12: Terrestrial Mammals) (Lawton et al 2019)
Red Fox (*Vulpes vulpes*)	Least Concern
European Rabbit (*Oryctolagus cuniculus*)	Least Concern

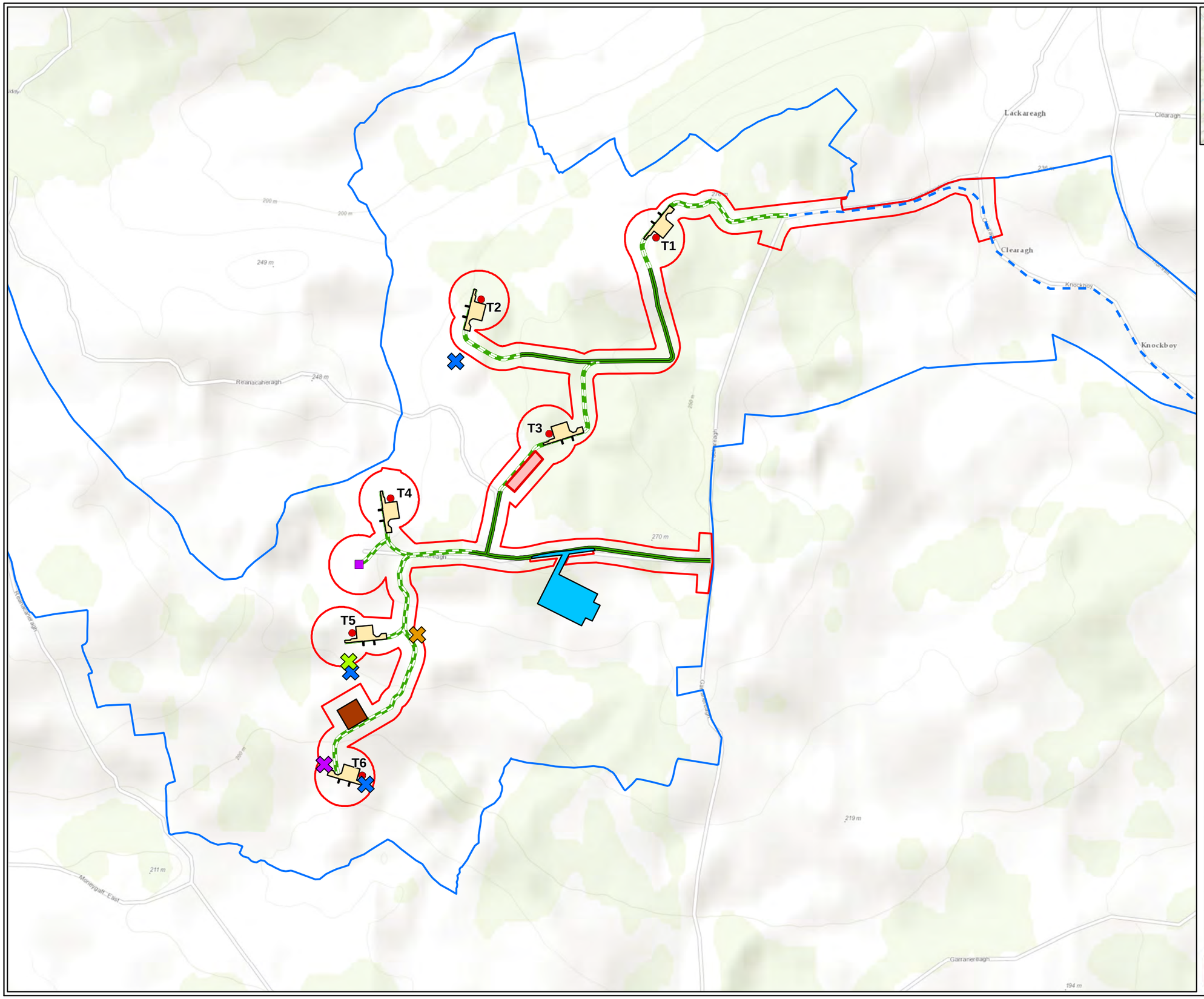
Rabbit

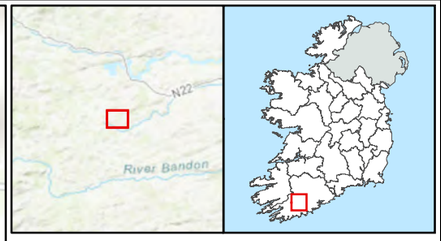
This species is present at the Proposed Development site, as indicated by the presence of droppings and burrows distributed across the site. Rabbits were also recorded during trail camera surveys.

Fox

A dead fox was observed along the farm track to the south of the site. Fox scat was observed throughout the site along with a den along a hedgerow to the south of the site. Fox were also recorded during trail camera surveys.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-11_Mammal_Signs_and_Sightings_A3.mxd





Legend

- Development Planning Boundary
- Lands in control of Applicant
- Turbine Hardstandings
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed Borrow Pit
- Proposed Met Mast
- Proposed Turbine Layout
- Turbine Delivery Route
- Tracks-Existing
- Tracks-Proposed

Mammals

Species, Type

- Fox
- Fox, den
- Fox, scat
- Rabbit, live individual

TITLE: Mammal Signs and Sightings			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	5.11		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:10000	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

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5.3.6 Bats

The review of existing records of bat species in the area of the site indicates that three of the ten known Irish species of bat have been recorded within a 4km radius of the study area, namely pipistrelle species, brown long-eared and lesser horseshoe bat, as shown in Table 5-32 below. Of these species, brown long-eared bat has been recorded roosting in a building located c.2.5km to the north of the study area, a building located c.4km to the east of the study area and also a building located c.4km to the south-east of the study area. Lesser horseshoe bat has been recorded roosting in a building located c.2km to the north of the study area and a building located c.4km to the north-east of the study area.

The Cave Database for the Republic of Ireland does not hold any records of caves within a 4km radius of the study area.

There are no designated sites for bats within 15km of the Proposed Development.

Table 5-31: NBDC and NPWS bat records within a 4km radius of the study area

Common Name	Scientific Name	Present (Y/N)	Date of Last Record	Location of Known Roost (to 1km OS Grid Square Resolution)
Pipistrelle spp.	*Pipistrellus pipistrellus sensu lato*	Y	04/05/2003	None
Soprano Pipistrelle	*Pipistrellus pygmaeus*	N	-	-
Nathusius's Pipistrelle	*Pipistrellus nathusii*	N	-	-
Leisler's Bat	*Nyctalus leisleri*	N	-	-
Brown Long-eared Bat	*Plecotus auritus*	Y	29/07/2001	, c. 22km north, 36km east and 38km northeast
Daubenton's Bat	*Myotis daubentonii*	N	-	-
Whiskered Bat	*Myotis mystacinus*	N	-	-
Natterer's Bat	*Myotis nattereri*	N	-	-
Lesser Horseshoe Bat	*Rhinolophus hipposideros*	Y	16/07/2013	c. 22km north, and 40km northeast
Brandt's Bat	*Myotis brandtii*	N	-	-

Bat Landscapes

Based on Lundy et al., (2011) habitat suitability index, the overall suitability for the study area of the Proposed Development has been scored as holding low to moderate suitability for all bat species combined. For individual species it was ranked as having moderate to high suitability for bats including common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle, brown long-eared, Leisler's and natterer's bat; and low to moderate suitability for lesser horseshoe, whiskered bat, Daubenton's bat and Nathusius' pipistrelle.

The habitat within the wind farm site and substation is comprised of improved grassland, wet grassland, scrub and conifer plantation. All proposed turbines are within improved agricultural grassland, excluding T4 which is located within wet grassland.

Bat Activity/ Transect Surveys

The results of the bat activity surveys carried out in 2021 and 2022 are presented below in Table 5-34. Weather conditions for each of the survey dates are presented in Table 5-33.

Overall, four bat species were recorded (common pipistrelle, soprano pipistrelle, Leisler's bat and unidentified Myotis species). In situations where the call could not be identified to species, the identification was determined to genus level.

The most commonly recorded species was common pipistrelle followed by soprano pipistrelle and Leisler's bat, with much lower activity levels for brown long-eared bat Myotis bat spp at detected.

The highest level of activity recorded for common pipistrelle, soprano pipistrelle pispistrelle spp, myotis spp and No ID was during the transects on 30th August 2021 (158 passes, 97 passes, 6 passes, 2 passes and 2 passes respectively) Leisler's bat on 18th September 2022 (with 51 passes), and brown long-eared bat and whiskered bat on 26th June 2021 (1 pass each).

Table 5-32: Weather conditions during bat activity surveys

Date	Sunset	Start	Finish	Temp (°C)	Wind (Beaufort)	Cloud (Oktas)	Precipitation
26/06/2021	21:58	21:56	23:31	14	3	2	None
30/08/2021	20:27	20:24	22:16	14	2	6	None
17/09/2021	19:50	19:50	21:30	15	2	2	None
25/08/2022	20.36	20.30	22.35	16	2	7	None
18/09/2022	19.43	19.40	21.40	14	2	6	None

Table 5-33: Bat activity survey results

Date	Common pipistrelle (CP)	Soprano pipistrelle (SP)	Pipistrelle spp (Pi)	Leisler's (Lei)	Brown long-eared (BLE)	Whiskered bat (Wh)	Myotis spp. (My)	No ID	Total
26/06/2021	36	1	-	7	1	1	-	-	46
30/08/2021	158	97	6	36	-	-	2	2	301
17/09/2021	55	13	1	16	-	-	-	-	85
25/08/2022	23	-	-	14	-	-	1	-	38
18/09/2022	38	14	-	51	-	-	-	-	103

Roost Surveys

Trees:

A total of three trees within the study area were categorised as being of moderate suitability for roosting bats as they contained one or more potential roost features, but none are suitable for use by larger numbers of bats on a regular basis due to their size and lack of protected, sheltered conditions. A further three trees supporting Ivy growth that may have potential for individual/ small numbers of bats to roost opportunistically were recorded at the east of the study area; these trees are classified as being of low suitability to support roosting bats.

Buildings

No relevant underground features (natural or man-made) were identified during the desk study, and no other underground sites were recorded on-site.

A total of six buildings/clusters of buildings were identified in the preliminary ecological appraisal as being of potential to support roosting bats. These are detailed in Table 5-35.

Table 5-34: Buildings with bat potential located within the study area for bat surveys (landownership boundary + 275m buffer)

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
Building 1 Grid Ref: 5341xx,5639xx	A 2-storey disused dwelling with rendered walls and a slate roof. Potential entry points for bats were present via slipped tiles, raised ridge tiles, under chimney flashing, gaps between bricks in the chimney and gaps at the edge of a window.	Scattered bat droppings were recorded inside the dwelling and one dead Leisler's bat was present in a first-floor room. The dwelling is of **high** suitability for bats (presence of bats confirmed).
Building 2 Grid Ref: 5345xx,5627xx	A 2-storey disused dwelling and attached outbuilding with rendered walls and a slate roof. Potential entry points for bats were present in the dwelling via a raised ridge tile and under chimney flashing. The outbuilding supported potential access for bats via slipped tiles.	Dwelling and outbuilding are potentially of **moderate** suitability for roosting bats based on the material of their construction, their state of repair and the presence of potential bat access points as viewed from the farmyard.
Building 3 Grid Ref: 5339xx,5628xx	Occupied dwelling. External inspection undertaken using binoculars. Two storeys dwelling with slate roof. Roof in good repair. Agricultural outbuildings steel frame corrugated sheds.	Dwelling and outbuildings considered to be of **low** suitability for roosting bats in light of the material of their construction and state of repair as viewed from the farmyard.
Cluster of buildings 4 Grid Ref: 5347xx,5635xx	Disused dwelling and outbuildings in farmyard. External inspections undertaken from the farmyard & public road.	The disused dwelling is of **moderate** suitability for roosting bats based on the material of its construction, its state of repair and the presence of potential bat access points as viewed from the farmyard.

Building number and Grid Reference (ITM)	Description	Suitability to Support Roosting Bats
	2-storey disused dwelling with rendered walls and a slate roof. Potential access via slipped tiles and under chimney flashing. Outbuilding constructed of stone with a slate roof; potential access via missing windows and door and gaps between stonework. Occupied dwelling to north of farmyard was a 2-storey modern building with a tile roof. Structure in good condition with no obvious entry/exit points for bats.	The stone outbuilding is of **low** suitability for bats as it was open and relatively draughty and may be used by individual/ small numbers of bats but is unsuitable to support a roost of high conservation value. The occupied dwelling is of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on observation from the public road.
Building 5 Grid Ref: 5348xx,5639xx	Old national school. Single storey stone building with rendered walls and slate roof. Potential access for bats via slipped tiles, open windows and raised ridge tiles. Potential roosting space behind fascia boards and between roof tiles and ceiling boards.	Considered to be of **moderate** suitability for roosting bats based on the material of its construction, its state of repair and the presence of potential bat access points and roosting spaces.
Building 6 Grid Ref: 5349xx,5639xx	Occupied dwelling: two storey modern building with a tile roof in very good upkeep. No obvious entry/exit points for bats. External inspection undertaken from the public road. Agricultural outbuildings steel frame and corrugated sheds. One outbuilding was constructed of stone with a corrugated roof. Structure did not have windows or a door and was open and draughty.	Dwelling considered to be of **low** suitability for roosting bats in light of the material of its construction and its state of repair based on external inspection from within the study area using binoculars. Outbuildings of **low** suitability based on material of construction and state of repair.

Emergence Surveys

Emergence roost surveys were undertaken of structures within study area buffer that were of moderate to high suitability for roosting bats. The emergence surveys were undertaken by two surveyors in August 2021 and were repeated in August 2022.

Building 1:

Emergence surveys were undertaken at Building 1 on 27th August 2021 and 23rd August 2022. In 2021, one Leisler's bat and five pipistrelle were recorded emerging from between stonework on the northern gable end and the bottom of the chimney. The pipistrelles comprised three soprano pipistrelle and two common pipistrelle. In 2022, one Leisler's bat and eight pipistrelle bats (mixed soprano and common pipistrelle) emerged from the locations described above plus the roof of the porch located on the western elevation of the building. After emerging from the dwelling, the pipistrelle were recorded foraging along the treeline adjacent to the dwelling and Leisler's foraged briefly above the site.

Building 2:

No bats were recorded emerging from the disused dwelling or outbuildings during the emergence surveys undertaken on 30th August 2021 and 25th August 2022. In 2022, one common pipistrelle was observed emerging from the Ash tree identified, located to the south of Building 2. In 2021, soprano and common pipistrelle were recorded from c.12 minutes after sunset foraging along the public road adjacent to the building, indicating the likely presence of a roost nearby.

Cluster of buildings 4

A total of seven natterer's bats and one brown long-eared bat were recorded emerging from the disused dwelling during the emergence survey undertaken on 28th August 2021. One natterer's bat and five common pipistrelle were recorded emerging from the disused dwelling during the emergence survey undertaken on 22nd August 2022. Other species recorded foraging in the vicinity of the farmyard during the course of the emergence surveys included common pipistrelle, Leisler's bat; one whiskered bat was also recorded in 2021.

Building 5

No bats were recorded emerging from the old national school during the emergence survey undertaken on 31st August 2021 and 24th August 2022.

Static Detector Surveys 2021

The results of the static detector surveys deployed over three rounds are shown below.

Nine species of bats were recorded during the three survey periods with a total of 44,226 recordings over the three survey periods. The most commonly recorded species was common pipistrelle, followed by Leisler's and soprano pipistrelle. Much lower levels of activity of Daubenton's bat, Nathusius' pipistrelle, Natterer's bat, whiskered bat, brown long-eared bat and lesser horseshoe bat were detected.

Table 5-36 below summarises the results of static detector surveys completed in 2022. Six static units were deployed over the survey period. Overall, nine bat species were recorded (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bat, whiskered bat, brown long-eared bat and lesser horseshoe bat). Where the call could not be identified to species, the identification was determined to genus level. The graphs within Plate 5-1 to Plate 5-7 below shows the number of bat passes (per species) recorded at each static detector site over the three surveillance periods.

Table 5-35: Summary results of static bat detectors deployed during survey rounds 1 to 3 (Spring, Summer and Autumn 2021)

Static Detector No. and location habitats	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
BV1 Hedgerow adjacent to agricultural grassland	Daubenton's bat Whiskered bat Leisler's bat Common pipistrelle Soprano pipistrelle Brown long-eared bat Lesser horseshoe bat	Daubenton's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Lesser horseshoe bat Brown long-eared bat
BV2 Stream adjacent to wet grassland/ roadside along treeline	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat Lesser horseshoe bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat
BV3 Hedgerow adjacent to drainage ditch/ agricultural land	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat Lesser horseshoe bat
BV4 Wet grassland	Daubenton's bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat

Static Detector No. and location habitats	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
BV5 Hedgerow adjacent to agricultural grassland/ Improved grassland	Daubenton's bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Daubenton's bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat
BV6 Hedgerow adjacent to agricultural grassland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown-long eared bat	No data	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat
BV2Extra	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown-long eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown-long eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Brown long-eared bat Lesser horseshoe bat

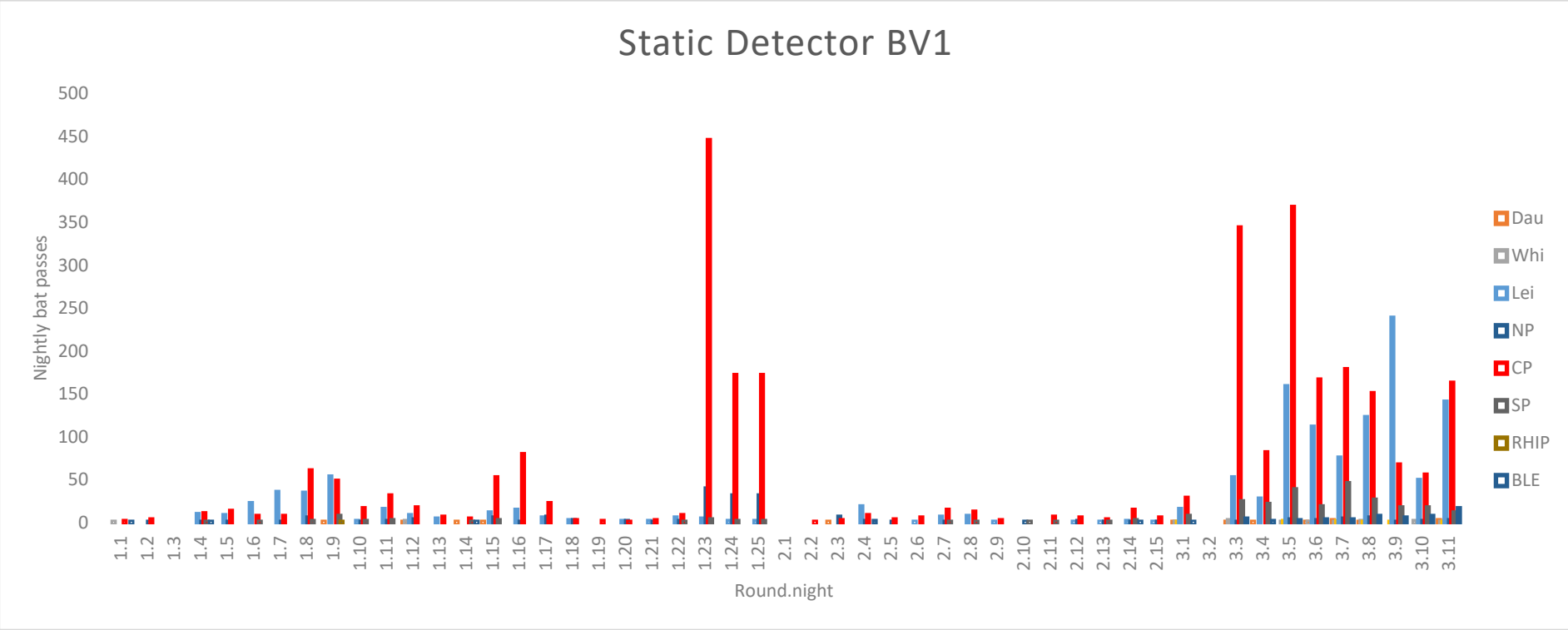


Plate 5-1: Total number of nightly bat passes recroded at Static location BV1

The static unit BV1 recorded eight species of bat. A higher level of activity was recorded in period 1 (22nd May to 16th June 2021) and period 3 (20th to 31st August 2021) compared to period 2 (2nd to 16th July 2021). Common pipistrelle had a spike in activity on night 23 of round 1 (13th June 2021) with 446 passes. Leisler's bat had a spike in activity on night 9 of round 3 (28th August 2021) with 239 passes. There was one singular pass for lesser horseshoe bat throughout all the survey periods, recorded on night 9 of round 1 (30th May 2021).

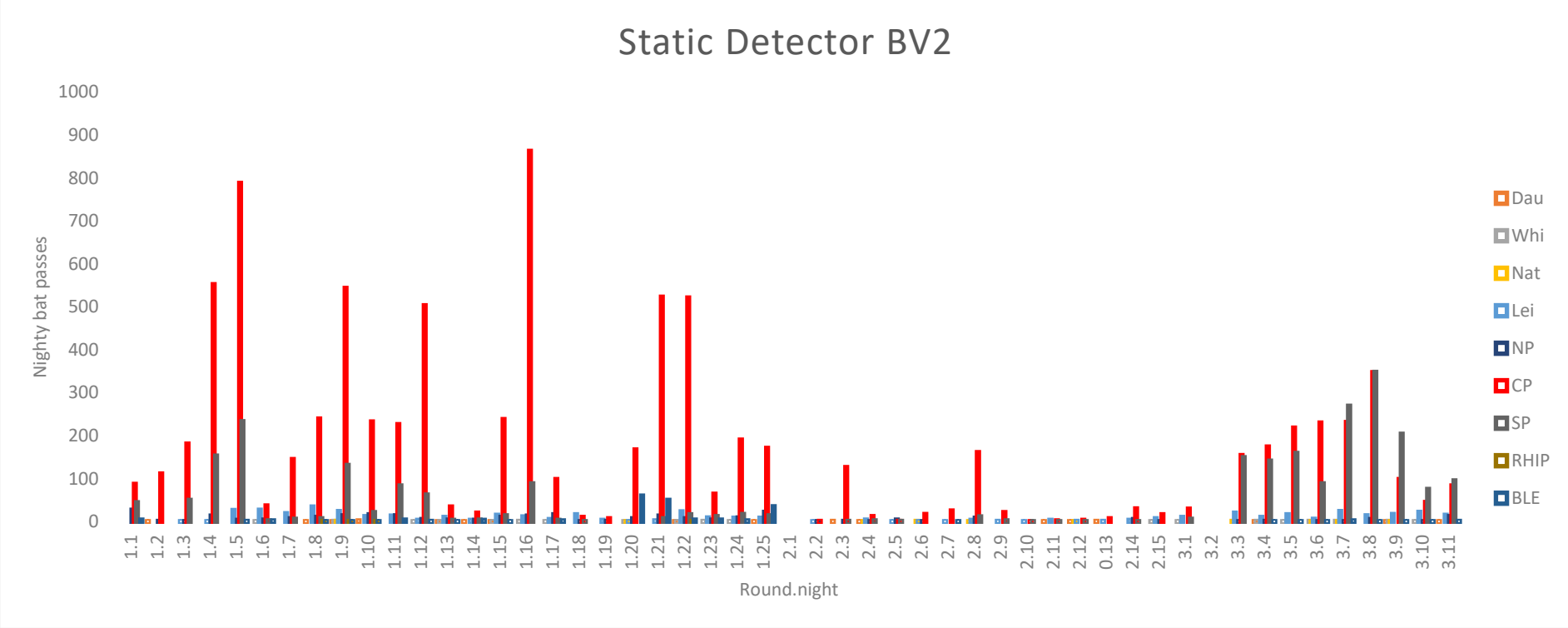


Plate 5-2: Total number of nightly bat passes recorded at Static location BV2

The static unit BV2 recorded nine species of bat. A higher overall level of activity was recorded in period 1 (22nd May to 16th June 2021) compared to the other periods. Common pipistrelle activity was particularly high in Round 1, peaking at 863 passes on night 16 (6th June 2021). Soprano pipistrelle had a spike in activity on night 8 of Round 3 (27th August 2021) with 349 passes. A much lower level of bat activity for all bat species recorded was noted during the survey periods. There were four singular passes for lesser horseshoe bat throughout all the survey periods, recorded on night 8 to 10 and night 22 of round 1 (29th to 31st May and 12th June 2021).

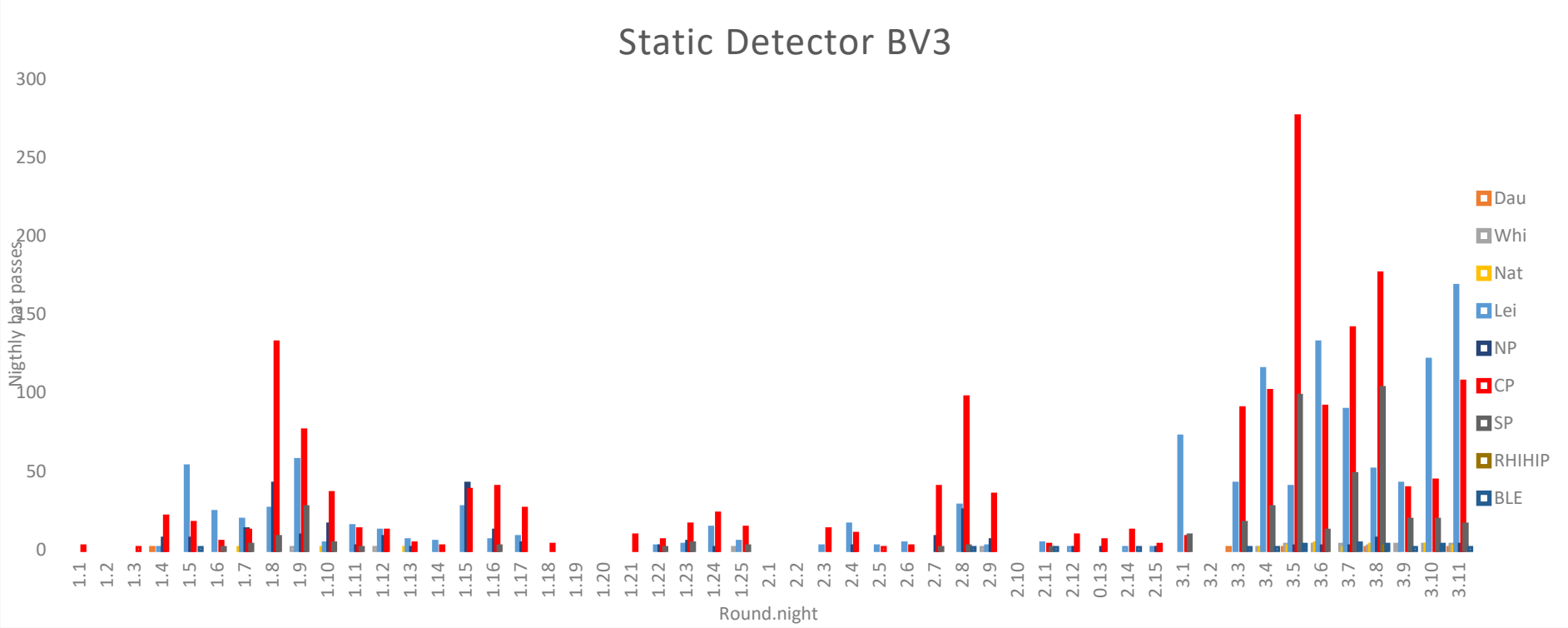


Plate 5-3: Total number of nightly bat passes recorded at Static location BV3

The static unit BV3 recorded nine species of bat. A higher overall level of activity was recorded in period 3 (20th to 31st August 2021) compared to the other periods. Common pipistrelle and Leisler's bat passes had nights of high activity across all three rounds. Common pipistrelle had a particularly high peak of activity on night 5 of Round 3 (24th August 2021) with 276 passes respectively. Leisler's bat had a peak night 11 of round 3 (30th August 2021) with 168 passes. There were two passes for lesser horseshoe bat recorded on night 8 of round 3 (27th August 2021).

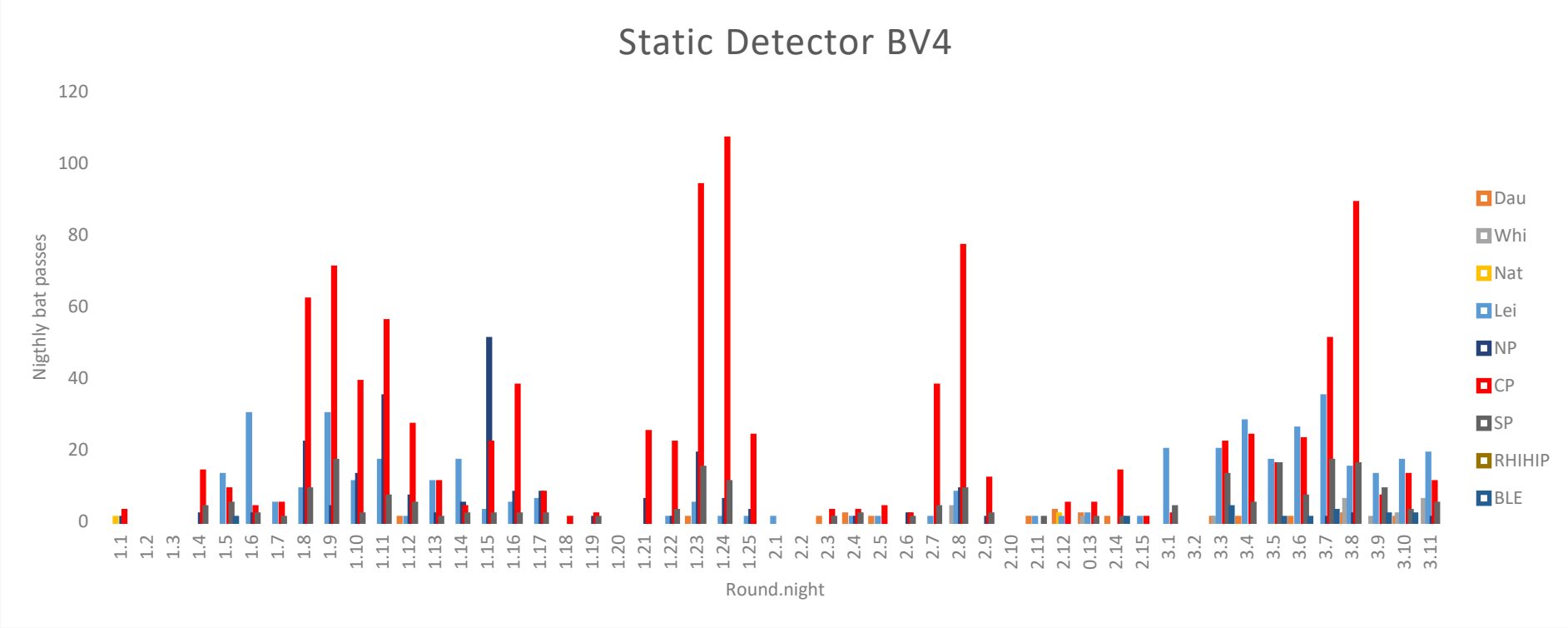


Plate 5-4: Total number of nightly bat passes recorded at Static location BV4

The static unit BV4 recorded eight species of bat. Activity levels varied within each survey period. Common pipistrelle had a peak number of passes on night 24 of round 1 (14th June 2022) with 107 passes. Nathusius pipistrelle had a spike in activity on night 15 of Round 1 (5th June 2022) with 5 passes. Leisler's bat activity peaked on night 7 of round 3 (26th August 2021) with 35 passes.

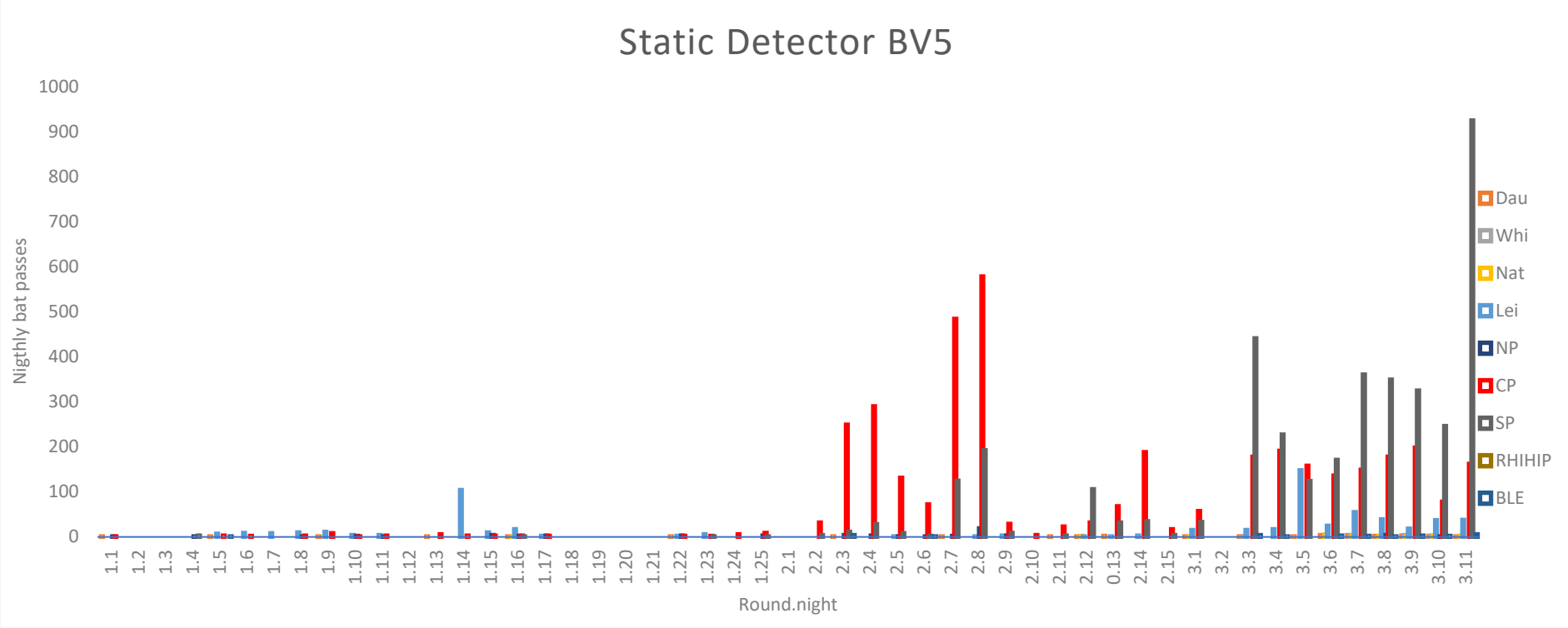


Plate 5-5: Total number of nightly bat passes recorded at Static location BV5

The static unit BV5 recorded eight species of bat. Round 1 (22nd May to 16th June 2021) had a lower level of activity then the other two rounds. Soprano pipistrelle had a spike in activity on night 11 of round 3 (30th August 2021) with 924 passes. Common pipistrelle activity peaked on night 8 of round 2 (9th July 2021) with 187 passes.

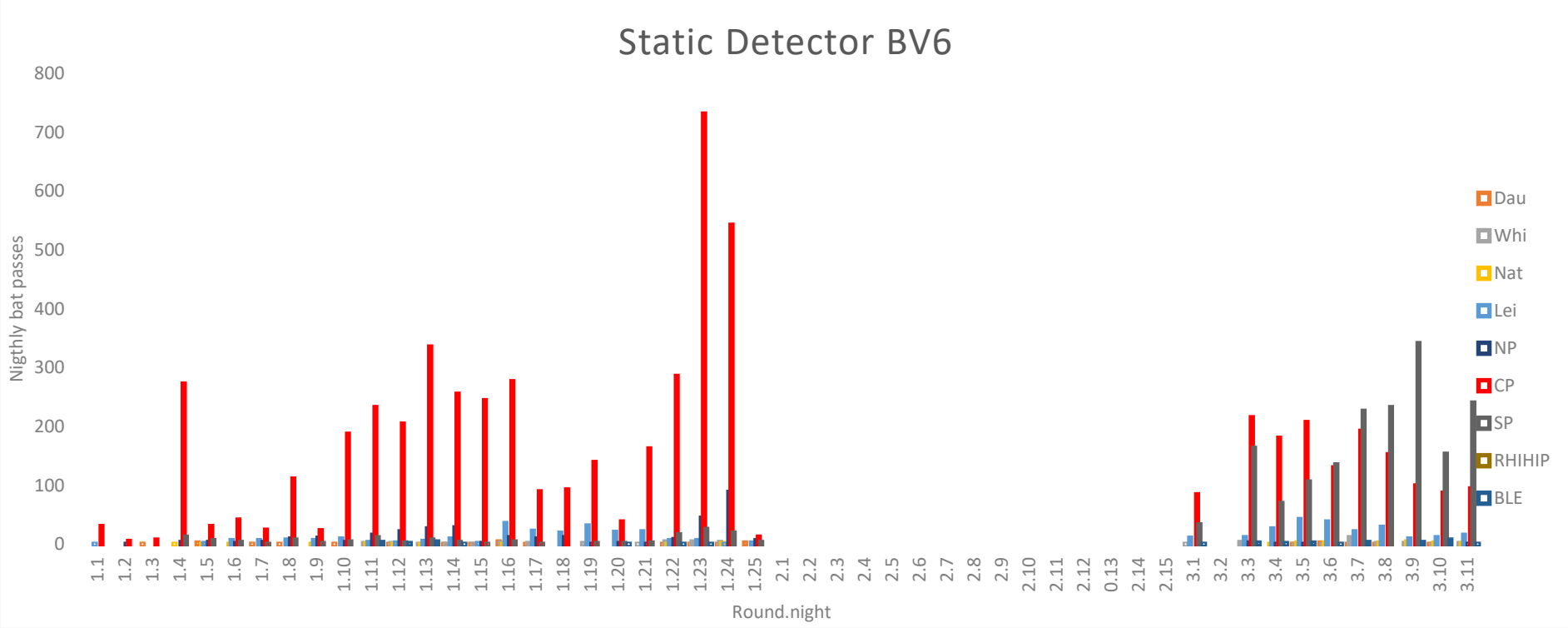


Plate 5-6: Total number of nightly bat passes recorded at Static location BV6

The static unit BV6 recorded eight species of bat. The detector failed to record for round 2. Common pipistrelle showed the highest level of activity over the two rounds, peaking on night 23 of round 1 (13th June 2021) with 732 passes, followed by 543 passes on night 24 of round 1 (14th June 2021). Soprano pipistrelle had a peak activity on night 9 of round 3 (28th August 2021) with 342 passes.

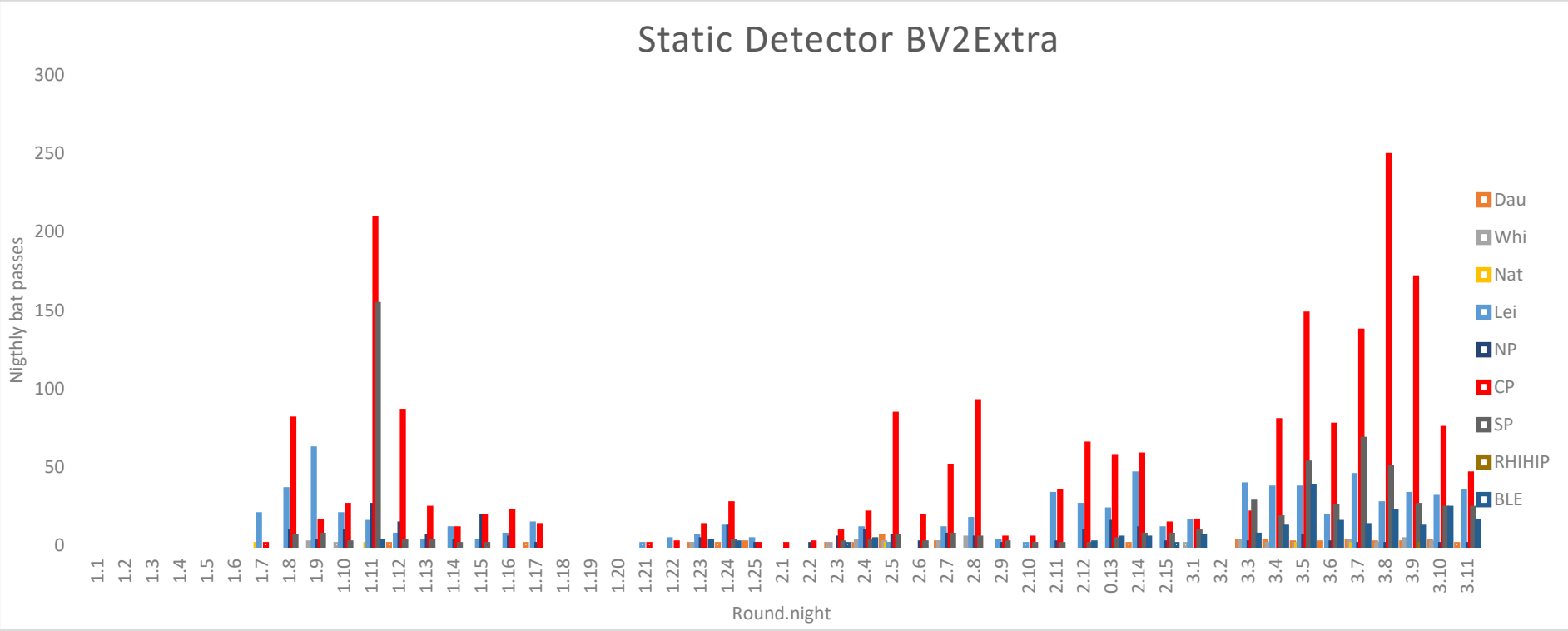


Plate 5-7: Total number of nightly bat passers recorded at Static location BV2Extra

The static unit BV2Extra recorded nine species of bat. Activity levels varied within each survey period. Common pipistrelle had a spike in activity on night 8 of round 3 (27th August 2021) with 249 passes and on night 11 of round 1 (1st June 2021) with 209 passes. Soprano pipistrelle also had a spike in activity on night 11 of round 1. There was one singular pass for lesser horseshoe bat throughout all the survey periods, recorded on night 9 of round 3 (28th August 2021).

The graphs within Plate 5-8to Plate 5-10show the number of passes for individual species (common pipistrelle, soprano pipistrelle and Leisler's bat) at each static detector location for the full survey period of 2021. Location BV1 has the highest number of passes for Leisler's bat, Location BV2 for common pipistrelle and BV5 for soprano pipistrelle.

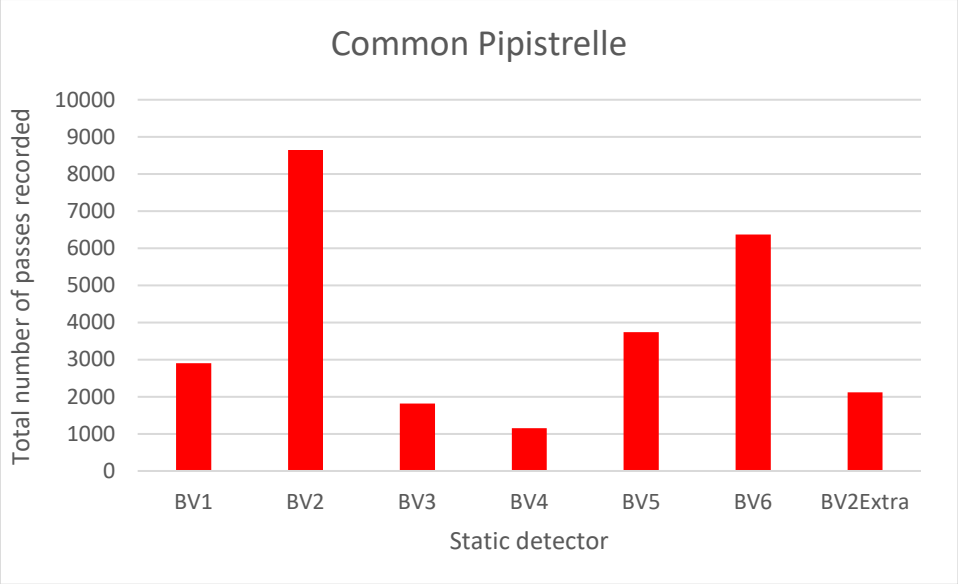


Plate 5-8: total number of bat passes recorded for common pipistrelle at each of the static detector locations during 2021

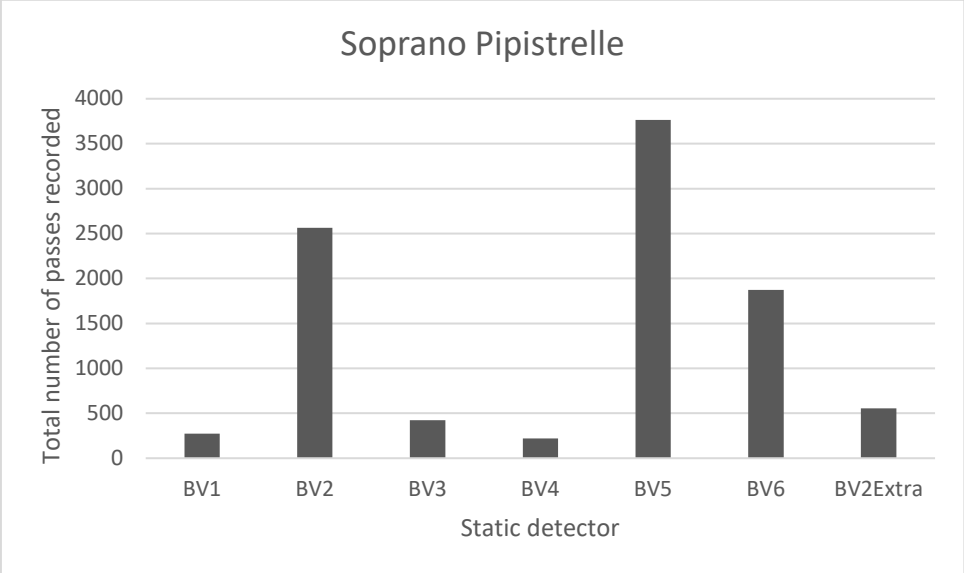


Plate 5-9: Total number of bat passes recorded for soprano pipistrelle at each of the static detector locations during 2021

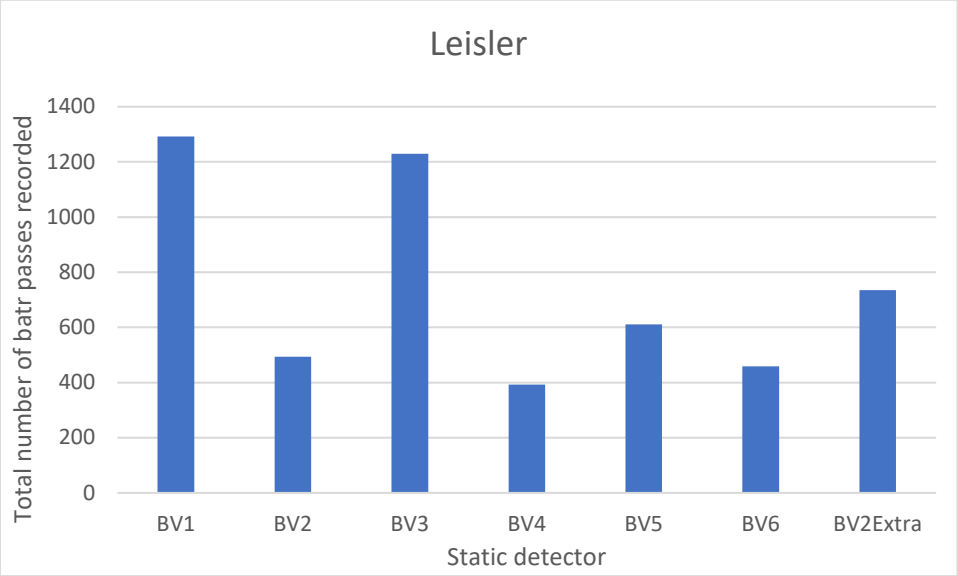


Plate 5-10: Total number of bat passes recorded for Leisler's bat at each of the static detector locations during 2021

Static location BV2 has the highest number of passes, recorded during the surveillance surveys of 2021, for Nathusius' pipistrelle (n=176) and brown long-eared bat (n=202), BV6 for whiskered bat (n=55) and Natterer's bat (n=32) and BVExtra for Daubenton's bat (n=37). Lesser horseshoe bat has the most passes (n=4) at BV2.

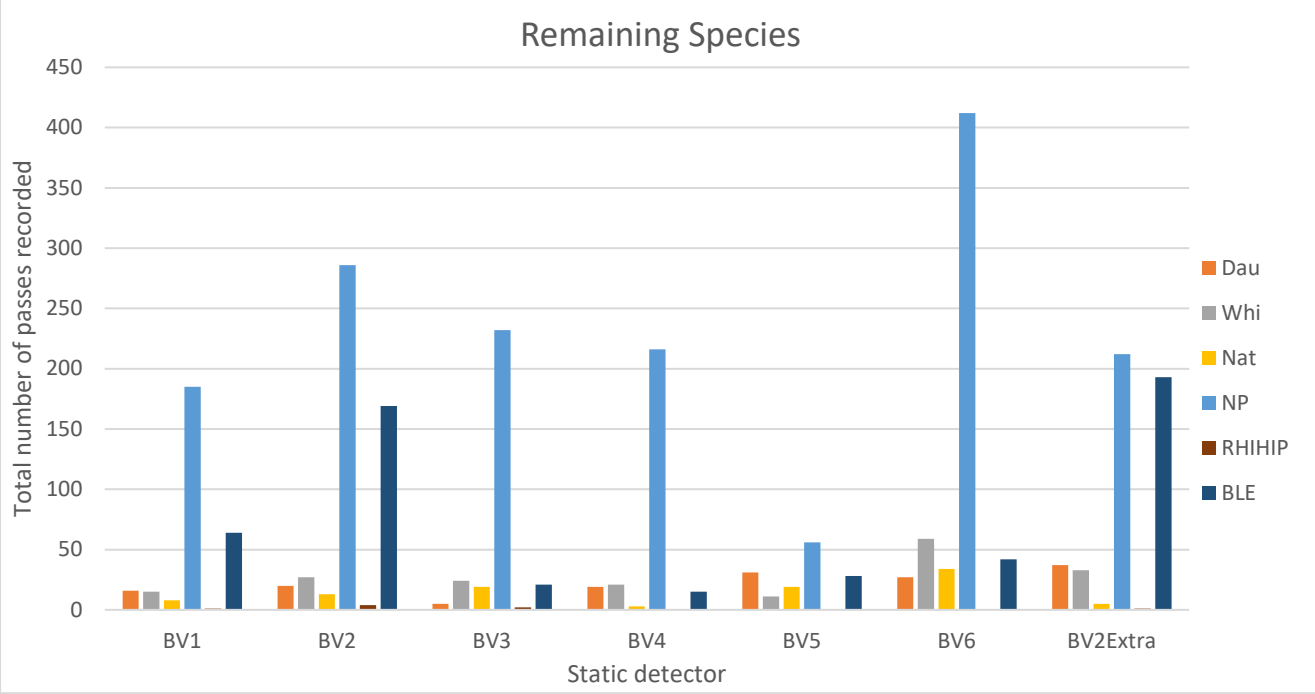


Plate 5-11: Total number of bat passes recorded for remaining bat species at each of the static detector locations during 2021

Static Detector Surveys 2022

The results of the static detector surveys deployed over three rounds are shown below.

Eight species of bats were recorded during the three survey periods with a total of 12,516 recordings over the three survey periods. The most commonly recorded species was common pipistrelle, followed by Leisler's and soprano pipistrelle. Much lower levels of activity of Daubenton's bat, Nathusius' pipistrelle, Natterer's bat, whiskered bat and lesser horseshoe bat were detected.

Brown long-eared bat is thought to be present on-site, with a known roost in close proximity to the site, but this species is very quiet and sometimes hunts without echolocating, therefore this species was not captured by the static detectors.

Table 5-36 below summarises the results of static detector surveys completed in 2022. Six static units were deployed over the survey period. Overall, eight bat species were recorded (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bat, whiskered bat and lesser horseshoe bat). Where the call could not be identified to species, the identification was determined to genus level. The graphs within Plate 5-1to Plate 5-6 below shows the number of bat passes (per species) recorded at each static detector site over the three surveillance periods.

Table 5-36: Summary results of static bat detectors deployed during survey rounds 1 to 3 (Spring, Summer and Autumn 2022)

Static Detector No. and location habitats	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
BV1 Hedgerow adjacent to agricultural grassland	Daubenton's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle Lesser horseshoe bat
BV2 Stream adjacent to wet grassland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle
BV3 Hedgerow adjacent to drainage ditch/ agricultural land	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Leisler's bat Common pipistrelle Soprano pipistrelle

Static Detector No. and location habitats	Species detected during Spring (Round 1)	Species detected during Summer (Round 2)	Species detected during Autumn (Round 3)
BV4 Wet grassland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle
BV5 Hedgerow adjacent to agricultural grassland	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	No data	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle
BV6 Hedgerow adjacent to agricultural grassland	No data	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle Nathusius' pipistrelle

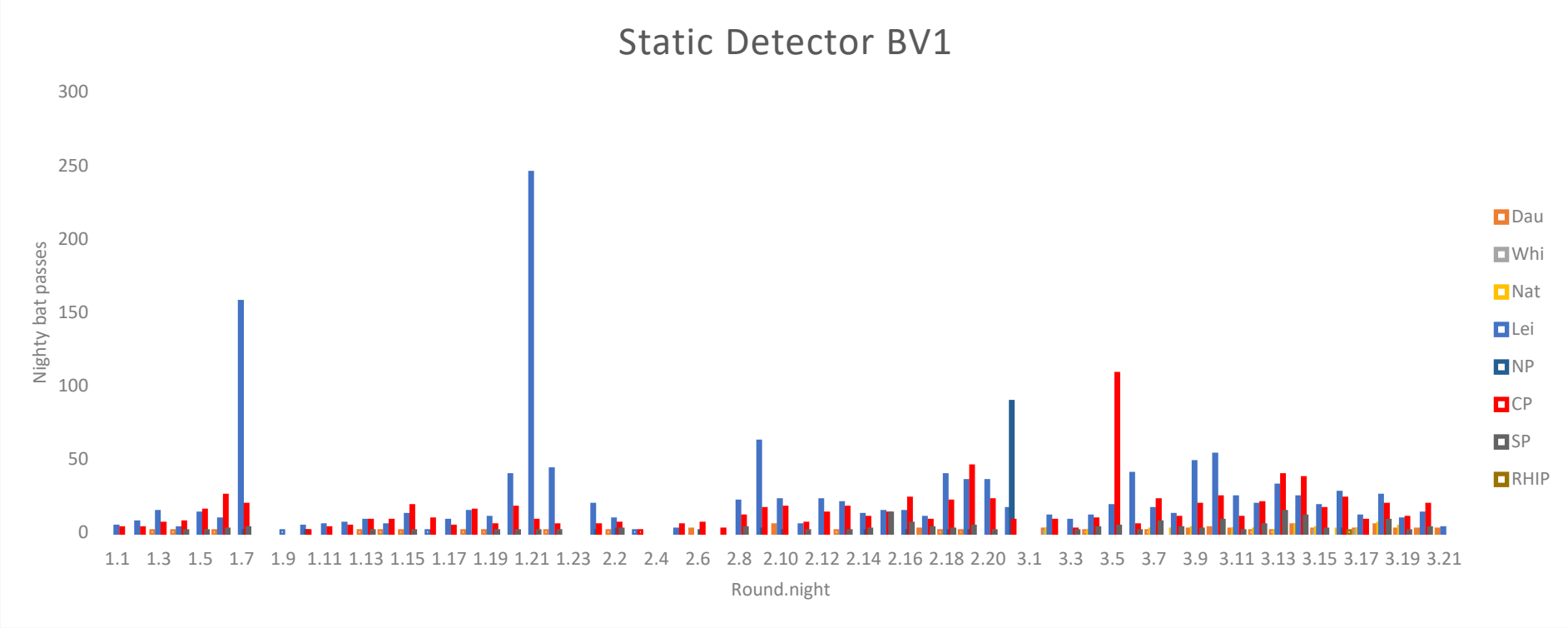


Plate 5-12: Total number of nightly bat passes recorded at Static location BV1

The static unit BV1 recorded eight species of bat. A higher level of activity was recorded in period 2 (22nd June to 13th July 2022) and period 3 (15th August to 5th September 2022) compared to period 1 (9th May to 1st June 2022). Common pipistrelle had a consistent level of activity across the three rounds, with a spike in activity on night 5 of round 3 (19th August 2022) with 108 passes. Leisler's bat had a spike in activity on night 21 and night 7 of round 1 (29th May 2022 and 15th May 2022) with 245 passes and 157 passes respectively. There was one singular pass for Lesser horseshoe bat throughout all the survey periods, recorded on night 16 of round 3 (30th August 2022).

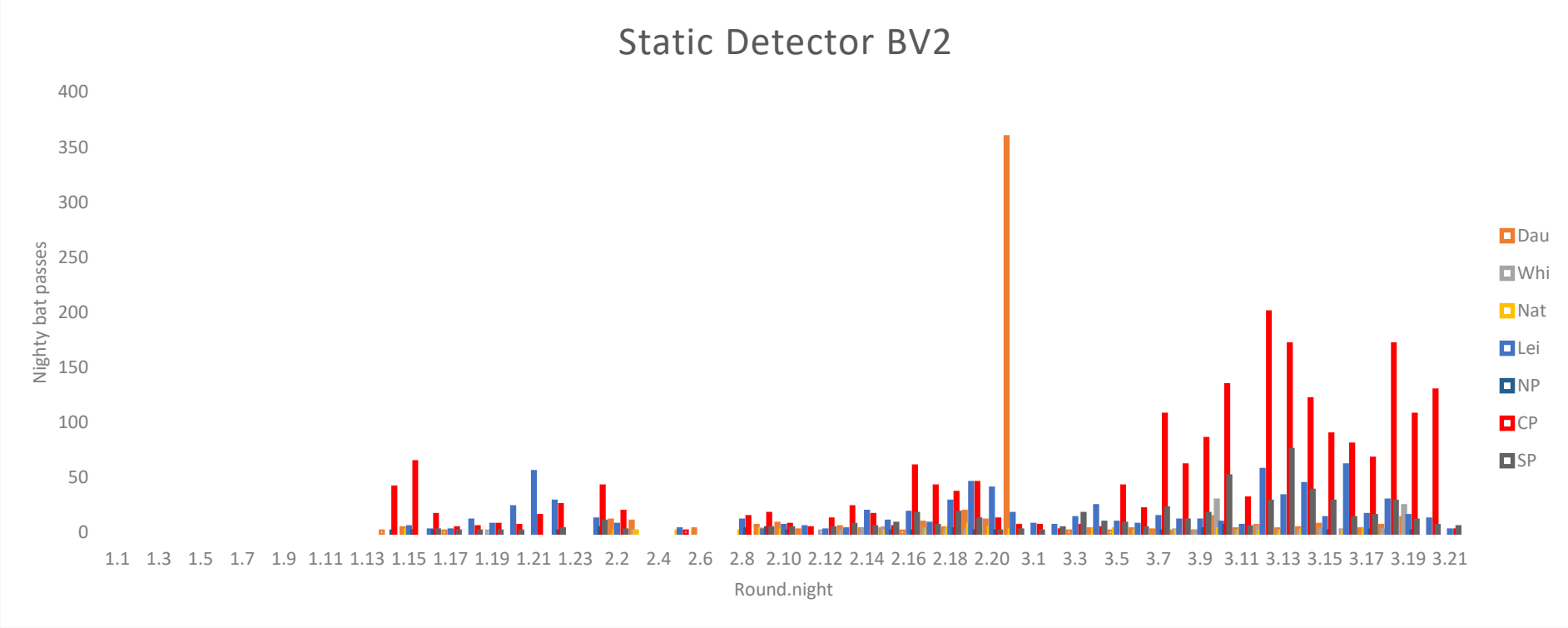


Plate 5-13: Total number of nightly bat passes recorded at Static location BV2

The static unit BV2 recorded seven species of bat. A higher overall level of activity was recorded in period 3 (15th August to 5th September 2022) compared to the other periods. Common pipistrelle activity was particularly high in Round 3, peaking at 200 passes on night 12 (26th August 2022). Daubenton's bat had a spike in activity on night 21 of Round 2 (12th July 2022) with 349 passes, likely one or two individuals foraging near the detector, as the next highest passes per night for Daubenton's bat was 19 passes on day 19 of Round 2 (10th July 2022). A much lower level of bat activity for all bat species recorded was noted during Period 1.

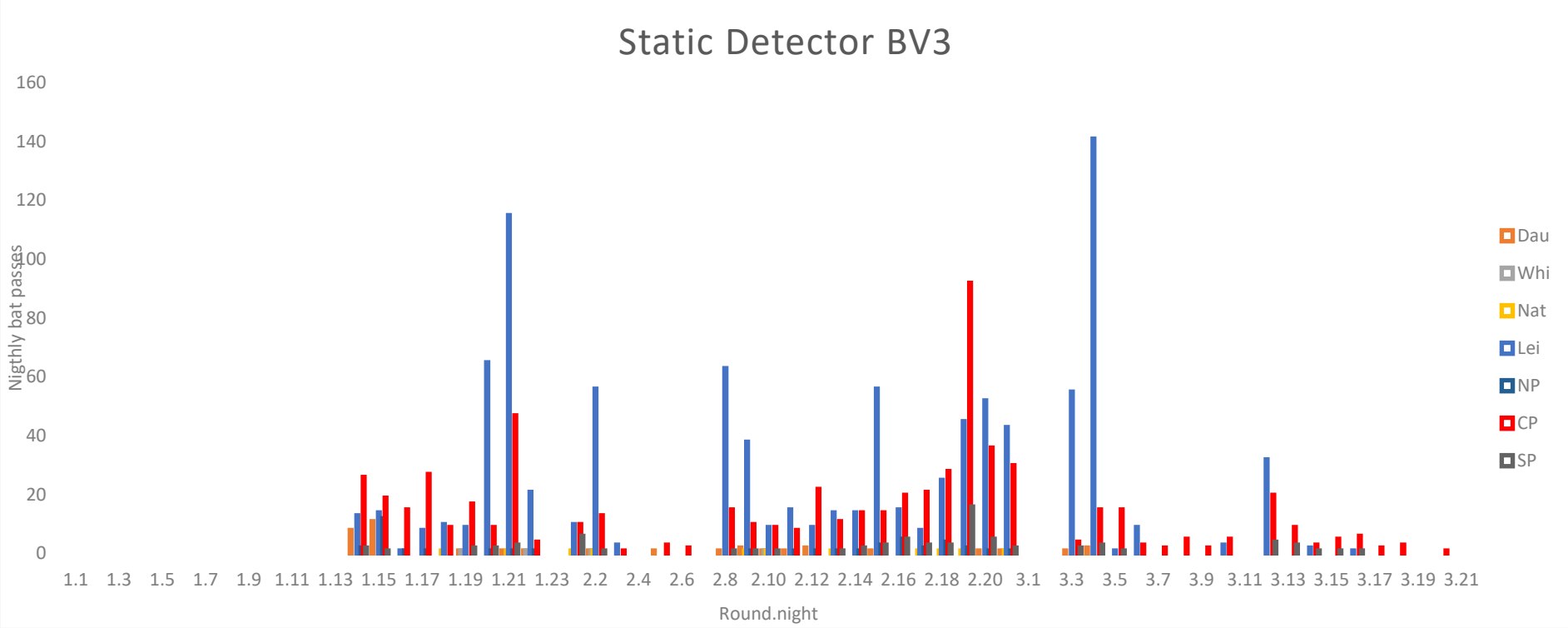


Plate 5-14: Total number of nightly bat passes recorded at Static location BV3

The static unit BV3 recorded seven species of bat. A higher overall level of activity was recorded in period 1 (09th May to 1st June 2022) and period 2 (22nd June to 13th July 2022) compared to period 3 (15th August to 5th September 2022). During period 1 and period 2 a higher level of common pipistrelle was recorded, while Leisler's bat passes had nights of high activity across all three rounds. Common pipistrelle had a particularly high peak of activity on night 2 of Round 2 and night 21 of Round 1 (23rd June 2022 and 29th May 2022) with 92 and 47 passes respectively. Leisler's bat had a peak night 4 of round 3 (18th August 2022) with 141 passes and day 21 of round 1 (12th July 2022) with 115 passes. A much lower level of bat activity for all bat species recorded was noted during Period 3.

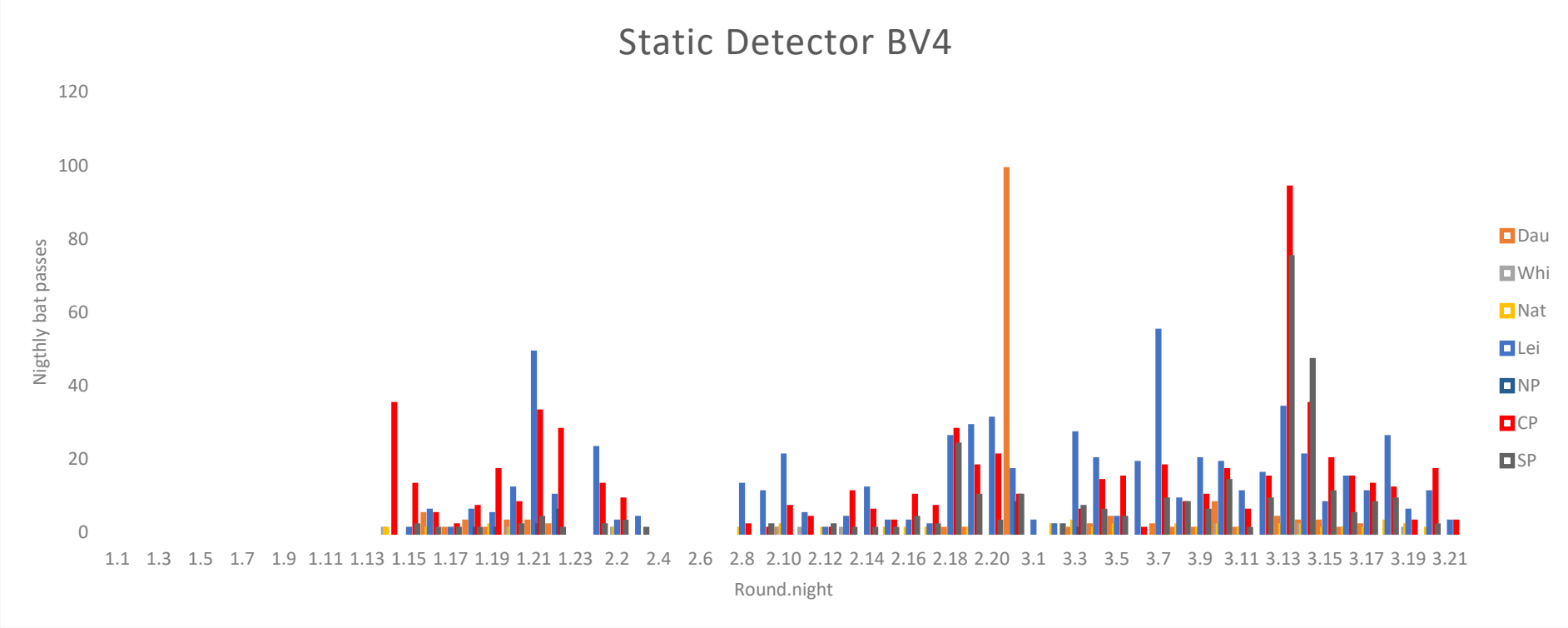


Plate 5-15: Total number of nightly bat passes recorded at Static location BV4

The static unit BV4 recorded seven species of bat. A higher level of activity was recorded in period 3 (15th August to 5th September 2022) compared to the other periods. Common pipistrelle and Soprano pipistrelle both had a peak number of passes on night 13 of round 3 (27th August 2022) with 94 and 75 passes respectively. Daubenton's bat had a spike in activity on night 21 of Round 2 (12th July 2022) with 99 passes. Leisler's bat activity peaked on night 7 of round 3 (21st August 2022) with 55 passes.

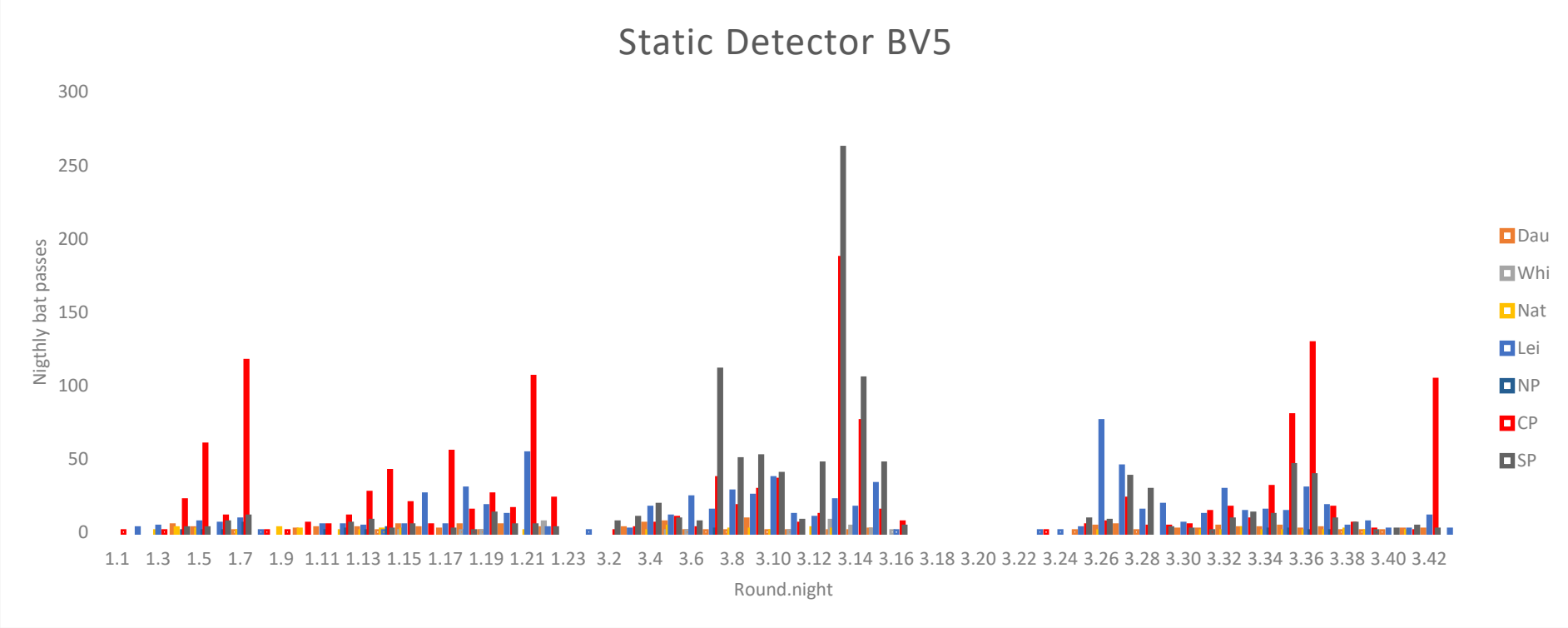


Plate 5-16: Total number of nightly bat passes recorded at Static location BV5

The static unit A5 recorded seven species of bat. Similar levels of activity were recorded across the two rounds. Soprano pipistrelle had a spike in activity on night 13 of round 3 (27th August 2022) with 262 passes. Common pipistrelle activity also peaked on this night with 187 passes, followed by night 36 of round 3 (19th September 2022) with 129 passes. Leisler's bat activity peaked on night 26 of round 3 (9th September 2022) with 76 passes. There were no recordings for round 2 due to a technical error with the detector, double effort was applied in round 3.

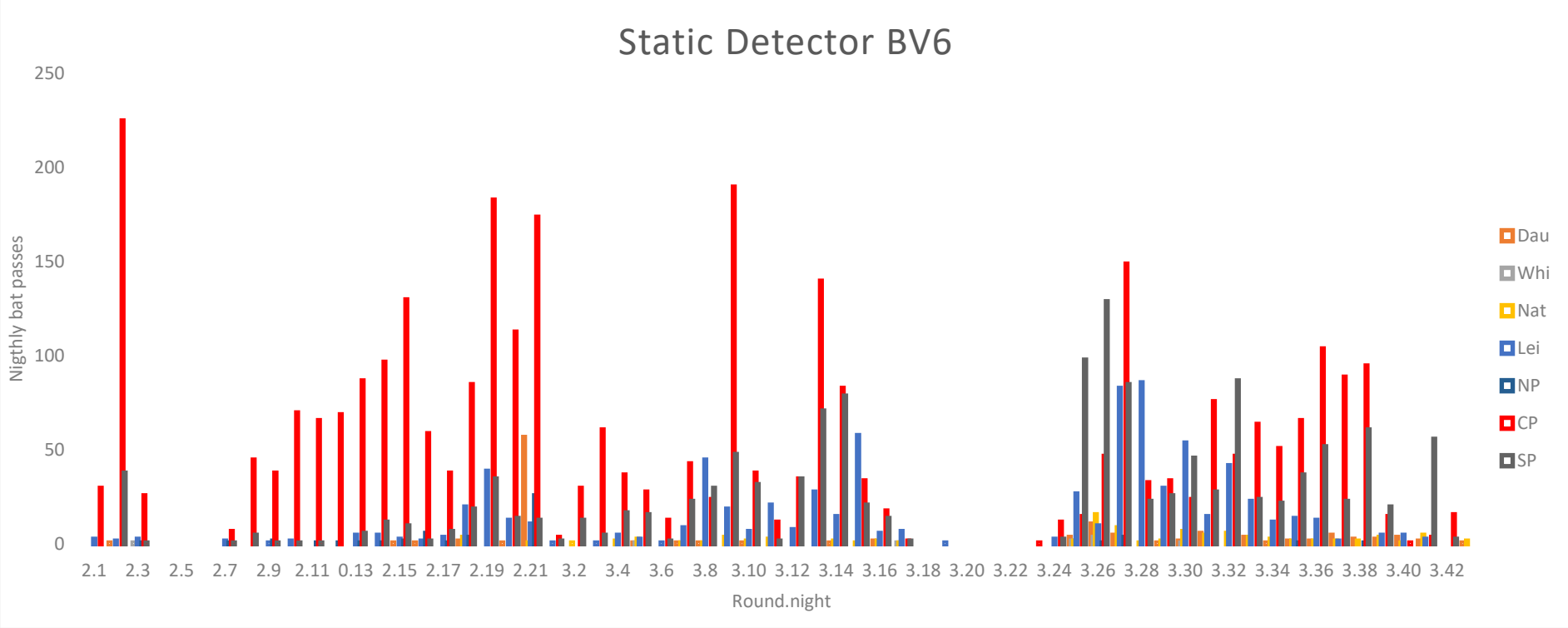


Plate 5-17: Total number of nightly bat passes recorded at Static location BV6

The static unit BV6 recorded seven species of bat. Common pipistrelle showed the highest level of activity over the two rounds, peaking on night 2 of round 2 (23rd June 2022) with 225 passes, followed by 190 passes on night 9 of round 3 (23rd August 2022). Soprano pipistrelle had a peak activity on night 26 of round 3 (9th September 2022) with 129 passes followed by 98 passes the previous night. Leisler's bat activity peaked on night 28 of round 3 (11th September 2022) with 85 passes. There were no recordings for round 1 due to a technical error with the detector, double effort was applied in round 3.

The graphs within Plate 5-18 to Plate 5-20 show the number of passes for individual species (common pipistrelle, soprano pipistrelle and Leisler's bat) at each static detector location for the full survey period of 2022. Locations BV6 has the highest number of passes for common and soprano pipistrelle, while BV1 and BV3 have the highest number of passes of Leisler's bat.

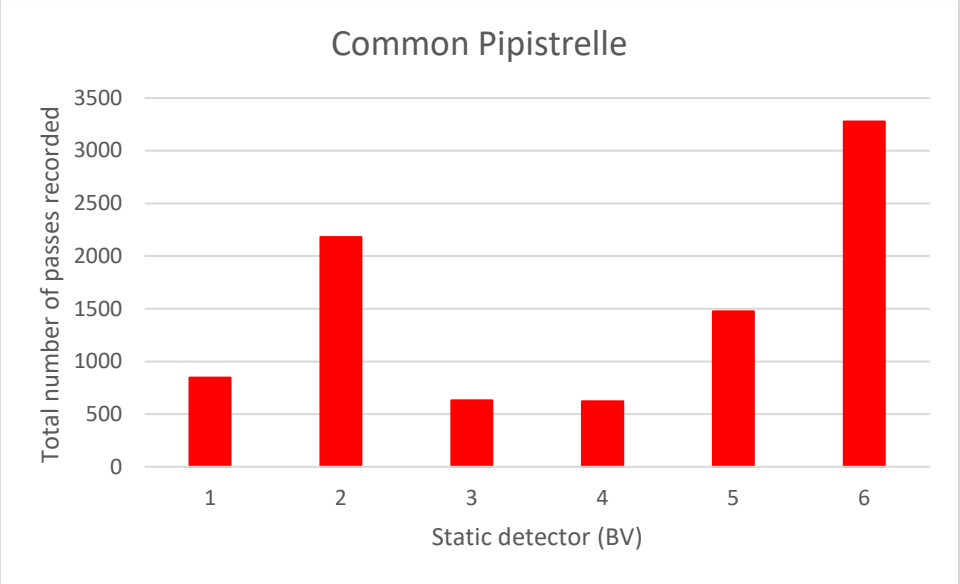


Plate 5-18: Total number of bat passes recorded for common pipistrelle at each of the static detector locations during 2022

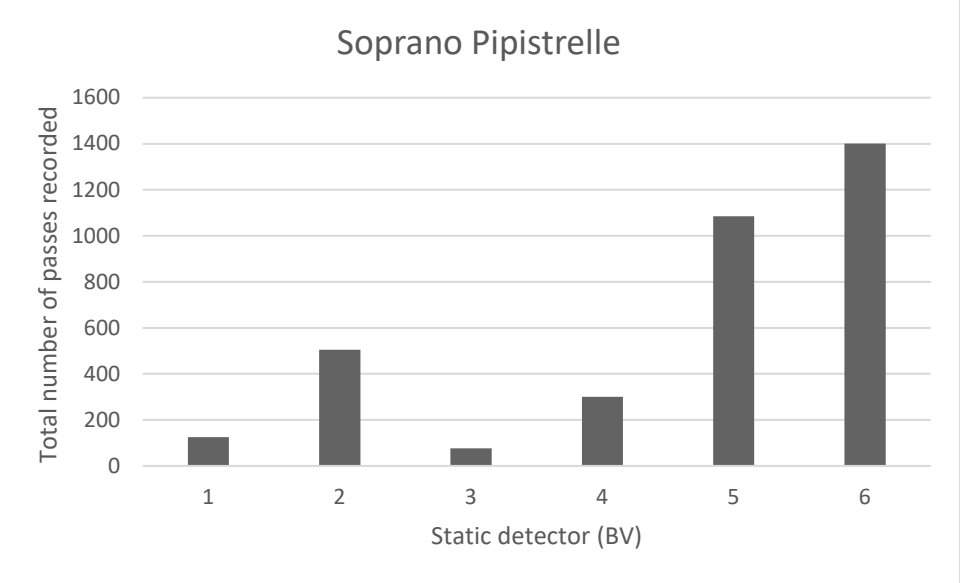


Plate 5-19: Total number of bat passes recorded for soprano pipistrelle at each of the static detector locations during 2022

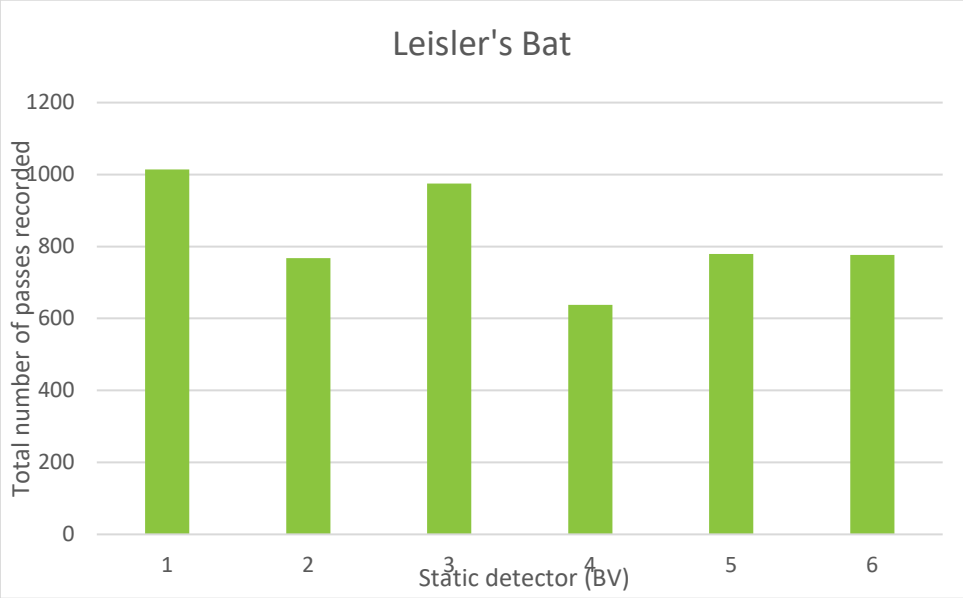


Plate 5-20: Total number of bat passes recorded for Leisler's bat at each of the static detector locations during 2022

Static location BV2 has the highest number of passes, recorded during the surveillance surveys of 2022, for Daubenton's bat (n=531) and whiskered bat (n=89), BV6 for Natterer's bat (n=103), and BV1 for Nathusius' pipistrelle (n=104) and the only record for lesser horseshoe bat (n=1).

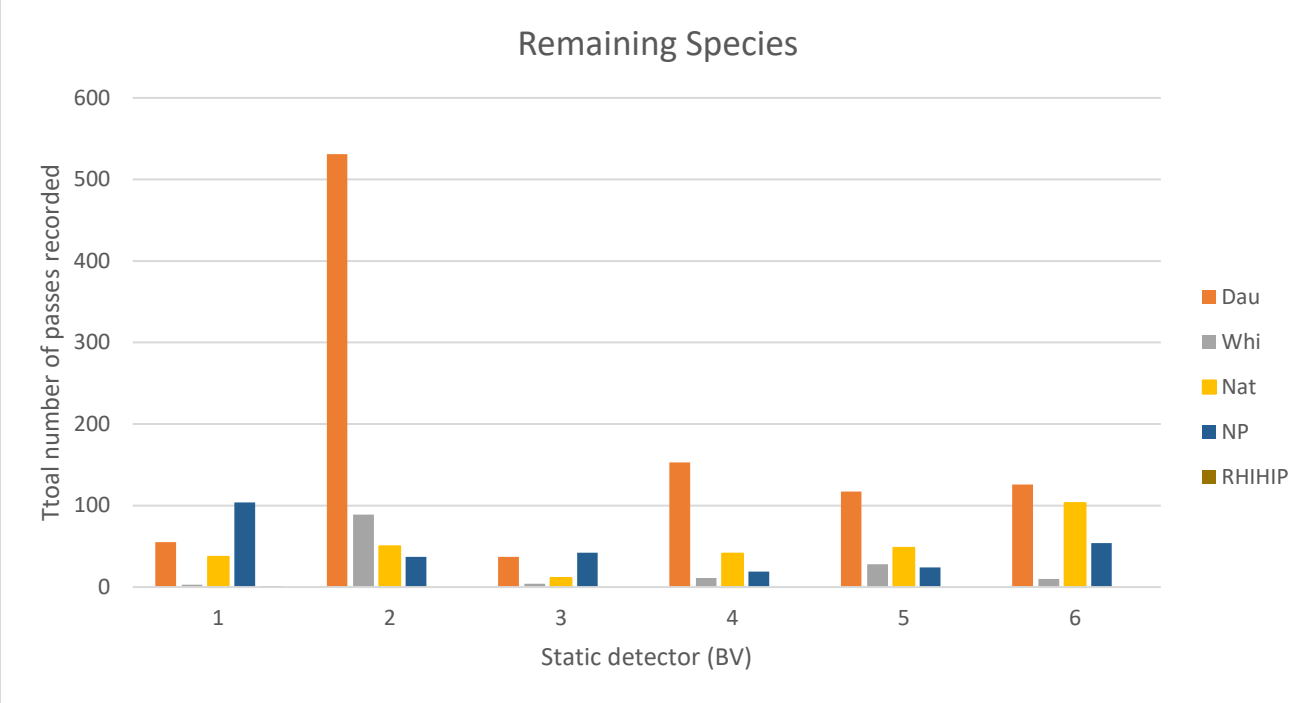


Plate 5-21: Total number of bat passes recorded for remaining bat species at each of the static detector locations during 2022

Ecobat analysis

The static detector data was uploaded and analysed using the Ecobat tool. This analysis was undertaken for each survey period separately. Where groups of detectors were deployed for different dates within a survey period, those that were deployed for the same dates were analysed together (details are provided for each survey period below).

The reference range datasets were stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100 km^2 of the survey location.
- Records using any make of bat detector.

The Ecobat tool provides are series of summary tables to enable analysis of the bat activity level at each static location.

These are presented below, and categorisation of activity level is based on the following table:

Table 5-37: Percentile score and categorised level of bat activity (NatureScot, 2021)

Percentile	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

Round 1 - Spring 2022

A summary showing the number of nights recorded bat activity within each activity band for each species is presented in Appendix 5.2.

Bat surveys were conducted for 23 nights between 09/05/2022 and 01/06/2022, using Wildlife Acoustics static bat detectors for static locations, excluding BV6.

Only BV1 had nights (no=2) of High Activity during the survey period, for Leisler's bat.

All static locations are deemed to have a low Bat Activity (for all bat species) level based on the Percentile Median value, excluding BV4 which has a Low-Moderate Bat activity level for Nathusius' pipistrelle.

Round 2 - Summer 2022

A summary showing the number of nights recorded bat activity within each activity band for each species is presented in Appendix 5.2.

Bat surveys were conducted for 21 nights between 22/06/2022 and 13/07/2022 for static locations, excluding BV5. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis. This is available within the Ecobat report in Appendix 5.2.

Two of the five static locations (BV1 and BV2) had at least one night of High Activity during the survey period.

BV4 is deemed to have a Moderate Bat Activity level for Nathusius' pipistrelle based on the Median Percentile value.

The following Static locations are deemed to have a Low-Moderate Bat Activity (for specific bat species) level based on the Median Percentile value:

- BV2 for Nathusius' pipistrelle, whiskered and Natter's bat; and
- BV6 for Natterer's bat.

All other static locations are deemed to have a Low Bat Activity (for all bat species) level based on the Percentile Median value.

Round 3 - Autumn 2022

A summary showing the number of nights recorded bat activity within each activity band for each species is presented in Appendix 5.2.

Bat surveys were conducted for 43 nights between 15/08/2021 and 27/09/2022 for static locations BV5 and BV6 and for 21 nights between 25/08/2022 and 05/09/2022 for the remaining four static locations, using Wildlife Acoustics SM4BAT-FS static bat detectors. Analysis is based on the number of nights the bats were detected on each recorder, therefore the nights no bats were detected have not been provided within the analysis, this is available within the Ecobat report (See Appendix 5.2).

Static location BV6 had at least one night of High Activity during the survey period for Natterer's bat, the rest of locations did not have any nights of High Activity.

BV4 is deemed to have a Moderate-High Bat Activity level for Natterer's bat based on the Median Percentile value.

BV1 is deemed to have a Moderate Bat Activity level for Natterer's bat and lesser horseshoe bat based on the Median Percentile value.

BV2, BV4 and BV5 is deemed to have a Low-Moderate Bat Activity level for whiskered and Natterer's bat based on the Median Percentile value.

All other static locations are deemed to have a low Bat Activity (for each bat species) level based on the Percentile Median value.

Indication of Bat Roost Present by Ecobat Analysis

The results of the static detector Ecobat analysis of the 2022 results identified the potential presence of Daubenton's, Leisler's and Pipistrelle bat roosts in the vicinity of the Proposed Development. The common/soprano pipistrelle tree roost was located during roost surveys within the bat survey study area (land ownership boundary + 275m). The Leisler's bat and common/soprano pipistrelle roost (Building 1) was also located during roost surveys. A Natterer's bat maternity roost and pipistrelle and brown long-eared bat roost (Cluster of buildings 4) was also located during roost surveys.

Table 5-38 provides a summary of the bat assessment. It outlines whether a bat species identified for the desktop study was subsequently recorded within the Proposed Development site during the bat surveys that took place in 2022.

Table 5-38: Bat survey summary results

Bat Species	Desktop Study (NBDC and NPWS)	2022 Activity Surveys	2021 Static Detector Surveys	2022 Static Detector Surveys	2021 and 2022 Roost Surveys
Myotis spp.	X	✓	N/A	N/A	N/A
Daubenton's bat	X	Myotis spp.	✓	✓	x
Whiskered bat	X	Myotis spp.	✓	✓	X
Natterer's bat	X	Myotis spp.	✓	✓	✓- maternity roost
Leisler's bat	X	✓	✓	✓	✓- confirmed roost
Pipistrelle sp.	✓	N/A	N/A	N/A	N/A
Nathusius' pipistrelle	Pipistrelle spp.	X	✓	✓	X
Common pipistrelle	Pipistrelle spp.	✓	✓	✓	✓- confirmed roosts
Soprano pipistrelle	Pipistrelle spp.	✓	✓	✓	✓- confirmed roosts
Brown-long eared bat	✓	X	✓	X	✓- confirmed roost
Lesser horseshoe bat	✓	X	✓	✓	X

5.3.7 Avifauna

Desk Study

A desktop study was undertaken to locate any records of rare or protected avian species that have previously been recorded in the site and the surrounding area. Examination of NPWS and NBDC records indicates that there is a combined total of 107 species recorded in the 10 km grid square (W36) which overlaps the study area and are listed in Table 5-39, below. These species are comprised of 20 that are on the current Birds of Conservation Concern in Ireland (BoCCI) red list (Gilbert et al., 2021) and 33 are on the BoCCI amber list (Gilbert et al., 2021). Eight of the species are further listed on Annex I of the EU Birds Directive (EC, 2009). Other species which are not rare (Red or Amber listed) or protected under Annex I (Habitats Directive) but have been included as they are indicator/keystone species and/or may be sensitive to wind farm development; including buzzard (*Buteo buteo*), sparrowhawk (*Accipiter nisus*), grey heron (*Ardea cinerea*), little).

Of the 107 records, just 13 were within the last ten years: Red-listed Curlew in 2017, Red-listed Barn Owl in 2017 and Amber-listed Little Plover in 2013. The invasive avian species Ruddy Duck was recorded within the overlapping grid square in 2011.

Table 5-39: NBDC bird records for target species within 10km from 2012-2022

Species	Latin	Year of last record	BoCCI status	Annex I status
Barn Owl	*Tyto alba*	2017	Red	
Black-headed Gull	*Larus ridibundus*	2011	Amber	
Black-necked Grebe	*Podiceps nigricollis*	2005	Red	
Black-tailed Godwit	*Limosa limosa*	2011	Red	
Brambling	*Fringilla montifringilla*	1984	Amber	
Buzzard	*Buteo buteo*	2021	Green	
Common Gull	*Larus canus*	2011	Amber	
Common Sandpiper	*Actitis hypoleucos*	2011	Amber	
Common Tern	*Sterna hirundo*	**1972**	**Amber**	**X**
Coot	*Fulica atra*	2011	Green	
Cormorant	*Phalacrocorax carbo*	2011	Amber	
Curlew	*Numenius arquata*	2017	Red	
Dunlin	*Calidris alpina*	**2011**	**Red**	**X**
Goldcrest	*Regulus regulus*	2011	Amber	
Golden Plover	*Pluvialis apricaria*	**2011**	**Red**	**X**
Goldeneye	*Bucephala clangula*	2011	Red	

Species	Latin	Year of last record	BoCCI status	Annex I status
Goosander	*Mergus merganser*	2011	Amber	
Great Crested Grebe	*Podiceps cristatus*	2011	Amber	
Greater Scaup	*Aythya marila*	2011	Amber	
Greenfinch	*Carduelis chloris*	2011	Amber	
Grey Heron	*Ardea cinerea*	2011	Green	
Grey Wagtail	*Motacilla cinerea*	2011	Red	
Hen Harrier	*Circus cyaneus*	2011	Amber	X
Herring Gull	*Larus argentatus*	1984	Amber	
House Martin	*Delichon urbicum*	2011	Amber	
House Sparrow	*Passer domesticus*	2011	Amber	
Kestrel	*Falco tinnunculus*	2011	Red	
Kingfisher	*Alcedo atthis*	**2011**	**Amber**	**X**
Lesser Black-backed Gull	*Larus fuscus*	2011	Amber	
Linnet	*Carduelis cannabina*	2011	Amber	
Little Grebe	*Tachybaptus ruficollis*	2011	Green	
Little Plover	*Charadrius dubius*	2013	Amber	
Long-eared Owl	*Asio otus*	2011	Green	
Mallard	*Anas platyrhynchos*	2011	Amber	
Meadow Pipit	*Anthus pratensis*	2011	Red	
Merlin	*Falco columbarius*	**2011**	**Amber**	**X**
Mute Swan	*Cygnus olor*	2011	Amber	
Northern Lapwing	*Vanellus vanellus*	2011	Red	
Northern Shoveler	*Anas clypeata*	2011	Red	
Oystercatcher	*Haematopus ostralegus*	2011	Red	
Peregrine Falcon	*Falco peregrinus*	**2011**	**Green**	**X**
Pochard	*Aythya ferina*	2011	Red	
Redwing	*Turdus iliacus*	2020	Red	

Species	Latin	Year of last record	BoCCI status	Annex I status
Ringed Plover	*Charadrius hiaticula*	1972	Amber	
Sand Martin	*Riparia riparia*	2011	Amber	
Skylark	*Alauda arvensis*	2011	Amber	
Snipe	*Gallinago gallinago*	2011	Red	
Sparrowhawk	*Accipiter nisus*	2020	Green	
Spotted Flycatcher	*Muscicapa striata*	2011	Amber	
Starling	*Sturnus vulgaris*	2011	Amber	
Stock Dove	*Columba oenas*	2011	Red	
Swallow	*Hirundo rustica*	2011	Amber	
Swift	*Apus apus*	2011	Red	
Teal	*Anas crecca*	2011	Amber	
Tufted Duck	*Aythya fuligula*	2011	Amber	
White-throated Dipper	*Cinclus cinclus*	2011	Green	
Whooper Swan	*Cygnus cygnus*	**2011**	**Amber**	**X**
Wigeon	*Anas penelope*	2011	Amber	
Willow Warbler	*Phylloscopus trochilus*	2011	Amber	
Woodcock	*Scolopax rusticola*	2011	Red	
Yellowhammer	*Emberiza citrinella*	2011	Red	

Targets Species Observations (Flight Activity Surveys)

As per SNH[18] (2017) guidelines the site for the purposes for the flight activity surveys (vantage point surveys) is defined not by the planning boundary for the Proposed Development but by a 500m radius circle (buffer) around the proposed wind turbines locations. The proposed turbine locations form the centre point of each of these 500m radius buffers. This study area is called the 'flight activity survey area' and is unique to this survey type. Any target species passing within this 500m buffer from proposed turbine locations (flight activity survey area) is considered within the Proposed Development site under the SNH (2017) guidance.

Target species recorded are shown below in Table 5-40.

[18] Now called NatureScot.

During the winter 2020/2021 season, ten target species were recorded. Of these, three species were red-listed (golden plover, kestrel and snipe), three species were amber-listed (hen harrier, lesser black-backed gull and mallard), and four were green-listed (buzzard, grey heron, and peregrine falcon and sparrowhawk). Hen harrier, golden plover and peregrine falcon are also listed under Annex I of the EU Birds Directive.

During the winter 2021/2022 season, nine target species were recorded. Of these, three species were red-listed (golden plover, kestrel and snipe), two species were amber-listed (lesser black-backed gull and mallard) and four were green-listed (buzzard, grey heron, peregrine falcon and sparrowhawk). Golden plover and peregrine falcon are also listed under Annex I of the EU Birds Directive.

During the summer 2021 season, nine target species were recorded. Of these, three species were red-listed (golden plover, kestrel, and swift), two species were amber-listed (herring gull and lesser black-backed gull), and four were green-listed (buzzard, grey heron, peregrine falcon and sparrowhawk). Golden plover and peregrine falcon are also listed under Annex I of the EU Birds Directive.

During the summer 2022 season, nine target species were recorded. Of these, two species were red-listed (kestrel and snipe), three species were amber-listed (herring gull, lesser black-backed gull and mallard), and four were green-listed (buzzard, great spotted woodpecker, peregrine falcon and sparrowhawk). Peregrine falcon is also listed under Annex I of the EU Birds Directive.

Many of the observations of target species were outside of the flight activity survey area. However, the details of these observations were noted during the survey. The 'rotor sweep zone' is the height at which the proposed turbine blades would be rotating. It extends for the minimum tip of the blade from the ground to the maximum tip height of the blade in rotation.

With a proposed hub height of 72.5m and a blade radius of 58.5m, the lower tip height is 14m and the upper tip height is 131m. Theoretically birds flying within this height range (14m to 131m) would be at risk of collision without the consideration of avoidance.

Table 5-40: Observation time recorded during Vantage Point surveys within the flight activity survey area (500 m turbine buffer) and the rotor sweep zone –October 2020 to September 2022, inclusive.

Species	Total Observation time during VPs (Seconds)	Total observation time in the flight activity survey area (Seconds)	Percentage of all VP observation time in the flight activity survey area (%)	Total observation time in the Rotor Sweep zone (Seconds)	Percentage of all VP observation time in the Rotor Sweep zone (%)
Buzzard	26,721	19,890	1.923	13,392	1.295
Golden Plover*	44,908	21,660	2.094	388	0.038
Great Spotted Woodpecker	50	50	0.005	50	0.005
Grey Heron	66	66	0.006	56	0.005
Hen Harrier*	446	446	0.043	446	0.043
Herring Gull	605	35	0.003	30	0.003
Kestrel	3,890	3,269	0.316	3043	0.294

Species	Total Observation time during VPs (Seconds)	Total observation time in the flight activity survey area (Seconds)	Percentage of all VP observation time in the flight activity survey area (%)	Total observation time in the Rotor Sweep zone (Seconds)	Percentage of all VP observation time in the Rotor Sweep zone (%)
Lesser Black-backed Gull	56,068	48,788	4.717	3936	0.381
Mallard	213	133	0.013	50	0.005
Peregrine Falcon*	795	574	0.056	574	0.056
Snipe	1,073	594	0.057	136	0.013
Sparrowhawk	1,124	1,072	0.104	966	0.093
Swift	440	440	0.043	110	0.011

* Species listed on Annex 1 of the Birds Directive (EC, 2009)

Hinterland Surveys

Hinterland surveys to establish occupancy and quantity of target species that could potentially cross the site whilst moving to and from roosting and feeding grounds within a 10 km radius of the site were carried out monthly across two years of surveys, between October 2020 and October 2022, inclusive. These surveys were for waterbird, wildfowl, waterbirds, geese, waders, swans, raptors and breeding target species.

Target species recorded are shown below in Table 5-41.

During the winter 2020/2021 season, 33 target species were recorded. Of these, eight species was red-listed (black-tailed godwit, curlew, dunlin, golden plover, lapwing, shoveler, snipe and woodcock), 15 were amber-listed (barnacle goose, black-headed gull, brent goose, coot,, goosander, great crested grebe, greylag goose, lesser black-backed gull, mallard, mute swan, teal, tufted duck, white-fronted goose, whooper swan, and wigeon) with the remainder green-listed (buzzard, great black-backed gull, green sandpiper, greenshank, grey heron, little egret, little grebe, moorhen, pink-footed goose and water rail). Barnacle goose, golden plover, little egret, white-fronted goose and whooper swan are also listed under Annex I of the EU Birds Directive.

During the winter 2021/2022 season, 32 target species were recorded. Of these, eight species were red-listed (black-tailed godwit, curlew, dunlin, golden plover, goldeneye, kestrel, lapwing, and snipe), 14 were amber-listed (barnacle goose, black-headed gull, coot, garganey, goosander, great crested grebe, greylag goose, lesser black-backed gull, mallard, mute swan, teal, tufted duck, whooper swan, and wigeon) with the remainder green-listed (buzzard, great black-backed gull, great white egret, green sandpiper, grey heron, little egret, little grebe, moorhen, peregrine falcon and sparrowhawk. Barnacle goose, golden plover, great white egret, peregrine falcon and whooper swan are also listed under Annex I of the EU Birds Directive.

During the summer 2021 season, 28 target species were recorded. Of these, six species were red-listed (curlew, golden plover, kestrel, lapwing, snipe and swift), 14 species were amber-listed (black-headed gull, coot, great crested grebe, greylag goose, hen harrier, herring gull, lesser black-backed gull, mallard, mute swan, swallow, teal, tufted duck, whooper swan and wigeon) with the remainder green-listed (buzzard, Egyptian goose, great black-backed gull, grey heron, moorhen, peregrine falcon, pink-footed goose and sparrowhawk). Golden plover, hen harrier, peregrine falcon and whooper swan are also listed under Annex I of the EU Birds Directive.

During the summer season 2022, 28 target species were recorded. Of these four were red-listed (curlew, kestrel, lapwing, and snipe), 15 species were amber-listed (black-headed gull, common sandpiper, coot, gadwall, garganey, great crested grebe, greylag goose, lesser black-backed gull, mallard, mute swan, swallow, teal, tufted duck, whooper swan and wigeon) with the remainder green-listed (buzzard, great black-backed gull, green sandpiper, grey heron, little egret, moorhen peregrine falcon, sparrowhawk and whimbrel). Little egret, peregrine falcon and whooper swan are also listed under Annex I of the EU Birds Directive.

Species have been selected for detailed discussion on the basis of conservation status, vulnerability to wind farm developments and if species sightings have been confirmed on or near the Proposed Development site, which will indicate potential links between species recorded at the proposed site and the surrounding environment.

Table 5-41: Target species and species of conservation concern recorded during Barnadivane hinterland surveys between October 2020 and September 2022

Species	BoCCI*	Annex I**	Winter 20/21	Winter 21/22	Summer 21	Summer 22
Barnacle Goose	**Amber**	**Yes**	**X**	**X**		
Black-headed Gull	Amber	No	X	X	X	X
Black-tailed Godwit	Red	No	X	X		
Brent Goose	Amber	No	X			
Buzzard	Green	No	X	X	X	X
Common Sandpiper	Amber	No				X
Coot	Amber	No	X	X	X	X
Curlew	Red	No	X	X	X	X
Dunlin	Red	No	X	X		
Egyptian Goose	Green	No			X	
Gadwall	Amber	No		X		X
Garganey	Amber	No				X
Golden Plover	**Red**	**Yes**	**X**	**X**	**X**	
Goldeneye	Red	No		X		
Goosander	Amber	No	X	X		

Species	BoCCI*	Annex I**	Winter 20/21	Winter 21/22	Summer 21	Summer 22
Great Black-backed Gull	Green	No	X	X	X	X
Great Crested Grebe	Amber	No	X	X	X	X
Great White Egret	**Green**	**Yes**		**X**		
Green Sandpiper	Green	No	X	X		X
Greenshank	Green	No	X			
Grey Heron	Green	No	X	X	X	X
Greylag Goose	Amber	No	X	X	X	X
Hen Harrier	**Amber**	**Yes**			**X**	
Herring Gull	Amber	No			X	
Kestrel	Red	No		X	X	X
Lapwing	Red	No	X	X	X	X
Lesser Black-backed Gull	Amber	No	X	X	X	X
Little Egret	**Green**	**Yes**	**X**	**X**		**X**
Little Grebe	Green	No	X	X		
Mallard	GAmber	No	X	X	X	X
Moorhen	Green	No	X	X	X	X
Mute Swan	Amber	No	X	X	X	X
Peregrine Falcon	**Green**	**Yes**		**X**	**X**	**X**
Pink-footed Goose	Green	No	X		X	
Shoveler	Red	No	X			
Snipe	Red	No	X	X	X	X
Sparrowhawk	Green	No		X	X	X
Swallow	Amber	No			X	X
Swift	Red	No			X	
Teal	Amber	No	X	X	X	X
Tufted Duck	Amber	No	X	X	X	X
Water Rail	Green	No	X			

Species	BoCCI*	Annex I**	Winter 20/21	Winter 21/22	Summer 21	Summer 22
Whimbrel	Green	No				X
White-fronted Goose	**Amber**	**Yes**	**X**			
Whooper Swan	**Amber**	**Yes**	**X**	**X**	**X**	**X**
Wigeon	Amber	No	X	X	X	X
Woodcock	Red	No	X			

* Species of conservation concern in Ireland (BoCCI) (Gilbert et al., 2021)

** Species listed on Annex 1 of the Birds Directive (EC, 2009)

Winter and Breeding Transect Surveys

Transect surveys for all species were recorded during surveys of the Proposed Development over two winters and two summers. This survey captured the baseline of avian species using the site as well as their abundance and includes seasonal visitors of the winter (i.e., redwing) and summer months (i.e., swallow). Over the entire survey period, a total of 38 bird species were recorded. No Annex I listed species were recorded, while four are red-listed (grey wagtail, kestrel, meadow pipit and redwing) and eight are amber-listed (goldcrest, greenfinch, house sparrow, lesser black-backed gull, starling, swallow and willow warbler). The recorded information is provided in Table 5-45:

Table 5-42: Avaifauna species recorded during Barnaidvane transect surveys (wintering and breeding) between October 2020 and September 2022 inclusive

Species	BoCCI*	Annex I**	Winter 20/21		Winter 21/22		Summer 21		Summer 22	
			Total	Mean	Total	Mean	Total	Mean	Total	Mean
Blackbird	Green	No	22	2.2	17	2.1	14	1.8	10	1.4
Blackcap	Green	No	-	-	-	-	1	1	-	-
Blue Tit	Green	No	10	2	1	1	2	2	1	1
Bullfinch	Green	No	-	-	3	3	-	-	-	-
Buzzard	Green	No	-	-	1	1	-	-	1	1
Chaffinch	Green	No	34	3.8	13	4.3	7	1.8	5	1
Coal Tit	Green	No	7	1.75	2	1	-	-	2	2
Dunnock	Green	No	11	1.8	1	1	2	1	2	1
Goldcrest	Amber	No	4	2	1	1	1	1	1	1
Goldfinch	Green	No	-	-	-	-	-	-	19	4.8

Species	BoCCI*	Annex I**	Winter 20/21		Winter 21/22		Summer 21		Summer 22	
			Total	Mean	Total	Mean	Total	Mean	Total	Mean
Great Tit	Green	No	14	2.8	3	1.5	1	1	3	1.5
Greenfinch	Amber	No	2	2	-	-	-	-	-	-
Grey Wagtail	Red	No	-	-	1	1	-	-	1	1
Hooded Crow	Green	No	22	2.4	20	1.7	6	1.5	14	2.3
House Sparrow	Amber	No	2	2	-	-	-	-	-	-
Jackdaw	Green	No	152	13.8	34	4.9	27	5.4	17	8.5
Kestrel	Red	No	-	-	-	-	1	1	-	-
Lesser Black-backed	Amber	No	-	-	-	-	-	-	177	22.1
Lesser Redpoll	Green	No	-	-	-	-	-	-	1	1
Linnet	Amber	No	-	-	-	-	1	1	6	3
Magpie	Green	No	8	1.6	1	1	1	1	3	3
Meadow Pipit	Red	No	25	3.1	26	8.7	13	4.3	9	1.8
Mistle Thrush	Green	No	-	-	5	1.7	1	1	1	1
Pheasant	Green	No	1	1	1	1	1	1	1	1
Pied Wagtail	Green	No	3	1.5	5	1.7	1	1	1	1
Raven	Green	No	3	1.5	1	1	-	-	2	1
Redwing	Red	No	136	15.1	37	12.3	-	-	-	-
Robin	Green	No	30	3	17	1.6	6	2	11	1.8
Rook	Green	No	184	14.2	58	7.3	10	3.3	240	40
Sedge Warbler	Green	No	-	-	-	-	1	1	1	1
Siskin	Green	No	-	-	1	1	-	-	1	1
Song Thrush	Green	No	16	2.3	2	1	1	1	1	1
Starling	Amber	No	229	20.8	184	46	6	1.5	170	34
Stonechat	Green	No	3	1.5	2	1	-	-	1	1
Swallow	Amber	No	-	-	-	-	3	3	1	1
Willow Warbler	Amber	No	-	-	-	-	3	1	11	1.1

Species	BoCCI*	Annex I**	Winter 20/21		Winter 21/22		Summer 21		Summer 22	
			Total	Mean	Total	Mean	Total	Mean	Total	Mean
Woodpigeon	Green	No	5	1.7	30	7.5	10	2	4	1
Wren	Green	No	21	3	10	1.7	10	3.3	21	2.1

* Species of conservation concern in Ireland (BoCCI) (Gilbert et al., 2021)

** Species listed on Annex 1 of the Birds Directive (EC, 2009)

Breeding Wader Surveys

Snipe was the only wader species recorded during the 2021 and 2022 breeding wader surveys. There were two separate records of Snipe heard calling on the 11th of April 2021. One snipe was heard calling while it was flying over farmland and another snipe was heard calling, while it was flying over heath bog. Both encounters involved bird heard calling but were not seen.

5.3.8 Aquatic Ecology

Description of Watercourses in the study area

The Proposed Wind Farm project is located in an upland area within the townlands of Capeen East, Moneygaff East and Lactanashinnagh, approximately 5km southwest of Kilmurry, Co. Cork. The Proposed Development site is within the Southwestern River Basin District and within hydrometric area 19 (Lee, Cork Harbour and Youghal Bay) within the Lee[Cork]_SC_030 and Lee[Cork]_SC_050 river sub-catchments. The Proposed Development site is drained by the Cummer River (EPA code: 19C02) to the north and the Moneygaff East Stream (19F09), Barnadivane Stream (19B22) and River Bride (EPA code: 19B04) to the south.

The watercourses and aquatic surveys sites in the vicinity of Barnadivane wind farm are typically small, upland eroding channels (FW1; Fossitt, 2000). Predominantly, the watercourses flow over areas of Devonian old red sandstone, sandstone, conglomerate and mudstone (Geological Survey of Ireland data). Land use practices in the wider survey area comprise pastures (CORINE 231), with localised coniferous forests (CORINE 312) and transitional woodland scrub (CORINE 324).

River Bride [Cork]

A total of four contemporary EPA biological monitoring stations were located on the River Bride (19B04). The river achieved Q4 (good status) at Hornhill Bridge (station RS19B040400, survey site B5) in 2020. The river achieved Q3-4 (moderate status) at station RS19B040600 near Crookstown in 2020, approx. 1.6km downstream of survey site B6. The water quality improved to Q4 (good status) at Coolmucky Bridge (station RS19B040900) in 2020 but declined to Q3-4 (moderate status) at Kilcrea Bridge (station RS19B041300) in 2020.

The upper reaches of the Bride (Bride (Lee)_010 river waterbody) achieved high status in the 2013-2018 period and were considered 'not at risk' of achieving target good status water quality (WFD Risk 3rd cycle). The Bride (Lee)_020, Bride (Lee)_030 and Bride (Lee)_050 also achieved good status in the same period. The Bride (Lee)_030 and Bride (Lee)_040 river waterbodies were considered 'at risk' of not achieving target good status water quality (WFD Risk 3rd cycle). The primary risk to water quality within these river waterbodies is wastewater discharge (EPA, 2019).

Cummer River

Three contemporary EPA biological monitoring stations were located on the River Cummer (19C02). The river achieved Q4 (good status) at station RS19C020200 (survey site A3) in 2020. The river achieved Q4-5 (high status) at station (RS19C020500) approx. 0.6km downstream of survey site A4. In the lower reaches, at Athsollis Bridge (station RS19C020800), the river achieved Q4 (good status) in 2020.

The Cummer River in Cummer_010 and _020 river waterbodies achieved good status in the 2013-2018 period and were considered 'not at risk' of achieving target good status water quality (WFD Risk 3rd cycle).

Desktop Study

Fisheries survey sites were present on the Cummer River (EPA code: 19C02), Clearagh Stream (19C64), River Bride (19B04), Moneygaff East Stream (19F09) and Barnadivane Stream (19B22) (see Appendix 5.4).

The River Bride (19B04) rises 1.5km upstream of the Proposed Development (near Coppeen) and meanders for approx. 35km before it joins the River Lee (19L03) at Inniscarra Graveyard near Ballincollig. It is a productive river and contains a good population of brown trout (*Salmo trutta*) and, in the lower reaches, Atlantic salmon (*Salmo salar*) (O'Reilly, 2009). Lamprey (*Lampetra sp.*) are also known from the River Bride (NPWS data).

Fisheries data for the other watercourses within the survey area was not available at the time of survey although many are locally known to support brown trout populations.

Aquatic Ecology Baseline Results

Full report in Aquatic Ecology Report detailed in Appendix 5.4.

Survey Site A1

Given the presence of salmonids, in addition to good status water quality, the aquatic ecological evaluation of site A1 was of *Local* importance.

Survey Site A2

Given the presence of salmonids, the aquatic ecological evaluation of site A2 was of *Local* importance.

Survey Site A3

Given the presence of salmonids and high-quality salmonid habitat, in addition to Annex I floating river vegetation (3260) and good status water quality, the aquatic ecological evaluation of site A3 was of *Local* importance.

Survey Site A4

Given the presence of salmonids, high-quality salmonid habitat and good status water quality, in addition to utilisation by Annex II otter, the aquatic ecological evaluation of site A4 was of *Local* importance.

Survey Site A5

Given the presence of salmonids, high-quality salmonid habitat and good status water quality, in addition to Annex II *Lampetra sp*., Annex I floating river vegetation (3260) and utilisation by Annex II otter, the aquatic ecological evaluation of site A5 was of *Local* importance.

Survey Site B1

Given the presence of salmonids, in addition to good status water quality, the aquatic ecological evaluation of site B1 was of *Local* importance.

Survey Site B2

Given the presence of salmonids, in addition to good status water quality, the aquatic ecological evaluation of site B2 was of *Local* importance.

Survey Site B3

Given the absence of aquatic species or habitats of higher conservation value, in addition to poor status water quality, the aquatic ecological evaluation of site B3 was of *Site* importance.

Site B4

Given the presence of salmonids (including Annex II Atlantic salmon), high-quality salmonid habitat and good status water quality, in addition to Annex I floating river vegetation (3260), the aquatic ecological evaluation of site B4 was of local importance (higher value).

Site B5

Given the presence of salmonids (including Annex II Atlantic salmon), high-quality salmonid habitat and good status water quality, in addition to Annex I floating river vegetation (3260) and utilisation by Annex II otter, the aquatic ecological evaluation of site B5 was of *Local* importance.

Site B6

Given the presence of salmonids (including Annex II Atlantic salmon), high-quality salmonid habitat and good status water quality, in addition to utilisation by Annex II otter, the aquatic ecological evaluation of site B6 was of *Local* importance.

White-clawed Crayfish

No White-clawed Crayfish were detected within the study area during surveys. The watercourses within the Proposed Development are not suitable for white-clawed crayfish and they have not been recorded within 10km of the Proposed Development historically.

Annex I Habitat

There is floating river vegetation at the lower reaches of the Blackwater (Clare) which may correspond the Annex I habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' (3260) (i.e. 'floating river vegetation').

Non-native Invasive Species

No invasive species were recorded during aquatic surveys.

Freshwater Pearl Mussel

No mussels were found in any of the survey sites in either the Cummer or the Bride and there are no records of FPM anywhere in either of these rivers on the NPWS database. Composite water samples collected from the Cummer River and the River Bride returned a negative result for freshwater pearl mussel, i.e. freshwater pearl mussel eDNA not present or was present below the limit of detection in a series of 12 qPCR replicates (0 positive replicates out of 12, respectively). These results were considered as evidence of the species' absence at and or upstream of the sampling locations.

5.3.9 Other Species

A desk study covering other protected or rare fauna (amphibians, reptiles and terrestrial invertebrates) was carried out using NPWS and NBDC data for the 10 km grid square W36 overlapping the study area.

Amphibians

Smooth Newt *Lissotriton vulgaris* has been recorded within 10 km grid square W36 overlapping the Proposed Development. There are no high-resolution records (up to 2 km2) overlapping the Proposed Development site.

There is also suitable habitat for common frog *Rana temporaria* in the wet grassland and drainage ditches.

Invertebrates

Marsh fritillary (*Euphydryas aurinia*) is a vulnerable butterfly species listed on Annex II of the Habitats Directive. This species has been historically recorded in the hectad W36 overlapping the Proposed Development site. No large stands of the larval food plant, devils bit scabious *Succisa pratensis*, was noted during botanical surveys. A number of near threatened invertebrates species have been historically recorded in the 10 km grid squares overlapping the Proposed Development. These are listed below in Table 5-43.

A detailed search using the biodiversity Ireland web viewer indicated none of these species has been recorded within the Proposed Development site.

Table 5-43: Rare/ protected terrestrial invertebrate species (NBDC records for X12)

Common name	Latin name	Date of last record	Designation
Gatekeeper	*Pyronia tithonus*	1999	Near threatened
Marsh Fritillary	*Euphydryas aurinia*	2018	Annex II
Small Heath	*Coenonympha pamphilus*	2021	Near threatened

5.4 Biodiversity Evaluation

5.4.1 Habitat Evaluation

Table 5-44 below outlines the ecological resources in the form of habitat types found within the study area. Key receptors as per NRA guidance (NRA 2009a and CIEEM, 2018), for which impact assessment is to be carried out, are also indicated.

The habitats within the Proposed Development site are dominated by improved agricultural grassland GA1 and wet grassland (GS4), with lesser areas of scrub (WS1) and conifer plantation (WD4).

Habitats evaluated as *Local* Importance and above which are within the development footprint or zone of influence of proposed infrastructure are classified as key receptors, while habitats outside the development footprint or zone of influence or those within the development footprint evaluated as *Site* Importance are not classified as key receptors.

Table 5-44: Summary of habitat evaluations and identification of key receptors

Fossitt Habitat Classification (Code)	Evaluation (CIEEM 2018)	Rationale	Key Receptor
Improved Agricultural Grassland (GA1)	Site Importance	Intensively managed and artificial habitat of limited biodiversity value.	No
Wet grassland (GS4)	Local Importance	A habitat likely to be of local importance to avifauna and small mammals as a viable foraging habitat and localised refuge. This habitat is overlapped by access tracks, turbine hard standings, met mast access track and foundations. There are areas of diverse and flushed wet grassland on peaty soils located within the southern section of the site.	Yes
Scrub (WS1)	Local Importance	A habitat of moderate floristic value. However, scrub habitats provide valuable ecosystem services for other semi-natural habitats and faunal species in the locality in terms of cover, refuge and connectivity. Overlapped by proposed access tracks.	Yes
Conifer woodland (WD4)	Site Importance	A habitat of poor floristic value. However, conifer woodland can provide suitable habitat for faunal species in the locality in terms of cover, refuge, and connectivity. Conifer woodland onsite is represented by small scattered areas, 0.38Ha within the study areas, or 0.4% of habitat areas. Proposed access tracks overlap conifer plantation.	No
Drainage Channels (FW4)	Local Importance	Indirect effects including siltation and pollution could occur.	Yes
Eroding/upland river (FW1)	Local Importance	Indirect effects including siltation and pollution could occur.	Yes
Hedgerows (WL1)	Local Importance	Hedgerows are a valuable semi-natural habitat and provide ecosystem services to a range of ecological receptors. This habitat is intersected by proposed access tracks and overlapped by a number of turbine hard standings.	Yes
Treelines (WL2)	Local Importance	Treelines are a valuable semi-natural habitat and provide ecosystem services to a range of ecological receptors. This habitat is intersected by proposed access tracks and overlapped by a number of turbine hard standings.	Yes

5.4.2 Fauna (excluding avifauna) Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the Proposed Development are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2018). Table 5-45 below outlines the key receptors selected for assessment and the rationale for same.

Table 5-45: Evaluation of Fauna

Fossitt Habitat Classification (Code)	Consevration Status	Evaluation	Rationale	Key Receptor
Bats	EU Habitats Directive Annex IV; Wildlife Act (Amendment) 2000	*National* Importance	Bat activity at the Proposed Development. Recent records of bat roosts and activity within 2km of the Proposed Development.	Yes
Badger	Wildlife Act (Amendment) 2000	*Site* Importance	No setts observed within the vicinity of the Proposed Development. Suitable foraging habitat within wind farm site for surrounding populations.	Yes
Pygmy Shrew	Wildlife Act (Amendment) 2000	*Site* Importance	No records within the Proposed Development site but may still use the site.	Yes
Red Squirrel	Wildlife Act (Amendment) 2000	*Site* Importance	Not recorded within the Proposed Development site. Suitable habitat within small stands of conifer plantations and treelines.	Yes
Otter	EU Habitats Directive Annex II and Annex IV; Wildlife Act (Amendment) 2000	*Local* Importance	No records for otter exist within the Proposed Development site. This species has been recorded downstream via aquatic surveys and could be subject to indirect effects.	Yes
Hedgehog	Wildlife Act (Amendment) 2000	*Site* Importance	Not recorded within Proposed Development but suitable habitats onsite.	Yes
Irish Hare	Wildlife Act (Amendment) 2000	*Site* Importance	Not recorded within Proposed Development but suitable habitats onsite.	Yes
Fox	None	*Site* importance	Present onsite but not of conservation concern.	No

Fossitt Habitat Classification (Code)	Consevration Status	Evaluation	Rationale	Key Receptor
Wood Mouse	None	*Site* Importance	Records in local area. Not of conservation concern.	No
American Mink	Invasive non-native species	Not of conservation importance	Records in local area. Not of conservation concern.	No
Bank Vole	Invasive non-native species	Not of conservation importance	Records in local area. Not of conservation concern.	No
Brown Rat	Invasive non-native species	Not of conservation importance	Records in local area. Ubiquitous rodent likely to be present nearby. Not of conservation concern.	No
Rabbit	Invasive non-native species	Not of conservation importance	Present onsite but not of conservation concern.	No
House Mouse	Invasive non-native species	Not of conservation importance	Records in local area. Not of conservation concern.	No
Sika Deer	Invasive non-native species	Not of conservation importance	Records in local area. Not of conservation concern.	No

5.4.3 Avifauna Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the Proposed Development are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM 2018). Table 5-46 outlines the key receptors selected for assessment and the rationale for same based on NRA guidance (NRA, 2009a); the overall importance or sensitivity evaluation for each key receptor, taken from guidance such as Percival 2007 is also illustrated.

Table 5-46: Avifauna Key Receptor Evaluations

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Barnacle goose	Annex 1 Amber Listed (Win.)	International and European.	Not recorded within the flight activity survey area. Closest record ca. 6.3 km from site.	No	Very High
Black-headed gull	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area. Closest record ca. 6.3 km from site.	No	Medium
Black-tailed godwit	Red Listed	Site	Not recorded within the flight activity survey area.	No	High

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
	(Win.)		Recorded twice during winter hinterland surveys. Closest record ca. 6.3 km from site.		
Brambling	Amber Listed (Win.)	Site	Not recorded within the flight activity survey area. Recorded once during breeding hinterland surveys, within 5km of the Proposed Development.	No	Medium
Brent goose	Amber Listed (Win.)	Site	Not recorded within the flight activity survey area. Closest record ca. 8 km from site.	No	Medium
Buzzard	Green	Local	Recorded within the flight activity survey area.	Yes	Low
Common Sandpiper	Amber Listed (Br.)	Site	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Coot	Amber Listed (Br. & Win.)	Site	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Cormorant	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Curlew	Red Listed (Br. & Win.)	National	Not recorded within the flight activity survey area. Closest record 7.5 km from site, outside Curlew max range of 2km.	No	High
Dunlin	Annex I Red Listed (Br. & Win)	National	Not recorded within the flight activity survey area.. No suitable habitat onsite.	No	Very High
Egyptian goose	Green	Site	Not recorded within the flight activity survey area. Recorded once during breeding hinterland surveys. Closest record ca. 6.3 km from site.	No	Low
Gadwall	Amber Listed (Br. & Win)	Site	Not recorded within the flight activity survey area.	No	Medium

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			Re. No suitable habitat onsite.		
Garganey	Amber Listed (Br.)	Site	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Goldcrest	Amber Listed (Br.)	County (or other local authority-wide area)	Common resident. Recorded as a non-target species during vantage point surveys and breeding bird and winter transects. Likely breeding in hedgerows onsite.	Yes	Medium
Golden Plover	Annex I Red Listed (Br. & Win)	International and European	Recorded within the flight activity survey area.	Yes	Very High
Goldeneye	Red Listed (Win.)	Site	Not recorded within the flight activity survey area. Recorded once during winter hinterland surveys.	No	High
Goosander	Amber Listed (Br.)	Site	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Great Black-backed gull	Green	Local	Not recorded within the flight activity survey area. Closest record ca. 6.3 km from site.	No	Low
Great crested grebe	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Great spotted woodpecker	Green Listed	Site	This green listed species was recorded within the flight activity survey area. A relatively new coloniser of Ireland.	No	Low
Great white egret	Annex I Green Listed	International and European	Not recorded within the flight activity survey area. Closest record ca. 7.5 km from site.	No	Very High
Greenfinch	Amber Listed (Br.)	County (or other local	Common resident. Recorded as a non-target species during vantage point	Yes	Medium

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
		authority-wide area)	surveys and winter transects. Likely breeding in the study area or wider area.		
Greenshank	Green Listed	Site	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Low
Grey heron	Green Listed	Local	Recorded within the flight activity survey area.	Yes	Low
Grey wagtail	Red Listed (Br.)	National	Recorded as a non-target species during vantage point surveys and breeding bird and winter transects. Likely breeding in the wider area. Potential for indirect effects via water quality.	Yes	High
Greylag goose	Amber Listed (Win.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area. Closest record ca. 6.3 km from site.	No	Medium
Hen harrier	Annex I Amber Listed (Br.)	International and European	Recorded within the flight activity survey area.	Yes	Very High
Herring gull	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Recorded within the flight activity survey area.	Yes	Medium
House martin	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during VP surveys.	Yes	Medium
House sparrow	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during winter transects.	Yes	Medium
Kestrel	Red Listed (Br.)	National	Recorded within the flight activity survey area.	Yes	High
Kingfisher	Annex I Amber Listed (Br.)	International and European	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Very High
Lapwing	Red Listed (Br. & Win.)	National	Not recorded within the flight activity survey area.	No	High

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			Closest record ca. 6.3 km from site.		
Lesser black-backed gull	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Recorded within the flight activity survey area.	Yes	Medium
Linnet	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during vantage point surveys and breeding bird transects.	Yes	Medium
Little Egret	Annex I Green Listed	International and European	Not recorded within the flight activity survey area. Closest record ca. 6.3 km from site.	No	Very High
Little grebe	Green	Site	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Low
Mallard	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Recorded within the flight activity survey area.	Yes	Medium
Meadow pipit	Red Listed (Br.)	National	Recorded as a non-target species during vantage point surveys and breeding bird and winter transects. Suitable wet grassland habitat onsite for this ground-nesting species.	Yes	High
Moorhen	Green	Local	Not recorded within the flight activity survey area.. No suitable habitat onsite.	No	Low
Mute swan	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area.. No suitable habitat onsite.	No	Medium
Peregrine	Annex I Green	International and European	Recorded within the flight activity survey area.	Yes	Very High
Pink-footed goose	Green	Site	Not recorded within the flight activity survey area. Closest record ca. 6.3 km from site.	No	Low

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Redwing	Red Listed (Win.)	National	Recorded as a non-target species during vantage point surveys and winter transects.	Yes	High
Ruff	Annex I Amber Listed	Local	Not recorded within the flight activity survey area. Closest record ca. 7.5 km from site.	No	Medium
Sand martin	Amber Listed (Br.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area. No suitable nesting habitats within the vicinity of the Proposed Development.	No	Medium
Shoveler	Red Listed (Br. & Win.)	Site	Not recorded within the flight activity survey area. Closest record ca. 6.3 km from site.	No	High
Skylark	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during vantage point surveys.	Yes	Medium
Snipe	Red Listed (Br. & Win.)	National	Recorded within the flight activity survey area. Also recorded during breeding wader surveys on the 11th of April 2021 when it was heard calling.	Yes	High
Sparrowhawk	Green	Local	Recorded within the flight activity survey area.	Yes	Low
Starling	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during vantage point surveys and breeding bird and winter transects.	Yes	Medium
Stock dove	Red Listed (Br.)	Local	Observation of two birds once during VP surveys in July 2021.	Yes	High
Swallow	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during vantage point and breeding bird surveys.	Yes	Medium
Swift	Red Listed (Br.)	County (or other local	Recorded within the flight activity survey area.	Yes	High

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
		authority-wide area)			
Teal	Amber Listed (Br. & Win.)	National	Not recorded within the flight activity survey area.. No suitable habitat onsite.	No	Medium
Tufted duck	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Water rail	Green Listed	Site	Not recorded within the flight activity survey area. Closest record ca. 7.5 km from site.	No	Low
Wheatear	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during vantage point surveys.	Yes	Medium
White-fronted goose	Annex I Amber Listed (Win.)	International and European	Not recorded within the flight activity survey area. Closest record ca. 6.3 km away from site.	No	Very High
Whooper swan	Annex I Amber Listed (Br. & Win.)	International and European	Not recorded within the flight activity survey area. Closest record ca. 6.3 km away from site.	No	Very High
Wigeon	Amber Listed (Br. & Win.)	County (or other local authority-wide area)	Not recorded within the flight activity survey area. No suitable habitat onsite.	No	Medium
Willow Warbler	Amber Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during vantage point and breeding bird surveys.	Yes	Medium
Woodcock	Red Listed (Br.)	Site	Not recorded within the flight activity survey area. Recorded once during hinterland surveys ca. 7 km away from site.	No	Low[19]

[19] Wintering population is green listed. Only wintering woodcock were recorded at the site.

Common Name	Conservation Status	CIEEM Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Yellowhammer	Red Listed (Br.)	County (or other local authority-wide area)	Recorded as a non-target species during vantage point surveys.	Yes	High
Green-listed passerine sp.	Green Listed	Site	Recorded on various surveys throughout.	No	Negligible
Green-listed non-passerine sp.	Green Listed	Site	Recorded on various surveys throughout.	No	Negligible

(Br./Win.) refers to whether BoCCI status applies to wintering (Win) or breeding (Br) populations.

5.4.4 Aquatic Ecology Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the Proposed Development are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2018). Table 5-47 below outlines the key receptors selected for assessment and the rationale for same.

All watercourses are considered key receptors. This includes minor streams with no fisheries value due to downstream connectivity to high value watercourses.

Table 5-47: Aquatic Ecology Surveys Overview and Evaluation

Site no.	Watercourse	EPA Code	Evaluation of Importance	Rationale Summary*
A1	Cummer River	19C02	*Local* importance	Upper reaches of small, shallow upland eroding watercourse with moderate fisheries value; low density of brown trout recorded via electro-fishing; Q4 (good status) water quality
A2	Clearagh Stream	19C64	*Local* importance	Upper reaches of small, shallow upland eroding watercourse with moderate fisheries value; low density of brown trout recorded via electro-fishing; Q3-4 (moderate status) water quality
A3	Cummer River	19C02	*Local* importance	Semi-natural, medium-sized upland eroding watercourse with high value for salmonids & an excellent salmonid nursery; high density of brown trout recorded via electro-fishing; Annex I habitat floating river vegetation (3260) present; Q4 (good status) water quality
A4	Cummer River	19C02	*Local* importance	Large, semi-natural upland eroding watercourse with high value for salmonids; high density of mixed-cohort brown trout recorded via electro-fishing; otter latrine identified; Q4 (good status) water quality
A5	Cummer River	19C02	*Local* importance	Large, semi-natural upland eroding watercourse of lower gradient with good value for salmonids; moderate numbers of mixed-cohort brown trout recorded via electro-fishing in addition to Lampetra sp. & three-spined stickleback; Annex I habitat floating river vegetation (3260) present; Q4 (good status) water quality
B1	River Bride	19B04	Local importance	Uppermost reaches of small, shallow, semi-natural upland eroding watercourse with moderate fisheries value; low numbers of brown trout recorded via electro-fishing; Q4 (good status) water quality
B2	Moneygaff East Stream	19F09	Local importance	Small, high gradient upland eroding watercourse with moderate fisheries value; low numbers of brown trout recorded via electro-fishing; Q4 (good status) water quality
B3	Barnadivane Stream	19B22	*Site* importance	Upper reaches of small, semi-natural upland eroding watercourse with low fisheries value; no fish recorded via electro-fishing; Q3 (poor status) water quality; no aquatic species or habitats of high conservation value
B4	River Bride	19B04	*Local* importance	Medium-sized, semi-natural upland watercourse of lower gradient with good value for salmonids with good quality salmonid spawning & nursery habitat; high numbers of brown trout and low numbers of Atlantic salmon recorded via electro-fishing; Annex I habitat floating river vegetation (3260) present; Q4 (good status) water quality
B5	River Bride	19B04	*Local* importance	Large, natural, high energy upland eroding watercourse of good value for salmonids; brown trout, Atlantic salmon & Red-listed European eel recorded via electro-fishing; a regular otter spraint site was recorded; Annex I habitat floating river vegetation (3260) present; Q4 (good status) water quality

Site no.	Watercourse	EPA Code	Evaluation of Importance	Rationale Summary*
B6	River Bride	19B04	*Local* importance	Large, natural, high energy upland eroding watercourse of high value for salmonids & an excellent salmonid nursery; moderate numbers of brown trout and high numbers of Atlantic salmon recorded via electro-fishing; regular otter spraint site recorded; Q4 (good status) water quality
B4	River Bride	19B04	*Local* importance	Medium-sized, semi-natural upland watercourse of lower gradient with good value for salmonids with good quality salmonid spawning & nursery habitat; high numbers of brown trout and low numbers of Atlantic salmon recorded via electro-fishing; Annex I habitat floating river vegetation (3260) present; Q4 (good status) water quality

* Conservation value: Atlantic salmon (*Salmo salar*), Lampetra spp. and otter (*Lutra lutra*) are all listed under Annex II of the Habitats Directive [92/42/EEC]. Furthermore, Atlantic salmon, Lampetra spp. are also listed under Annex V of the Habitats Directive [92/42/EEC] while otter are also listed on under Annex IV of the Habitats Directive [92/42/EEC]. Otters (along with their breeding and resting places) are also protected under provisions of the Irish Wildlife Acts 1976 to 2021. European eel are 'critically endangered' according to most recent ICUN red list (Pike et al., 2020) and listed as 'critically engendered' in Ireland (King et al., 2011). With the exception of the Fisheries Acts 1959 to 2019, brown trout have no legal protection in Ireland.

5.5 Do Nothing Scenario

If the Proposed Development does not proceed, the 'do nothing' scenario is that the existing environment and key receptors identified in 5.3 are likely to remain as described previously. This assumes the continuation of existing agricultural activities at the Proposed wind farm site but excludes forestry operations (thinning, harvesting and replanting).

If agricultural management activities proceed, the grassland onsite will undergo changes as they are tilled and subsequently replanted. Although key ecological receptors can fluctuate in abundance and may be found in different locations during different stages of said agricultural operations (, overall, the habitats and species found at the project will likely remain as they are currently.

5.6 Potential Impacts on Ecology

5.6.1 Construction Phases

5.6.1.1 Designated Sites

European sites

There are no designated European sites within the Proposed Development site, therefore no direct impacts are predicted during construction of the project. No works are required within any of these European sites.

An Appropriate Assessment Screening Report and Natura Impact Statement (NIS) have been prepared (Appendix 5.6) to provide the competent authority with the information necessary to complete an Appropriate Assessment for the Proposed Project in compliance with Article 6(3) of the Habitats Directive.

As per the EPA Guidance (2022), "*a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites contained in a Natura Impact Statement" but should "incorporate their key findings as available and appropriate*".

The Stage One Appropriate Assessment Screening report concluded that:

> *In the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of The Gearagh SPA cannot be excluded on the basis of objective scientific information.*

A Natura Impact Statement was therefore prepared. The elements of the Proposed Development, during construction, operation and decommissioning, which were identified as posing a pressure on the qualifying interests of the Gearagh SPA are identified as potential for collision with turbine towers, blades (moving or stationary) and/or associated infrastructure. These may also act as a barrier to dispersal during the operational phase. Mallard was not shown to be utilising the ground of this Proposed Development site, therefore habitat loss is not a potential impact.

The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the Proposed Development will not adversely affect the integrity of any European site.

Natural Heritage Areas or Proposed Natural Heritage Areas

Please note, details on the findings of the AA Screening/NIS report are included here to provide a summary of findings for European sites which overlap with National sites. This is not intended to replace assessment of National sites in their own right, which is also provided in this section.

A total of one pNHA within 15 km of the Proposed Development ZoI overlap European Sites for which likely significant effects have been identified within the AA Screening Report:

- The Geragh pNHA overlaps the Geargh SPA and the Gearagh SAC.

The NIS concluded the following:

In the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of the Gearagh SPA cannot be excluded on the basis of objective scientific information. A Natura Impact Statement was therefore prepared. The elements of the Proposed Development, during construction, operation and decommissioning, which were identified as posing a pressure on the qualifying interests of the Gearagh SPA are identified as potential for collision with turbine towers, blades (moving or stationary) and/or associated infrastructure. These may also act as a barrier to dispersal during the operational phase. Mallard was not shown to be utilising the habitats within the Proposed Development site, therefore habitat loss is not a potential effect.

The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the Proposed Development will not adversely affect the integrity of any European site.

Bandon Valley South of Dunmanway pNHA overlaps Bandon River SAC, which is not hydrologically connected to the Proposed Development. No pathways for likely significant effects on Bandon River SAC were identified in the Appropriate Assessment Screening, Appendix 5.6.

Within 15 km of the Proposed Development site there are a further seven pNHAs:

- Boylegrove Wood pNHA
- Lough Allua pNHA
- Killaneer House Glen pNHA
- Prohus Wood pNHA
- Lough Gal pNHA
- Bandon Valley West Of Bandon pNHA
- Glashgarriff River pNHA

None of the other sites are overlapped by any European site.

Potential Direct Impacts

The Proposed Development site is not within the boundaries of any designated nature conservation site. All pNHAs/NHAs previously described are outside the footprint of the Proposed Development site and therefore, no direct impacts are predicted.

Potential Indirect Impacts

In considering the potential for indirect impacts via the hydrological network, the following key information on water regions is of relevance; the Proposed Development site is situated within the Lee[Cork]_SC_050 and Lee[Cork]_SC_030 waterbody sub-catchment which includes the following two waterbody sub-basins overlapped by the Proposed Development site:

- BRIDE (LEE)_010– IE_SW_19B040400
- CUMMER_010- IE_SW_19C020500

The Gearagh pNHA (000108) is located c. 6 km from the Proposed Development. The features of interest for this pNHA are Wetland and Waterbirds. The Proposed Development site is located too far from the Gearagh to give rise to disturbance of birds using the site, and the Proposed Development site itself is not of value to waterbirds, with only limited, non-breeding waterbird activity having been recorded during ornithological surveys. There is no hydrological connection between the Proposed Development site and Gearagh pNHA.

Lough Gal pNHA (001067) is located 12km from the Proposed Development. The features of interest for this pNHA within the ZoI are wildfowl, ducks, geese and swans. The Proposed Development site is located too far from Lough Gal to give rise to disturbance of birds using the site, and the Proposed Development site itself is not of value to waterbirds, with only limited, non-breeding waterbird activity having been recorded during ornithological surveys. There is no hydrological connection between the Proposed Development site and Lough Gal pNHA.

All other aforementioned pNHA sites are not within the ZoI of the Proposed Development, Table 5-24. As such potential indirect effects are precluded for these sites.

Other Designated Sites

The Dunmarklun Wet Woodland is downstream of the Proposed Development site., via the Cummer 19 River. This woodland is an alder woodland with occasional ash and willow species. No rare or protected species are noted, and therefore no direct or indirect impacts from the Proposed Development on this woodland are predicted.

5.6.1.2 Habitats and Flora

Potential Direct Impacts

Table 5-48 details the areas covered by all habitats and habitat mosaics within the habitat survey study area. It also indicates which habitats are key receptors and summarises the anticipated habitat loss which will result from the Proposed Development. Table 5-49 summarises habitat loss for linear habitats. Areas of anticipated habitat loss are depicted in Figure 5-12.

Table 5-48: Anticipated Habitat loss (habitat areas) within the Proposed Development site

Habitat (Code)	Key Receptor	Total habitat in Study Area (Ha)	% of total Study Area	Loss (area) (Ha)	% loss of total habitat type within the Study Area (%)
Improved agricultural grassland (GA1)	No	80.1	73.3	5.29	6.6
Wet grassland (GS4)	Yes	24.13	21	1.05	4.4
Scrub (WS1)	Yes	3.39	3.1	0.89	26
Conifer plantation (WD4)	No	0.38	0.3	0.01	2.6
Buildings and artificial surfaces (BL3)	No	1.28	1.2	0.02	1.6

Table 5-49: Habitat loss/alteration (linear habitats) as a result of the Proposed Development site

Habitat (Code)	Key Receptor	Total habitat in Study Area (km)	% of total Study Area	Loss (length) (km)	% loss of total habitat type within the Study Area (%)
Hedgerows (WL1)	Yes	8.9	54.7	1.6	18
Treelines (WL2)	Yes	1.7	10.6	0.24	14.1
Upland eroding rivers (FW1)	Yes	0.8	5	0	0
Drainage ditches (FW4)	Yes	1.3	8	0.02	1.5
Buildings and artificial surfaces (BL3)	No	3.6	21.8	0.9	25

The construction of access roads, temporary compound, on-site substation, foundations and hard standings as well as the excavation of cable trenches will result in a degree of habitat damage and loss. The habitat loss will be the total area covered by the access tracks (new sections and upgrading of existing tracks), plus the footprint associated with each of the six proposed turbines (foundations, hard standings, and associated bat clearance buffers) and all other wind farm infrastructure.

The most abundant habitat type within the study area is improved agricultural grassland which on its own accounts for 80.1 Ha (73.3 % of the study area). This is followed by wet grassland which accounts on its own for 24.13 Ha (21 % of the study area). Scrub is the third most abundant habitat within the study area, accounting for 3.39 Ha (3.1 % of the total).

Approximately 5.29 Ha (6.6%) of Improved agricultural grassland (GA1) within the Study Area will be lost under the footprint of the Proposed Development. Due to its artificial character and intensive management, GA1 has low intrinsic value in ecological terms and as such is not considered a key ecological receptor. Improved agricultural grassland will be subject to *Long-term Slight irreversible Site impacts*.

Wet grassland will be subject to loss of c. 1.05 Ha (4.4 %) of the total of this type within the study area. A *Long-term Slight irreversible Site impact* is predicted for this habitat.

In terms of collective loss of all grassland habitats, c. 6.05 Ha (6.4 %) of this grouping will be lost.

For conifer plantation, 0.01 Ha (2.6 %) of this habitat will be lost. Commercial conifer plantation, a monoculture commercial crop, is not a key receptor however, due to it's artificial nature and low floristic diversity. It has low intrinsic value in ecological terms and as such is not a key ecological receptor. This is considered to translate into a *Long-term Not Significant irreversible Site impact.*

Scrub is also present within the proposed footprint, with 0.89 Ha which equates to approximately 26% of the scrub habitat recorded within the Study Area) of this habitat type anticipated to be lost under the footprint of the Proposed Development combined with the bat buffer clearance areas. Scrub will be subject to *Medium-term Not Significant Reversible Site impact*.

As the buildings and artificial surfaces onsite consist of existing roads and hardstanding areas that will be upgraded, there will be no loss of this habitat onsite.

Approx. 1,641m of Hedgerows will be lost within the development footprint. This represents approx. 18 % of the total length of hedgerow within the study area. This is considered to translate into a *Long-term Moderate Local irreversible impact*.

Approximately 337m of treelines is anticipated to be lost within the development footprint. This represents approximately 14.1 % of the total length of treelines within the study area. Considering the relatively small proportion of this habitat which will be lost and the non-native nature of these treelines, a *Long-term Slight Local irreversible impact* is predicted.

A section of drainage ditch ca. 19m in length will be culverted (using 450mm diameter pipe) under a proposed access track. The drainage ditch in question has no fisheries value. This represents 1.5 % of the total length of drainage ditches within the study area. An additional section of drainage ditch will be cleared of vegetation extending beyond the bat buffer of T2, to discourage bats travelling along this drainage ditch towards T2 and to redirect them along existing hedgerows onsite, see Figure 3-2 in Appendix 5.7 for location. Vegetation will be cleared along c. 132m of this drainage ditch. The drainage ditch will remain, and only vegetation composition will be altered, therefore this is not considered under habitat loss. Considering the small proportion of this habitat which will be lost, localised nature of loss and lack of fisheries value, a *Long-term Imperceptible irreversible Site impact* is predicted.

Potential Indirect Impacts

Indirect impacts on habitats and flora include the spread of invasive species which could be distributed during construction works. During the site walkovers a total of six invasive and/or non-native species were observed at the Proposed Development site, namely Himalayan knotweed, cherry laurel, sycamore, sitka spruce, fuchsia, and New Zealand holly. A number of these species, including third schedule Himalayan knotweed, could potentially be spread by construction activities due to their close proximity to the access tracks. The risk of impact and legal status of these species is detailed in Table 5-28. Construction works could affect the existing environment by facilitating the spread of these species. It is considered that prior to mitigation a *Long-term Moderate Reversible Local Impact* could arise.

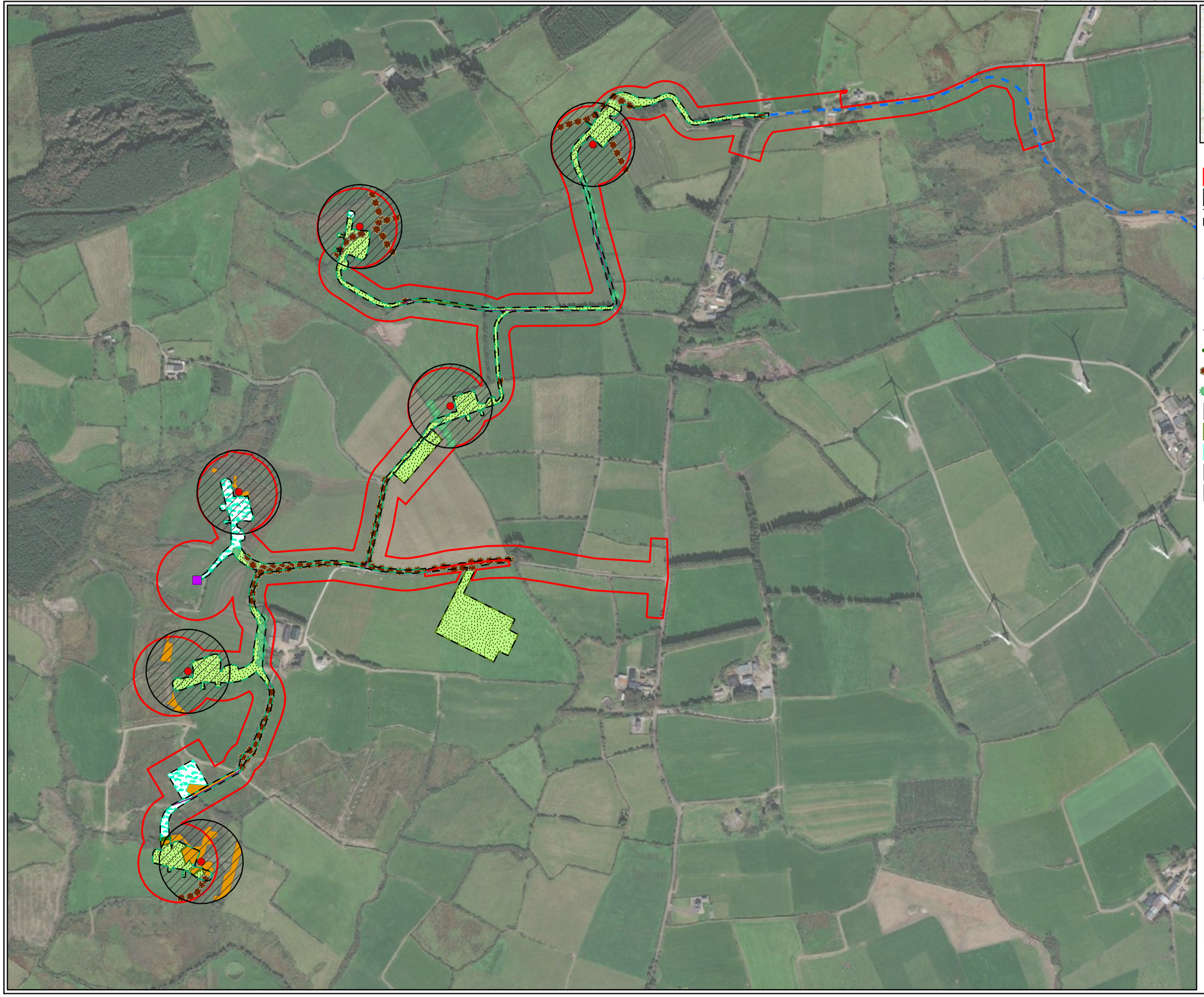
Deposition of dust could affect adjacent terrestrial habitats by inhibiting plant growth and contributing to the sediment load in watercourses. The Air Quality and Climate Chapter (Ch. 14) identified the Proposed Development site as a major construction site, which will result in soiling effects potentially occurring up to 100m from the source, with PM_{10} deposition and vegetation effects occurring up to 25m. A *Short-term Moderate Reversible Local Impact* in terms of vegetation effects is predicted.

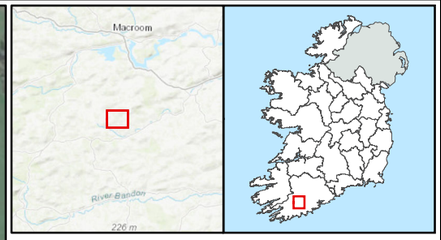
The deposition of dust in watercourses contributing to siltation of the hydrological network is identified as a *Short-term Not Significant Reversible Local Impact*. Potential effects on the aquatic receiving environment are considered in detail below.

The runoff of surface water containing sediment and pollutants into the surrounding waterbodies is discussed in 5.6.1.6.

The dewatering of excavations for turbine base construction could result in the drying out of surrounding habitats. Turbine T4 is located within wet grassland habitat. As dewatering is a temporary measure, *Temporary Slight-Moderate Reversible Local Impact* is predicted.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-12_Habitat_Loss_A3.mxd





Legend

- Development Planning Boundary
- Bat Vegetation Clearance Buffer
- Habitat Loss Buffer
- Proposed Met Mast
- Proposed Turbine Layout
- Turbine Delivery Route

Habitats

Fossitt Code

- BL3, Buildings and Artificial Surfaces
- FW4, Drainage Ditches
- WL1, Hedgerows
- WL2, Treelines
- BL3, Buildings and artificial surfaces
- GA1, Improved agricultural grassland
- GS4,Wet grassland
- WD4, Conifer plantation
- WS1, Scrub

0 200 400 800 Meters

TITLE: Habitat Loss

PROJECT: Barnadivane Wind Farm and Substation, Co. Cork

FIGURE NO:	5.12		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:7500	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

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5.6.1.3 Mammals (excluding bats)

Potential direct impacts

The construction of the Proposed Wind Farm and the Proposed Substation in addition to vegetation clearance buffers will lead to a permanent loss of approximately 7.26 Ha or c. 6.6% of habitats within the study area.

In parallel, the clearance and maintenance of buffer zones surrounding turbines located in scrub and near hedgerows/treelines will result in habitat alteration (from scrub to open habitats). The majority of scrub habitats within the study area will be retained, and similar habitats are present in the general area. Similarly, the loss of open habitats will be minimal and similar habitats are present in the surrounding landscape.

As such, the relatively small-scale loss of habitat at the Proposed Development site will not result in a significant negative impact on the distribution of local protected mammal fauna including Pygmy Shrew, Irish Hare, and Hedgehog.

Any unmitigated impacts to these species will be a *Short-term Imperceptible Reversible Site Impact*.

Badger

This species was not recorded during surveys, but occurs in desktop records in the locality, and the grassland habitats onsite are suitable for foraging badgers of surrounding populations. The total loss of grassland habitats within the study area will be 6.34 Ha or 6.1 % of the total habitat type within the study area. There are however ample areas of grassland habitats in the immediate area and greater surroundings. The impact to badger will be *Short-term Slight Reversible Site Impact*

Red squirrel

This species was not recorded during surveys, but occurs in desktop records in the locality, and the small stands of conifers, hedgerows and treelines onsite are suitable for red squirrel. The total loss of plantation habitats within the study area will be between 0.1 Ha or 2.6 % of the total habitat type within the study area. There are however ample areas of conifer plantation and mixed broadleaved woodland outside the Proposed Development, in the immediate area and greater surroundings. Conifer plantations are harvested and replanted as trees reach maturity and therefore the availability of this habitat is subject to transition as a resource for red squirrel under normal circumstances. As red squirrel are present in the area, a precautionary approach is required, and it is assumed that they may occur in any area where tree removal is proposed.

There is therefore the possibility that red squirrel breeding or resting sites may be disturbed during any tree removal. While no dreys were recorded during surveys and the habitat onsite are limited in value due to the small scale, if a drey were to be established within the footprint of tree removal works in the future, this could lead to a *Short-term Slight Reversible Site Impact* on red squirrel (prior to mitigation).

*5.6.1.4 **Bats***

Wind energy developments and associated infrastructure present a number of potential construction-phase impacts to bats, namely:

1. Damage of or disturbance to roost sites during construction
2. Loss or fragmentation of habitat

The impacts listed above are most relevant to the construction phase of the project. The following provides an assessment of the potential impacts on bats during the construction phase.

Potential Direct Impacts

Direct impacts 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.

No demolition or modification of existing buildings has been proposed as part this project, notably the buildings identified as roosts outside the site in Section 5.3.6 will remain in situ. Throughout the proposed construction corridor vegetation clearance will be required to facilitate access and construction activities, including creating gaps through treelines/hedgerows. In addition, vegetation clearance required to implement proposed bat buffers and substation standoffs has the potential to directly impact on roosting bats.

Vegetation clearance proposed for the following areas around turbines:

- The removal or surgery of discreet section conifer treelines and broadleaved hedgerows for the construction of the access track between turbines.
- Scrub removal surrounding T4, T5 and T6 and along access tracks between turbines.
- The removal of discreet sections of gorse dominated hedgerows at all turbine locations.
- The removal of discreet sections of willow dominated treelines/ hedgerows at T5 and T6.

As highlighted in the baseline survey results, no trees within the study area were confirmed as roost sites during the course of the survey undertaken in March 2022. The trees classified as being of moderate and low moderate suitability for roosting bats are located outside the proposed site boundary and therefore will not be directly impacted. The trees within the site are classified as having negligible bat roosting potential. It is considered that prior to mitigation a *Short-term Slight Reversible Site Impact* on bats could occur.

Potential Indirect Impacts

Potential indirect impacts 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, there will be no regular night-time working at the site and as such no additional lighting will be required for sustained periods during the construction phase of the works. Construction operations shall generally be restricted to between 08:00 hours and 19:00 hours Monday to Saturday. All bat roosts recorded during surveys are a minimum of 200m from the planning boundary. This precludes any disturbance effects to the roosts from the Proposed Development, including from artificial lightning.

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 – lesser horseshoe bats, brown long-eared bats and Myotis species. Lesser horseshoe bats are notably sensitive to light pollution.

The Proposed Development site holds a number of hedgerows, treelines, and woodland that are known to be used by foraging and commuting bats. The baseline study shows that linear features, the connecting treelines and hedgerows and vegetated drainage ditches are highly active foraging grounds for bats. Vegetation removal detailed in the previous section will also impact on bat foraging patterns within the site. The removal of vegetation capable of disrupting connectivity within the site is likely to occur at all turbine locations.

In the absence of mitigation, vegetation removal has the potential secondary impacts of the proposal upon bats are considered, without mitigation, to be *Short-term Significant Reversible Local Impact*.

5.6.1.5 Avifauna

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

Regarding impacts on bird species, it is considered that the main potential source of impacts on avian fauna is the construction of the Proposed Development, particularly the construction of turbines and the associated road network.

Consideration of the survey data against Table 5-46 indicates that three 'Very High' sensitivity species have been recorded within the Proposed Development study area (500m turbine buffer) and wider area (10 km turbine buffer) which have been identified as key receptors:

- Golden plover
- Hen harrier
- Peregrine

Consideration of the survey data against Table 5-49 indicates that eight 'High' sensitivity species have been recorded within the study area Proposed Development (500m turbine buffer) and wider area (5 km turbine buffer) which have been identified as key receptors:

- Grey wagtail
- Kestrel
- Meadow pipit
- Redwing
- Snipe
- Stock dove
- Swift
- Yellowhammer

'Medium' sensitivity species are also considered in this assessment. The 13 medium sensitivity species recorded within the Proposed Development study area (500m turbine buffer) and wider area (5 km turbine buffer) which have been identified as key receptors are:

- Goldcrest
- Greenfinch
- Herring gull
- House martin
- House sparrow
- Lesser black-backed gull
- Linnet
- Mallard
- Skylark
- Starling
- Swallow
- Wheatear
- Willow warbler

A total of three 'Low' sensitivity species are considered in this assessment:

- Buzzard
- Grey heron
- Sparrowhawk

Habitat Loss or Alteration

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to the above factors. For direct impacts during construction land take of potential breeding or foraging habitat is the primary impact. This may constitute land stripping or vegetation removal affecting ground nesting birds, hedgerow removal or trimming if this takes place during the breeding season and loss of nesting or roosting sites such as trees.

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

The construction of the wind farm tracks, turbine foundations and hard standings, substation compound and temporary site compound will result in some habitat damage and loss. Permanent clearance of scrub, hedgerows and treelines will also be required around the turbines and along the new access roads. The habitat loss will be the total area covered by the roads plus the footprint of each of the six proposed turbines. Vegetation clearance will be required at all of the turbines. Habitat that will be lost will be dominated by Improved agricultural grassland, followed by wet grassland.

For the purpose of the consideration of the potential effects to birds, species have been grouped into four categories namely passerines, birds of prey, gulls and waders/waterfowl (including geese and swans).

A passerine is any bird of the order Passeriformes, which includes more than half of all bird species. A notable feature of passerines is the arrangement of their toes (three pointing forward and one back) which facilitates perching. The group are sometimes known as perching birds or, less accurately, as songbirds.

Birds of prey are raptors that actively hunt other bird species. Waders are shorebirds with most species eating small invertebrates picked out of mud or exposed soil. Waterfowl are swimming gamebirds and are comprised of ducks, geese and swans.

Passerines

The loss of habitat due to the construction of the project has the potential to affect passerines. This can result in reduced feeding and nesting opportunities for birds. However, direct habitat loss by the development of wind farms tends to be relatively small (Drewitt and Langston 2006).

The Proposed Development site is dominated by pasture (improved agricultural grassland and wet grassland). Improved agricultural grassland is typically species poor and offers low value habitat for birds species. Wet grassland provides suitable habitat for passerine species.

There will be an approximate loss of 5.29 Ha (equating to 6.6 % of this habitat type within the study area) of improved agricultural grassland, and approx. 1.05 Ha (equating to 4.4 % of this habitat type within the study area) of wet grassland. It is noted the overall habitat loss for grassland habitats combined is 6.34 Ha or 6.1 %.

Linear habitat loss includes approx. 1,642m (equating to 18 % of this habitat type within the study area) of hedgerows, approximately 337m (equating to 14.1 % of this habitat type within the study area) of treelines.

Goldcrest, greenfinch, house sparrow, linnet, wheatear and willow warbler (Percival sensitivity: Medium), as well as Yellowhammer (Percival sensitivity: High), are species which may use the treelines and hedgerows at the site to nest and forage within. Greenfinch and linnet may also forage for seeds in wet grassland onsite. These are habitats which are common in the area of the Proposed Development. The higher impact Percival magnitude: medium (5-20% habitat loss for hedgerow and treelines) applies, resulting in a Percival impact significance of Low. The resultant loss for these species is deemed to be a *Local Long-term Not Significant effect and Reversible*.

Meadow pipit (Percival sensitivity: High) is a ground-nesting species which use the grassland habitats at the Proposed Development site to breed and forage. Percival impact significance is High based on medium magnitude (5-20 % habitat loss for grassland habitats). The loss of wet grassland and improved agricultural grassland on this species will give rise to a *Local Short-term Slight effect which is Reversible*. The predicted impact is lower than the Percival significance due to the abundance of similar agricultural habitats present in the area. Also, as bat buffer areas is revegetated with grassland species it will provide further foraging habitat for these species.

Redwing (Percival sensitivity: High) are winter visitors which may use the grassland habitats onsite to forage in. This species has been added to the red list due to the severity of long and short-term declines in it's wintering population. Suitable foraging habitat is generally abundant in agricultural landscapes, as is the case at the Proposed Development site and surrounding area. Percival impact significance is High based on medium magnitude (5-20 % habitat loss for grassland habitats). A *Local Temporary Not Significant and Reversible* effect is predicted for redwing due to the abundance of similar agricultural habitats in the area and mobility of wintering flocks.

Skylark (Percival sensitivity: Medium) are likely to use the proposed site primarily to forage in grassland, as they typically breed in cultivated areas, ungrazed grasslands and heathlands. Suitable foraging habitat is generally abundant in agricultural landscapes, as is the case at the Proposed Development site and surrounding area, and a *Local Short-term Imperceptible Reversible effect* could occur for skylark. Percival impact significance is Low based on medium magnitude (5 – 20 % habitat loss for grassland habitats).

Stock Dove (Percival sensitivity: High) are likely to use the proposed site primarily to forage in grassland, but could also use cavities in mature trees and buildings to nest in. Considering there are no suitable mature trees with cavities within and adjacent to the Proposed Development footprint, a *Site Short-term Imperceptible Reversible effect* could occur for starling. Percival impact significance is Low based on medium magnitude (5 – 20 % habitat loss for grassland habitats).

Swallow and House Martin (Percival significance: Medium) and Swift (Percival significance: High)are aerial species which forage over open habitats. There will be some loss of improved grassland and wet grassland. Percival impact significances are and Low based on medium magnitude (5-20 % habitat loss for grassland habitats), however these species forage over variety of open habitats present in the wider area beyond the site. As such potential impacts are not defined solely by the percentage of habitat loss at the scale of the proposed site and loss of these habitats for these species will give rise to a Local Temporary Imperceptible effect.

Starlings and House Sparrow (Percival sensitivity: Medium) are likely to use the proposed site primarily to forage in grassland, but could also use cavities in mature trees and buildings to nest in. Considering there are no suitable mature trees with cavities or buildings within and adjacent to the Proposed Development footprint , a *Site Short-term Imperceptible Reversible* effect could occur for starling. Percival impact significance is Low based on medium magnitude (5 – 20 % habitat loss for grassland habitats).

Grey wagtail (Percival sensitivity: High) forage along watercourses and may nest in bridges and buildings. As such this species will not be subject to the direct effect of habitat loss. White-throated dipper (Percival sensitivity: Low) also forage along watercourses and nest in bridges.

Birds of Prey, Gulls, Waders/ Waterfowl - Other Target Species

Table 5-50 below displays the direct impact character during construction as well as the significance of impacts without the implementation of mitigation.

Table 5-50: Impact of habitat loss to other target species

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Buzzard (Low)	This species was observed during two years of summer and winter VP surveys with flights regularly recorded within the study area. Buzzard was the most active target species recorded in the rotor sweep zone.	Magnitude of effects is assessed as Low (1-5 % habitat lost), species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)
Golden Plover (Very High)	This species was recorded five times during the 2021 VP surveys and was not recorded during the 2022 VP surveys. This species was observed flying through the site, consisting of 0.726% of all VP	Magnitude of effects is assessed as Negligible (>1% habitat lost), species sensitivity is Very High, overall effect

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	observations in the flight activity survey area, and 0.501% of all VP observations in the rotor sweep zone. Outside the breeding range of the Irish population. Considering the lack of usage of the 500 m turbine buffer, beyond birds occasionally flying through the area, the Proposed Development site and surrounding area was not found to be used by golden plover. Also, due to the fragmented nature of the wet grassland and the intensive nature of the remaining grassland, roosting habitat for golden plover is unlikely. As such the potential for roosting or foraging golden plover to use the habitats onsite is negligible. Effects on open agricultural habitats potentially used for foraging will be minimal (loss of 1.05 Ha/4.4 % of wet grassland).	significance is High (Criteria: Percival, 2003). Considering the suboptimal & fragmented nature of potential wader habitats onsite, combined with the absence of foraging Golden plover records from site walkovers and absence of roosting habitat within the proposed footprint, the assessment cannot be based solely on the proportion of potential sub-optimal wader foraging habitat loss at the proposed site. As such, the proposed impact of habitat loss will be a Local Long-term Not Significant effect (Criteria: EPA, 2022)
Grey Heron (Low)	This species was recorded three times onsite over the two-year survey period, all of individual birds. No habitats of potential value to this species will be lost.	Magnitude of effects is assessed as Negligible (<1% habitat lost), species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)
Hen Harrier (Very High)	This species was recorded twice during the two years of VP surveys. Both hen harrier recorded where winter season records. Based on limited habitat suitability for roosting hen harriers within the 500 m turbine buffer and the low usage recorded, survey effort provides a high level of confidence that there is no roost within the study area over the winter. Considering the exceptionally low usage of the 500 m turbine buffer, beyond providing habitat for the occasional foraging hen harrier, the Proposed Development site and surrounding area, recorded once during hinterland surveys c. 3km from the Proposed Development, was not found to be important for hen harriers. As such the potential for roosting or breeding hen harriers to use the habitats onsite is negligible.	Magnitude of effects is assessed as Negligible (<1% habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Herring Gull (Medium)	Four observations of herring gull were recorded, of one or two birds. This species was observed flying through the site, consisting of 0.058% of all VP observations in the flight activity survey area, and 0.050% of all VP observations in the rotor sweep zone. This species could occasionally forage in agricultural fields within site. Surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 6.34 Ha (6.1 % of total grouping) of combined grassland types, habitats common in the general area.	Magnitude of effects is assessed as Medium (5-20% habitat lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)
Kestrel (High)	Over the two-year study period, kestrels regularly foraged through the 500 m turbine buffer over both winter and breeding seasons. No breeding site were identified in the 500 m turbine buffer. Based on recorded activity, this site is used by foraging kestrels. The Proposed Development will alter the habitat mosaics present, however new edge effects will be created through this process. Effects on open agricultural habitats and open scrub mosaics potentially used for hunting will be minimal-moderate (loss of 1.05 Ha/ 4.4% of Wet grassland: loss of 0.89 Ha/ 26% of scrub mosaics). The former are abundant in the locality. Loss of hedgerow will be between 1,642m (18% of total within study area). It is noted that the figures quoted apply only to the Proposed Development site, and similar habitats are abundant in the wider area, reducing the percentage loss of potentially suitable habitats to c. 1-5% at the local scale.	Magnitude of effects is assessed as Low (1-5% habitat lost), species sensitivity is High, overall effect significance is High (Criteria: Percival, 2003). The proposed impact of hunting habitat loss will be a Local Short-term Moderate effect, reducing over time to a Local Long-term Slight effect considering the abundance of similar habitats in the surrounding area. (Criteria: EPA, 2022)
Lesser Black-backed Gull (Medium)	This species was recorded frequently during summer VP surveys and during the surveys in winter to a lesser extent. This species could occasionally forage in agricultural fields within site. Surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 6.34 Ha (6.1 % of total grouping) of combined grassland types and mosaics, habitats common in the general area.	Magnitude of effects is assessed as Medium (5-20% habitat lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Mallard (Medium)	Four observations of mallard were recorded, of two or three birds. This species was observed flying through the site, with no habitat which could be potentially used by this species is present within the proposed footprint.	Magnitude of effects is assessed as Negligible (<1% habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)
Peregrine (Very High)	Over the two years of surveys peregrine activity in the 500m turbine buffer was found to be low 14 observations across the two year period, and each observation was of a single bird. This species was observed flying through the site. There is no suitable nesting habitat for peregrine within the 2 km turbine buffer, which likely explains the relatively low levels of activity recorded in the general area. 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. As such there is no potential for roosting or breeding peregrine to use the habitats onsite.	Magnitude of effects is assessed as Negligible (<1% habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)
Snipe (High)	Snipe were heard calling twice on the 11th of April 2021. However there were not seen and no snipe was seen during wader surveys later in the breeding season 2021. No waders were noted at all during wader surveys in 2022. VP records of snipe were from the winter seasons, with the exception of a record on the 25th of September 2022 The agriculturally improved grassland in the majority of the 500 m turbine buffer is largely unsuitable for supporting breeding waders, although there are some less managed fields dominated by Juncus species and occasional patches of wet ground offering potential habitat for breeding snipe. Effects on open agricultural habitats potentially used for foraging or breeding will be minimal (loss of 1.05 Ha/4.4 % of Wet grassland). These habitats are common in the general area.	Magnitude of effects is assessed as Low (1-5% habitat lost), species sensitivity is High, overall effect significance is Medium (Criteria: Percival, 2003). The proposed impact of habitat loss will be a Local Long-term Moderate effect (Criteria: EPA, 2022).
Sparrowhawk (Low)	A relatively high level of sparrowhawk activity was recorded in the study area during VP surveys (19 observations). No breeding sites were recorded during surveys.	Magnitude of effects is assessed as Medium (5-20 % habitat lost), species sensitivity is Low, overall effect significance is Low (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	Effects on open wet grassland habitats and scrub mosaics potentially used for hunting will be minimal-moderate (loss of 1.05 Ha/ 4.4% of Wet grassland: loss of 0.89 Ha/ 26% of scrub). The latter are abundant in the locality, particularly conifer plantation margins outside the proposed footprint. Loss of hedgerow potentially of use for hunting will be between 1,642 km (18% of total within study area).	The proposed impact of habitat loss will be a Local Long-term Imperceptible effect (Criteria: EPA, 2022)

Disturbance and Displacement

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

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

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

Indirect Construction Impacts on Avifauna are shown in Table 5-51 below:

Table 5-51: Indirect Construction Impacts on Avifauna

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Buzzard (Low)	Possible noise/visual intrusion disturbance to breeding and hunting birds within the site may occur. Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: Low. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).
Goldcrest (Medium)	Recorded during transect counts within the site. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have	Probability of temporary to short-term impacts. Sensitivity: Medium; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via clearance of tree lines and hedgerows; these activities could also cause indirect disturbance.	
Golden Plover (Very High)	This species was recorded five times during the 2021 VP surveys and was not recorded during the 2022 VP surveys. This species was observed flying through the site, consisting of 0.726% of all VP observations in the flight activity survey area, and 0.501% of all VP observations in the rotor sweep zone. Considering the lack of usage of the 500 m turbine buffer, beyond birds occasionally flying through the area, the Proposed Development site and surrounding area was not found to be used by golden plover. Also, due to the fragmented nature of the wet grassland and the intensive nature of the remaining grassland, roosting habitat for golden plover is unlikely. Literature suggests differences in densities pre- and post-construction of wind farms not significant (Pearce-Higgins et al., 2012), implying low levels of permanent displacement.	Probability of temporary to short-term disturbance to winter birds. Sensitivity: Very High. Magnitude assessed as Negligible. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Temporary Not Significant effect (Criteria: EPA, 2022).
Greenfinch	Recorded during transect counts within the site. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via vegetation clearance and construction on open habitats; these activities could also cause indirect disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Grey Heron (Low)	Recorded three times onsite over the two-year survey period, all of individual birds. No habitats of potential value to this species will be lost. No breeding activity has been observed at the Proposed Development site or in the surrounding area. Foraging birds are likely to be disturbed. Grey Heron are known to acclimate to disturbance and are likely to continue foraging in other parts of the site away from areas subject to disturbance.	Probability of temporary to short-term impacts. Sensitivity: Low; magnitude Medium. Overall impact is Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Not Significant effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Grey wagtail (High)	Grey Wagtail was recorded during transect surveys. Grey Wagtail are generally tolerant of human presence. As such the mode of disturbance most likely to occur is indirect via pollution of watercourses which could affect foraging habitat, see Section 5.2.4.5. Given the potential for harmful emissions prior to mitigation, effects in this category must be considered.	Probability of temporary to short-term impacts. Sensitivity: High. Magnitude assessed as Medium. Overall significance assessed as High. (Criteria: Percival, 2003). Due to impacts to water quality (in the absence of mitigation) disturbance and/or displacement will be a Local Short-term Significant effect (Criteria: EPA, 2022).
Hen Harrier (Very High)	This species was recorded twice during the two years of VP surveys. Both hen harrier recorded where winter season records. Based on limited habitat suitability for roosting hen harriers within the 500 m turbine buffer and the low usage recorded, survey effort provides a high level of confidence that there is not a roost in regular use over the winter. Considering the exceptionally low usage of the 500 m turbine buffer, beyond providing habitat for very occasional foraging hen harrier, the Proposed Development site and surrounding area was not found to be important for hen harriers. Disturbance to birds hunting within the site and birds breeding/hunting near the site could potentially occur during vegetation clearance and construction works. Based on the limited occurrence of hen harrier at the proposed site however, the likelihood disturbance resulting in significant effects is unlikely.	Probability of temporary to short-term impacts. Sensitivity: Very High. Magnitude assessed as Negligible. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Herring Gull (Medium)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands	Probability of temporary to short-term impacts. Sensitivity: Medium. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).
House Martin (Medium)	Human presence is unlikely to alter the foraging patterns of this species, and no breeding habitat will be subject to disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium. Magnitude assessed as Negligible. Overall significance assessed as Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
House sparrow (Medium)	Recorded during surveys within the site. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via vegetation clearance and construction on open habitats; these activities could also cause indirect disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Kestrel (High)	Over the two-year study period, kestrels regularly foraged through the 500 m turbine buffer over both winter and breeding seasons. No breeding sites were recorded in the 500 m turbine buffer due to the lack of suitable habitats present. Based on recorded activity, this site is used by foraging kestrels. Disturbance to hunting kestrels could occur across the proposed site. Such disturbance would be temporary and localised however, and large areas of the site and surrounding area would remain available for use.	Probability of temporary to short-term impacts. Sensitivity: High. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	Possible indirect impact to commuting/foraging birds within the area, particularly within improved agricultural grasslands	Probability of temporary to short-term impacts. Sensitivity: Medium. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).
Linnet (Medium)	Recorded during surveys within the site. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via vegetation clearance and construction on open habitats; these activities could also cause indirect disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Mallard (Medium)	Four observations of mallard were recorded, of two or three birds. Mallard commuting over the site could alter course or altitude due to human presence.	Probability of temporary to short-term impacts. Sensitivity: Medium; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Meadow pipit (High)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands.	Probability of temporary to short-term impacts. Sensitivity: High; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Peregrine (Very High)	Over the two years of surveys peregrine activity in the 500m turbine buffer was found to be low and each observation was of a single bird. There is no suitable nesting habitat for peregrine within the 2 km turbine buffer. 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. Disturbance to commuting peregrine could occur across the proposed site. Such disturbance would be temporary and localized however, and large areas of the site and surrounding area would remain available for use.	Probability of temporary to short-term impacts. Sensitivity: Very High; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).
Redwing (High)	Recorded during surveys onsite. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands. Adequate displacement habitat is available in the surrounding area to offset any potential temporary disturbance.	Probability of temporary to short-term impacts. Sensitivity: High. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Skylark (Medium)	Recorded during surveys onsite. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands. Adequate displacement habitat is available in the surrounding area to offset any potential disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Snipe (High)	Recorded during VP surveys as well as breeding wader surveys of the site. The agriculturally improved grassland in the majority of the 500 m turbine buffer is largely unsuitable for supporting breeding waders, although there are some less managed fields dominated by Juncus species and	Probability of temporary to short-term impacts. Sensitivity: High. Magnitude assessed as Medium. Overall significance assessed as Medium. (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	occasional patches of wet ground offering potential habitat for breeding snipe. A potential snipe breeding territory overlaps part of the Proposed Development and as such disturbance to breeding birds is likely to occur. Breeding snipe can experience disturbance at distances of 500m (Pearce-Higgins et al. 2009). During vegetation clearance/construction activities, breeding and wintering snipe may be disturbed within the site or nearby.	Disturbance and/or displacement will be a Local Short-term Moderate effect (Criteria: EPA, 2022).
Sparrowhawk (Low)	No breeding sites were recorded during surveys. Disturbance to hunting sparrowhawks could occur across the proposed site. Such disturbance would be temporary and localised however, and large areas of the site and surrounding area would remain available for use.	Probability of temporary to short-term impacts. Sensitivity: Low. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).
Starling (Medium)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands. Adequate displacement habitat is available in the surrounding area to offset any potential disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Stock Dove (High)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands. Adequate displacement habitat is available in the surrounding area to offset any potential disturbance.	Probability of temporary to short-term impacts. Sensitivity: High. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Swallow (Medium)	There is no potential swallow breeding habitat within or in close proximity to the proposed site. Human presence is unlikely to alter the foraging patterns of this species, and potential feeding habitat for swallow is abundant in the wider landscape.	Probability of temporary to short-term impacts. Sensitivity: Medium. Magnitude assessed as Negligible. Overall significance assessed as Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Swift (High)	There is no potential swift breeding habitat within or in close proximity to the proposed site. Human presence is unlikely to alter the foraging patterns of this species, and potential feeding habitat for swift is abundant in the wider landscape.	Probability of temporary to short-term impacts. Sensitivity: High. Magnitude assessed as Negligible. Overall significance assessed as Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).
Wheatear (Medium)	Recorded during transect surveys. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via construction upon agricultural grasslands. Adequate displacement habitat is available in the surrounding area to offset any potential disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium. Magnitude assessed as Low. Overall significance assessed as Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Willow warbler (Medium)	Recorded during transect counts within the site. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via vegetation clearance of scrub and hedgerows; these activities could also cause indirect disturbance.	Probability of temporary to short-term impacts. Sensitivity: Medium; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Local Short-term Slight effect (Criteria: EPA, 2022).
Yellowhammer (High)	Recorded during winter transects within the site. Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Direct wintering habitat loss is the main effect via vegetation clearance and construction on open habitats; these activities could also cause indirect disturbance to wintering yellowhammer.	Probability of temporary to short-term impacts. Sensitivity: High; magnitude Low. Overall impact is Low. (Criteria: Percival, 2003). Disturbance and/or displacement loss will be a Local Short-term Imperceptible effect (Criteria: EPA, 2022).

5.6.1.6 Aquatic ecology

Wind farm developments, as with all major construction projects, have the potential to have significant negative effects on aquatic habitats and the key ecological receptors in the aquatic environment. Wind farm projects are often located near the sources of streams or rivers. These reaches are generally minor watercourses and are therefore potentially vulnerable to even relatively small pollution events. Such areas can also be important salmonid spawning and nursery areas; or can act as vectors of pollution to downstream areas. Minor headwaters and upper reaches can be of importance to protected or ecologically important features downstream.

The impacts of wind farm developments on aquatic areas are generally focused on the construction phase.

The Proposed Development will require tailored discreet clearance of trees/vegetation, particularly agricultural grassland, hedges and treelines to build site access roads, turbine foundations, hardstanding areas, substation, cable trenches and provide site drainage. These operations can effect the quality of habitats present for aquatic organisms. Wind farm construction can increase suspended solids loading of watercourses, alter recharge or drainage/runoff patterns and change surface water quantity thereby increasing flood risk for downstream watercourses, eroding watercourse banks and edges, widening channels and altering stream beds.

The potential impacts of the Proposed Development are outlined below for the construction phase of the project. These are the potential effects that could potentially occur in the absence of mitigation measures.

The watercourses on the Proposed Development site itself are small 1st order streams. The survey sites on the watercourses draining the Proposed Development site are in the upper reaches of the River Bride [Cork] and Cummer 19 River. These river stretches are of very little fisheries value. However, downstream at the receptor sites where the rivers increase in size fish diversity and habitat quality improves.

Direct Impacts

The Proposed Development site is drained by the River Bride [Cork] and Cummer 19 River. These are both located in the Lee, Cork Harbour and Youghal Bay catchment. While the watercourses onsite are not sensitive, the downstream waterbodies are sensitive ecological areas.

There is potential for releases of suspended solids and other substances associated with upgrading, realigning and construction of access roads within the site and also during the excavation work associated with these types of works. Installation, upgrading and/or extension of an internal road network on a wind farm site and excavations can result in increased silt runoff. Vegetation clearance will be required along with some discreet treeline felling in bat buffer areas, potentially resulting in the release of suspended solids. Suspended solids in even quite small quantities may have a serious effect on the spawning sites of salmonids. Spawning habitat on the Proposed Development site is not present, but does occur downstream in the Bride [Cork] River Cummer_19 River.

There are no in-stream works or stream crossings required for this development.

Permanent loss of aquatic habitats can also occur where access roads are constructed over or in close proximity to streams/rivers. However, no watercourse crossings are necessary for the Proposed Development.

'Improved' drainage of the site, along access tracks and around turbines, can potentially result in increased erosion of nearby streams and may result in lower water levels in dry weather, which will reduce the habitat available to fish. Any operations which result in loss of sediment will also result in increased nutrients being released from the soil. This has the potential to cause eutrophication of streams thereby lowering the capacity of the streams to support fish and invertebrate fauna. The construction of the Proposed Development is not expected to significantly affect the drainage regime on the site, with direct impacts affecting watercourses and aquatic ecology minimised via the protection of water quality within the site. The site surveys also revealed that the watercourses draining this area are being affected by background water quality issues, such as agricultural practises and channel maintenance. Potential direct construction phase effects on aquatic ecology, in the absence of mitigation, are assessed as being Slight Negative, Short-term, Reversible and in the local context. Mitigation is required to avoid potential effects.

Indirect Impacts

The most likely potential indirect effects during the construction phase of the wind energy development on receiving watercourses and aquatic habitats arises indirectly via impacts affecting water quality, such as accidental releases of silt laden runoff. Other potential impacts affecting aquatic ecology during the construction phase could also occur as a result of accidental spillage of cement or hydrocarbons stored on site impacting upon water quality. Waste from on-site toilets and wash facilities could also potentially have an effect on aquatic ecology.

Indirect water quality impacts can potentially occur during the construction of access roads. The access tracks will cross one manmade agricultural drain using 450mm diameter pipes. These works could result in silt run-off, pollution events originating from the site works and machinery used, which could indirectly affect areas elsewhere in the catchment. These indirect impacts could give rise to the potential for impacts affecting fish and fisheries, as well as aquatic invertebrate communities within the study area. Some of the downstream aquatic sites within the River Bride [Cork] recorded the presence of salmonids (including Annex II Atlantic salmon), high-quality salmonid habitat and good status water quality, in addition to Annex I floating river vegetation (3260), with an aquatic ecological evaluation of local importance (higher value).

Any engineering works which cause runoff of sediments can also increase the levels of nutrients in receiving streams. This can result in the enrichment or eutrophication of the affected streams and catchment areas further downstream, and a possible change in overall water quality status. Suspended solids or sediment in a river can have significant negative effects on aquatic invertebrate and instream flora. There were no aquatic species listed on Annex II of the EU Habitats Directive (92/43/EEC) found occurring on the Proposed Development site.

There is also a risk that machinery or materials imported onto the site could act as a vector for introducing or dispersing non-native invasive species. Potential indirect construction phase effects on aquatic ecology, in the absence of mitigation, are assessed as being Significant Short-term and in the local context. Mitigation is required to avoid potential effects.

5.6.1.7 Other species

Common Frog may be directly affected through habitat loss which will occur during construction, though this is considered unlikely to be significant due to the presence of similar habitats not impacted by the Proposed Development.

Common frog may also be indirectly affected through sediment or pollution run off into waterbodies. It is considered possible that any unmitigated impacts on water quality could be Significant. Interference with actively used amphibian breeding habitat during breeding periods could result in a *Short-term Significant Reversible Local Impact*.

Some invertebrate habitat will be directly lost through land take across various habitats. Due to the limited amount of habitat loss 1.95 Ha or 6.98% of suitable habitat areas (excluding improved agricultural grassland) and 2.76km of hedgerows / treelines. As a large proportion of wooded habitats being lost will be replaced with other semi-natural habitats, a *Short-term Not Significant Reversible Site Impact* is predicted for invertebrates as a general group.

5.6.2 Operational Phase

The operational phase will have lower potential for impacts on the local ecology than the construction phase. The main potential operational impacts of the project will arise from the rotation of the blades of the wind turbines and, to a lesser extent, from vehicular movement in relation to wind turbine maintenance along access roads. The rotation of the blades may result in displacement of local wildlife due to the avoidance by birds of the area around the turbines. In addition, the rotating blades present a potential collision hazard to local bird and bat species. The rotation of the blades of the turbines may also result in increased noise levels which may also cause disturbance to local wildlife. There is also potential for landscaping maintenance to cause disturbance to wildlife.

5.6.2.1 Designated Sites

European sites

A Natura Impact Statement (NIS) has been prepared for the Proposed Development. The NIS addresses potential adverse effects to the integrity of European sites resulting from the Proposed Project. The Stage One Appropriate Assessment Screening report concluded that, In the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of The Gearagh SPA cannot be excluded on the basis of objective scientific information.

The elements of the Proposed Development, during construction, operation and decommissioning, which were identified as posing a pressure on the qualifying interests of the European designated sites within the ZoI as stated above are identified as collision risk and habitat Loss for mallard.

A Natura Impact Statement was therefore required for the Gearagh SPA.

The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the Proposed Development will not adversely affect the integrity of any European site..

(Proposed) Natural Heritage Areas

As discussed above a NIS has been undertaken to identify any potential impacts to European sites (SACs and SPAs) as a result of the Proposed Development. There are two (p)NHA's within the ZoI, The Gearagh pNHA, which, overlaps with the Gearagh SPA which is assessed in the AA Screening and NIS report, and Lough Gal pNHA.

The Gearagh pNHA supports important populations of wintering waterfowl, including swans, dabbling duck, diving duck and some waders. Habitat quality is good and the site provides both feeding and roost sites for the birds. Six of the species have populations of national importance: Mute swan , wigeon, teal, shoveler, coot and golden plover . Other species which occur regularly include whooper swan, tufted duck and lapwing. The site is a Nature Reserve, Ramsar site and Biogenetic Reserve.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Gearagh SPA the competent authority is enabled to ascertain that the Proposed Development will not have any adverse effect on the integrity the Gearagh SPA in light of the site's conservation objectives and status.

Lough Gal pNHA (001067) is located 12km from the Proposed Development. The features of interest for this pNHA within the ZoI are wildfowl, ducks, geese and swans. The Proposed Development site is located too far from Lough Gal to give rise to disturbance of birds using the pNHA, and the Proposed Development site itself is not of value to waterbirds, with only limited, non-breeding waterbird activity having been recorded during ornithological surveys, see Section 5.5.3.

No operational phase impacts are predicted for the remaining pNHAs within 15 km of the Proposed Development.

5.6.2.2 Habitats and Flora

The habitats within bat vegetation clearance buffers will be maintained as treeless during the lifespan of the wind farm. This will have the effect of halting succession to scrub and woodland, producing bare/disturbed ground and grassland and rougher grassland in an ongoing cycle.

This will result in a neutral effect for each habitat type, as it will be succeeded and/or altered periodically but will return again due to ongoing maintenance. As such these habitats will persist for longer than they would if natural succession were allowed to proceed. No further habitat loss or impacts to habitats shall occur during the operational phase of the Proposed Development.

5.6.2.3 Mammals (excluding bats)

The level of human activity associated with the maintenance of the operational wind farm will be infrequent and minimal given that it will be monitored remotely. The Proposed Development is also located within an agricultural area, so there is already disturbance caused by human and machinery activity associated with agricultural management. As a result, any negative impact to terrestrial fauna as a general group during the operational phase of the Proposed Development is deemed to be a *Long-term Imperceptible Reversible Site Impact*.

5.6.2.4 Bats

Nine species of bat were recorded during the 2021 and 2022 bat surveys at Barnadivane. The table below provides an ecological valuation of each bat species and the collision risk factor in relation to wind farms. Four of the bat species recorded are considered to be High risk.

Table 5-52: Ecological evaluation of the bat species recorded during the bat survey (CIEEM Guidelines, 2018) and "Bat Risk" in relation to Wind Turbines (NatureScot 2021 and EC 2020)

Ecological Value	Geographical Scale of Importance	Bat Risk
International	Leisler's bat Lesser horseshoe bat	High Low
Regional	Brown long-eared bat Natterer's bat Nathusius' pipistrelle	Low Low High
County	-	-
Local	Soprano pipistrelle Common pipistrelle Whiskered bat Daubenton's bat	High High Low Low
Negligible	-	-

Site Risk Assessment & Impact Assessment

According to NatureScot 2021, to ensure that bats are protected by minimising the risk of collision, an assessment of impact at a site requires an appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted impacts are not mitigated.

In addition, it is recommended to consider the relevant factors in the assessment process:

- Is the bat species at the edge of its range
- Cumulative effects
- Presence of protected sites
- Proximity of maternity and winter roosts
- Key foraging areas
- Key flight lines
- Possible migration routes.

Using the NatureScot guidelines outlined in Table 5-53 the following risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

- Project Size = Medium (other wind energy developments within 10km)
- Habitat Risk = High

Table 5-53: Stage 1 - Initial site risk assessment extracted from NatureScot (2021) guidance document

Site Risk Level (1-5)*	Project Size			
		Small	Medium	Large
Habitat Risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	Description
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	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. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	Description
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

The Impact assessment is determined by multiplying the Site Risk Assessment value (4 as outlined above) by the Ecobat median (most frequent activity category) and maximum (highest activity category recorded) activity values converted to the percentile score as shown in Table 5-54.

The median activity levels for each of the High Risk (Leisler's bat, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle) species were converted to the percentile score and an average taken over the three survey periods for 2022.

The Impact Assessment is then carried out for the individual turbines using the overall site assessment value (4) and compared to the Risk Assessment Matrix (Table 5-54) in order to determine the level of overall risk to the population.

It should be noted that the Impact Assessment is based on the median values to determine overall risk to population.

Table 5-54: Bat risk assessment matrix

	Ecobat activity					
Site Risk	**Nil (0)**	**Low (1)**	**Low – Moderate (2)**	**Moderate (3)**	**Moderate – High (4)**	**High (5)**
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

Low Overall Risk (0-4)	Medium Overall Risk (5-12)	High Overall Risk (13-25)

Evaluation of 2022 survey results

With regards to the 2022 surveys, the Ecobat Median Percentile for Leisler's bat, all locations have a low risk factor. BV 1, BV2, BV3 and BV6 have a High-Risk Factor with regards to the Ecobat Maximum Percentile, while locations BV4 and BV5 have a medium Risk Factor. This is presented in Table 5-55:

Table 5-55: Risk assessment for each proposed turbine location - Leisler's bat

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
BV1	4	4	16	1	4
BV2	4	5	20	1	4
BV3	4	4	16	1	4
BV4	4	3	12	1	4

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
BV5	4	3	12	1	4
BV6	4	4	16	1	4

With regards to the 2022 surveys, the Ecobat Median and Maximum Percentile for common pipistrelle, all locations have a low risk factor. This is presented in Table 5-56:

Table 5-56: Risk assessment for each proposed turbine location - Common pipistrelle

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
BV1	4	1	4	1	4
BV2	4	1	4	1	4
BV3	4	1	4	1	4
BV4	4	1	4	1	4
BV5	4	1	4	1	4
BV6	4	1	4	1	4

With regards to the 2022 surveys, the Ecobat Median and Maximum Percentile for soprano pipistrelle, all locations have a low risk factor, except BV5 which has a medium risk factor in terms of the Maximum Percentile. This is presented in Table 5-57:

Table 5-57: Risk assessment for each proposed turbine location - Soprano pipistrelle

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
BV1	4	1	4	1	4
BV2	4	1	4	1	4
BV3	4	1	4	1	4

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
BV4	4	1	4	1	4
BV5	4	2	8	1	4
BV6	4	1	4	1	4

With regards to the 2022 surveys, the Ecobat Median Percentile for Nathusius' pipistrelle, all locations have a low risk factor, except BV4 which has a medium risk factor. All locations have a medium Risk Factor with regards to the Ecobat Maximum Percentile. This is presented in Table 5-58:

Table 5-58: Risk assessment for each proposed turbine location - Nathusius' pipistrelle

Bat detector ID No.	Site risk value	Ecobat Maximum Percentile	Turbine risk (site risk x Ecobat maximum percentile)	Ecobat median percentile	Turbine risk (site risk x Ecobat median percentile)
BV1	4	2	8	1	4
BV2	4	2	8	1	4
BV3	4	2	8	1	4
BV4	4	2	8	2	8
BV5	4	2	8	1	4
BV6	4	3	12	1	4

Habitat Assessment

The habitat assessment determines the value of the habitat to bat species with regards to potential roosting, commuting or foraging value as indicated by current guidelines and literature including (but not limited to) Collins (2016), Denzinger (2013) Kirkpatrick (2016) and Finch (2020).

Agricultural fields (improved and wet grassland)

A study carried out in the UK by Finch et al. (2020) found that bat activity for open agricultural habitats is lower than that of linear features and that bats are more likely to be associated with treelines (including mature trees within hedgerows) compared to other linear feature types. The study also found that, of all the records of bat activity, only 10% of the common pipistrelle activity was recorded within open habitats (e.g., agricultural fields). Soprano pipistrelle also showed to statistically favour linear habitats.

The agricultural fields are considered as Low Ecological value for bats.

Plantation woodland

A study by Kirkpatrick (2016) identified that, although bat associations with plantation habitat features are separated into two broad guilds (those using more complex habitats such as soprano pipistrelle and Myotis spp., and open space foragers such as noctule and to some extent common pipistrelle), all species preferentially used stand edges. Plantation edges may also allow both clutter tolerant and clutter sensitive bats access to navigate both within and around stands of plantation. The study further concluded that a possible reason for the higher activity levels found at forestry edges may be due to providing protection from the wind for weak flying prey or acting as windbreaks collecting airborne insects blown in from adjacent open or felled areas and also providing protection from predators.

The edge ecology is considered as High Ecological value for bats, while the dense woodland stands (internal ecology) are of Low Ecological value for bats at the Site.

Hedgerow (with/without treeline)

As highlighted in Fitch et al. (2020), bats are more likely to be associated with treelines (including mature trees within hedgerows) compared to other linear feature types. Therefore, the hedgerow bounding the fields are considered Moderate to High Ecological value due to the foraging and commuting potential.

Table 5-59: Summary of bat survey data and assessment

Static Detector ID	Risk Assessment Leisler's Bat		Risk Assessment Common Pipistrelle		Risk Assessment Soprano Pipistrelle		Risk Assessment Nathusius Pipistrelle		Clarifying Comment	Bat Habitat within 200m	Bat Habitat along wind farm access tracks	Bats along wind farm access tracks	If no mitigation applied, what is the potential impact level to the High Risk species
	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Ecobat Maximum Percentile	Ecobat Median Percentile	Is static at turbine location				Taking into consideration the clarrifying comment
BV1	16	4	4	4	4	4	8	4	N	Y	Y	Y	Medium
BV2	20	4	4	4	4	4	8	4	N	Y	Y	Y	Medium
BV3	16	4	4	4	4	4	8	4	N	Y	Y	Y	Medium
BV4	12	4	4	4	4	4	8	8	Y	Y	Y	Y	Medium
BV5	12	4	4	4	8	4	8	4	N	Y	Y	Y	Medium
BV6	16	4	4	4	4	4	12	4	N	Y	Y	Y	Medium

The assessments identified an overall potential for impact on the bat population at the Site as Medium for all four High Risk species; namely Leisler's bat, common, soprano, and Nathusius' pipistrelle should no mitigation be applied.

Bat mortality due to collisions with wind turbines is well known and studies have further shown that bats may be killed without physically contacting turbine blades. The death of bats due to the presence of the operating turbines may reduce local bat populations especially if a turbine is sited near a roost without appropriate mitigation. Although there are as yet no published results of a study of bat mortality from Irish wind turbines, considering recent research from mainland Europe and North America, there is an increasing amount of detailed published evidence that wind turbines cause bat fatalities. However, many of these overseas turbine/bat mortality studies are at wind farms, with significantly large numbers of turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries (Bat conservation Ireland, 2012; Dietz and Keifer, 2016).

There is currently no evidence that mortality of bats on the same scale occurs in Ireland. Also, although it is known that Nathusius' pipistrelle migrates from Scandinavia to Scotland and to the north of Ireland and back again (Russ et al., 2001), apart from this species, there is currently no evidence that internal or external migration routes of other bat species exist elsewhere in Ireland as no research has been undertaken. Nevertheless, risks to bats from wind turbines need to be acknowledged and there is the potential for some bat mortality to occur during the operation of the Proposed Development. Therefore, mitigation measures are proposed to reduce the likelihood of such fatalities.

All turbine locations are located within agricultural fields (improved or wet grassland) impacting existing sections of gorse or willow dominated hedgerows. The study conducted by Fitch (2020) identified that historic hedgerow do not influence the direction of flight for bat species. Therefore, following removal of the hedgerow in the vicinity of turbine locations, no features will remain which could influence bat species to commute via the turbine location. All static locations provide representative data of how bats use linear ecology within the study area. The assessments show there is a potential medium impact risk for Leisler's bats common pipistrelle, soprano pipistrelle, and Nathusius' pipistrelle at these proposed turbine locations in the absence of mitigation, based on this conservative assessment.

Potential Impacts

According to NatureScot (2021) wind farms can affect bats in the following ways:

1. Collision mortality, barotrauma[20] and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)
2. Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
3. Loss of, or damage to, roosts;
4. Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

[20] It should also be noted that although mortality of bats at wind farms include barotrauma (that results from exposure to the pressure variations caused by rotating turbine blades) as first presented by Baerwald et al. (2008) a number of studies since, including NREL (2012). Reducing Bat Fatalities From Interactions with Operating Wind Turbines and Lawson et al. (2020). An investigation into the potential for wind turbines to cause barotrauma in bats, dispute the hypothesis that barotrauma is responsible for a significant number of wind-turbine-related bat fatalities. However, the more recent studies have been undertaken on several mammal species (representative of bat species) as there is no data available on pressure change levels that cause barotrauma in bats.

Furthermore, as indicated in Richardson et al (2021) common pipistrelle bats may be attracted to wind turbines. The study showed common pipistrelle activity was 37% higher at turbines than at control locations. Soprano pipistrelle shows no increase in activity between the turbine and control locations. The study further discussed, the observed higher levels of activity could be because there are more bats around turbines, or because animals spend more time in these locations relative to controls, even if the number of individual common pipistrelles remains the same. We cannot distinguish between these possibilities using acoustic data. However, either way, higher levels of activity around turbines is likely to increase fatality risks and help to explain why fatality rates are often not predicted by acoustic surveys for common pipistrelle activity conducted prior to facility construction.

It has been suggested that lights for civil aviation above the nacelle may also attract bats; a 2014 study by Bennett and Hale (2014) however found there was no increased attraction of bats when red flashing lights were used versus no lighting, indicating the mode and colour of lighting are key factors in whether bats are attracted to aviation lighting. It has been observed that intense lighting can attract insects, which in turn may attract foraging bats. Light sources with an ultraviolet component or a high blue spectral content have been observed to be more attractive to night-flying insects (Bat Conservation Trust/ILP, 2018), and studies have shown that Leisler's and pipistrelle bats can congregate around white mercury streetlights (Rydell J et al 1993, Blake et al. 1994) and white metal halide lamps (Stone et al 2015) feeding on the insects drawn by the light.

As such, regarding the potential for aviation obstruction lighting to attract bats, the use of red light over white light is preferable, as is flashing over steady light. Therefore, operational stage mitigation in this area is required to ensure the type of aviation lighting selected does not increase the attractiveness of turbine locations to bats.

The foreseen potential effects during operation are as follows:

Potential Direct Impacts

- Death through collision with turbine blades as bats are known to have difficulty in detecting the moving blades with their echolocation due to the movement and the angle of the blade surfaces
- Death through barotrauma as bats may be killed by the change of atmospheric pressure resulting from the turning blades which can cause their lungs to haemorrhage.

Potential Indirect Impacts

- Indirect effects to nearby roosts are considered unlikely due to the distances of identified roosts from the closest elements of proposed infrastructure (765m, 1,000m and 695m) and intervening buffer provided by woodland plantations and hedgerows mean that no direct or indirect impacts to these roosts will occur during operation.
- The low potential (for roosting bats) trees identified outside the proposed footprint and could be subject to indirect impacts through increased noise in the event of their being occupied.

As such, any impacts on bats prior to mitigation (particularly vegetation clearance buffers) are predicted to be Long-term Significant Impacts on a Local Level and Irreversible.

5.6.2.5 Avifauna

Collision Risk

Studies on the operational effects of wind farms (Pearce-Higgins et al., 2009) have shown that certain species do exhibit levels of turbine avoidance during the operational phase which may be extrapolated to reductions in breeding bird densities. However, this may not be as significant as previously thought, certainly in comparison to effects during construction (Pearce-Higgins et al., 2012). It seems that there is little evidence for consistent post-construction population declines in any species, suggesting for the first time that wind farm construction can have greater effects on birds than wind farm operation; this is supported in the literature (Devereux et al., 2008).

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

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

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

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

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

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance between turbines and slower rotation speeds (Krijgsveld et al., 2009). Appraisal of collision risk for the Proposed Development is based on five specific sets of turbine dimensions, with rotor envelopes ranging between 36-176.5m (see Chapter 3 Description of Development, Section 3.2.2 of this EIAR).

The colour, mode, intensity and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009).

The directional intensity of lighting is also a factor in reducing the attraction of birds. As such, specification of aviation obstruction lighting to minimise effects on birds is included under operational mitigation measures.

Passerines

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

Non-Passerines

Potential collision risk to non-passerine target species is outlined in Table 5-60.

Table 5-60: Potential collision risk to non-passerine target species

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Buzzard (Low)	Twenty-seven buzzard fatalities have been recorded within the European context, with 27 recorded in a review of 46 wind farms up to 2004 (Hoetker et al., 2006). However, this number is low in relation to the estimated European population of up to one million pair (Gensbol, 2008) and best available knowledge suggests mortality due to wind farms is not sufficient to cause significant population declines of this green-listed species.	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is low, overall effect significance is low (Criteria: Percival, 2003). Probability of impact unlikely, based on recorded flight activity, with 1.295% of all VP observation time in the rotor sweep zone, published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Golden Plover (Very High)	Golden plover have been recorded in low numbers as collision fatalities at wind farms. The published avoidance rate by SNH for collision risk modelling for this species is 98% (SNH, 2018), indicating a high micro-avoidance rate regarding collision with turbines. In further support of a high micro-avoidance rate, a study in the Netherlands of three operational wind farms where golden plovers were both diurnally and nocturnally active found no fatalities. Golden plovers were not recorded foraging or roosting within the 500 m turbine envelope during the survey period which reduces magnitude.	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is very high, overall effect significance is low (Criteria: Percival, 2003). Probability of impact unlikely, with 0.038% of all VP observation time in the rotor sweep zone, published best scientific knowledge and low frequency of occurrence at the Site. Collision risk will be a long-term not significant effect (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Grey Heron (Low)	Three flights within the study area buffer were recorded, a typically below the rotor sweep area. No suitable breeding habitat within the 500 m turbine envelope which reduces magnitude.	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is low, overall effect significance is very low (Criteria: Percival, 2003). Probability of impact extremely unlikely, based on recorded flight activity, with 0.005% of all VP observation time in the rotor sweep zone, and low frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Hen Harrier (Very High)	No hen harriers were observed breeding on site, so potential collision risk significantly reduced due to the absence of breeding as territorial display known as 'skydancing', which often occurs at heights within the predicted rotor envelope. Documented as occasionally soaring or arriving at winter roosts 'at height', however no documented roosts were recorded within the surrounding areas. Literature suggests flying at low heights is a 'ubiquitous trait' supported by a number of studies. The species has a high, published avoidance rate 99% in relation to wind turbines (SNH, 2018). Two flights within the study area buffer were recorded over the two-year period.	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is very high, overall effect significance is low (Criteria: Percival, 2003). Probability of impact extremely unlikely, based on recorded flight activity, with 0.043% of all VP observation time in the rotor sweep zone, published best scientific knowledge and low frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Herring Gull (Medium)	A published review of 46 European wind farms found 189 fatalities across wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98%, suggesting birds exhibit a high level of micro-avoidance (SNH, 2018). Four flights of one or two individuals within the study area buffer were recorded over the two-year period.	Collision: Magnitude effects is assessed as medium (<1% population lost), species sensitivity is medium, overall effect significance is medium (Criteria: Percival, 2003). Probability of impact unlikely, with 0.003% of all VP observation time in the rotor sweep zone, published best scientific knowledge and low frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Kestrel (High)	29 fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European context (Hoetker et al., 2006). The published avoidance rate is 95% (SNH, 2018).	Collision: Magnitude effects is assessed as low (5-10% population lost), species sensitivity is high, overall effect significance is low (Criteria: Percival, 2003). Probability of impact unlikely, with 0.294% of all VP observation time in the rotor sweep zone, published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Lesser Black-backed Gull (Medium)	A published review of 46 European wind farms found 45 fatalities across wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH, 2018), suggesting birds exhibit a high level of micro-avoidance.	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is medium, overall effect significance is low (Criteria: Percival, 2003). Probability of impact unlikely, with 0.381% of all VP observation time in the rotor sweep zone, published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Mallard (Medium)	18 fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European context (Hoetker et al., 2006). The published avoidance rate is 98% (SNH, 2018).	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is medium, overall effect significance is low (Criteria: Percival, 2003). Probability of impact unlikely, with 0.005% of all VP observation time in the rotor sweep zone, published best scientific knowledge and low frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Peregrine (Very High)	Evidence of collision fatality is low, with only two birds recorded in published reviews of wind farm fatalities (Hoetker et al., 2006). The SNH recommended avoidance rate for collision-risk modelling is 98% (SNH, 2018), suggesting high micro-avoidance capabilities.	Collision: Magnitude effects is assessed is negligible (<1% population lost), species sensitivity is high, overall effect significance is very low (Criteria: Percival, 2003). Probability of impact unlikely, with 0.056% of all VP observation time in the rotor sweep zone, published best scientific knowledge and low frequency of occurrence at the Site.

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Snipe (High)	A published review of 46 European wind farms found 45 fatalities across wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH, 2018), suggesting birds exhibit a high level of micro-avoidance.	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is medium, overall effect significance is very low (Criteria: Percival, 2003). Probability of impact unlikely, with 0.013% of all VP observation time in the rotor sweep zone, published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).
Sparrowhawk (Low)	Sparrowhawks are a resident species of the wind farm study area, although no breeding has been recorded within the Site. Published fatality rates are low, with two fatalities from a review of 46 wind farms across Europe (Hoetker et al., 2006).	Collision: Magnitude effects is assessed as negligible (<1% population lost), species sensitivity is medium, overall effect significance is very low (Criteria: Percival, 2003). Probability of impact extremely unlikely, based on recorded flight activity, height of proposed envelope (43 - 136 m), published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a long-term imperceptible effect (Criteria: EPA, 2017).

Displacement and Disturbance

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

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

Whitfield and Madders (2006), suggest that most studies do not detect any significant displacement of raptor species by wind turbines although they note hen harrier and common buzzard may have low-medium sensitivity to displacement. There is no potential for displacement of breeding hen harrier at the proposed site due to the low suitability of the habitats onsite and the low activity levels recorded.

In a review of the published effects of wind farms on buzzard populations (Hoetker et al., 2006), it was found that overall, impacts on buzzard populations post-construction, across both winter and breeding seasons was not significant and that buzzards show habituation to the presence of wind farms (Hoetker et al., 2006).

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

Barrier Effect

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

Effects can be highly variable and range from slight 'checks' in-flight direction, height or speed, through to larger diversions around objects. Studies have shown that birds on migration may show avoidance of wind farms (Masden, 2009) but the observed distances involved were trivial in regard to total migration distances, and hence energy expenditure.

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

Potential disturbance and barrier effects due to the operation of the Proposed Development are outlined in Table 5-61.

Table 5-61: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Buzzard (Low)	Disturbance: In a review of the published impacts of wind farms on Buzzard populations (Hoetker et al., 2006), it was found that overall, impacts on Buzzard populations post-construction, across both winter and breeding seasons was not significant and that Buzzards do show habituation to the presence of wind farms (Hoetker et al., 2006). Barrier Effect: Barrier effects on either migration or regular flights of Buzzard has been shown at two out of six studies to date (2004) in a European context (Hoetker et al., 2006). The overall barrier effect was not shown to be significant.	Disturbance: Magnitude of effects is assessed as Low (1-5% of habitat/population lost), species sensitivity is Low, overall effect significance is Low (Criteria: Percival 2003). Magnitude Imperceptible due to published habituation to wind farms; overall significance considered Local Imperceptible Long-term Impact (Criteria: EPA 2022). Effect Barrier Effect: Magnitude of effects is assessed as Low , species sensitivity is Low, overall effect significance is Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		effect assessed as Imperceptible; overall significance considered Local Imperceptible Long-term effect (Criteria: EPA 2022).
Goldcrest (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. There was no information available on disturbance to goldcrest populations post-construction (Hotker et al. 2006). Barrier Effect: Hoetker et al., 2006 found no evidence of a barrier effect in Goldcrest.	Disturbance: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight to Moderate to due to high proportion of suitable breeding habitat and evidence of breeding on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Golden Plover (Very High)	Disturbance: Unlikely due to species absence within site. This species was recorded commuting through the study area on five occasions. Literature suggests differences in densities pre- and post-construction of wind farms is not significant (Pearce-Higgins et al., 2012); displacement is not significant but may occur up to 175 m (Hoetker et al., 2006). Barrier Effect: Low published avoidance rates of wind farms (Krijgsveld et al., 2009) and changes in	Disturbance: Magnitude of effects is assessed as Negligible; species sensitivity is Very High. Overall impact is Low (Criteria: Percival 2003). Magnitude Not Significant; overall significance considered Local Long-term, Not Significant effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % habitat lost), species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	densities within wind farms post construction (Pearce-Higgins et al., 2012), suggests wind farms do not act as significant barriers to golden plover. The low level of golden plover flight activity in the study area suggests any impacts will be very low or absent.	Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests low published avoidance rates of wind farms; overall significance considered a Local Imperceptible Long-term effect (Criteria: EPA, 2022).
Greenfinch (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. There was no information available on disturbance to greenfinch populations post-construction (Hotker et al. 2006). Barrier Effect: Barrier effects have been shown in a total of one study within the European context (Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight to Moderate to due to high proportion of suitable breeding habitat and evidence of breeding on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Grey Heron (Low)	Disturbance: In a review of the published effects of wind farms on grey heron populations (Hotker et al. 2006), it was found that overall, effects on grey heron populations post-construction, across both winter and breeding seasons was not significant and that grey herons exhibit very low avoidance of wind farms, implying minimal disturbance effects.	Disturbance: Magnitude of effects is assessed as Negligible, species sensitivity is low, overall effect significance is very low (Criteria: Percival 2003). Magnitude imperceptible due to published habituation to wind farms; overall significance considered a Local Imperceptible long-term Effect (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Barrier Effect: Barrier effects on either migration or regular flights of grey heron have been shown for four out of seven studies in a European context (Hotker et al. 2006). The overall barrier effect was not shown to be significant. The ornithological assessment considered impacts on grey heron to be associated with disturbance during construction, and that the Proposed Development site is not considered important for grey herons.	Barrier Effect: Magnitude of effects is assessed as Negligible (<1% of habitat/population lost), species sensitivity is low, overall effect significance is very low (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as imperceptible; magnitude of daily barrier effect assessed as imperceptible; overall significance considered a Local imperceptible long-term Effect (Criteria: EPA 2022).
Grey Wagtail (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. There was no information available on disturbance to grey wagatil populations post-construction (Hotker et al. 2006). Barrier Effect: Barrier effects have been shown in a total of one study within the European context (Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight to Moderate to due to high proportion of suitable breeding habitat and evidence of breeding on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Hen Harrier (Very High)	Disturbance: Considering the exceptionally low usage of the 500 m turbine buffer and that no roosts or breeding sites were detected within the 2 km turbine buffer, beyond providing habitat for the occasional foraging hen harrier, the	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/ habitat lost), species sensitivity is Very High, overall effect significance is low (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Proposed Development site and surrounding area was not found to be important for hen harriers. Noise disturbance/visual intrusion unlikely to deter foraging as evidence suggests birds may continue to utilise wind farms post construction (Robinson et al., 2012). Barrier Effect: Although barrier effect has been documented in at least one study in the European context; recent evidence suggests that birds continue to use wind farms post construction (Whitfield and Madders, 2006) (Robinson et al., 2012) indicating wind farms may not be significant barriers. It is also noted the turbine layout features large gaps (minimum of c. 376m) between individual turbines, avoiding a 'wall' or barrier effect.	Magnitude Not significant due to low amount of hunting activity within the site; overall significance considered a Local Long-term not significant effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Negligible, species sensitivity is Very High, overall effect significance is Low (Criteria: Percival, 2003). Magnitude to birds in terms of energy expenditure assessed as Not Significant; magnitude of daily barrier effect assessed as Not Significant; overall significance considered a Local Long-term not significant effect (Criteria: EPA, 2022).
Herring Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may impact gull species in-land. Barrier Effect: Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude of effects is assessed as Low, species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Local Long-term Not Significant effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1% population/habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term effect (Criteria: EPA 2022).
House Martin (Medium)	Disturbance: In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on disturbance to house martin populations post-construction. No house martin breeding habitat is present in the proposed footprint.	Disturbance: Magnitude of effects is assessed as Negligible, species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Barrier Effect: Barrier effects have been shown in a total of two studies within the European context (Hoetker et al., 2006).	Magnitude Imperceptible; overall significance considered Local Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible, species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term Effect (Criteria: EPA 2022).
House Sparrow (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hoetker et al., 2006 there was no information available on disturbance or barrier effects to house sparrow populations post-construction.	Disturbance: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight to Moderate to due to high proportion of suitable breeding habitat and evidence of breeding on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Kestrel (High)	Disturbance: Disturbance (in terms of minimal distance to wind farm) has been recorded in 14 studies on wind farms in Europe; however, the maximum distance recorded was 150 m (Hotker et al., 2006). This is unlikely to be significant. Habituation to wind farms has been recorded in Kestrel (Hotker et al., 2006). Barrier Effect: Barrier effects have been shown to a degree in either migrating Kestrel or regular flight paths within the European context (3 of 5 studies; Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as Low; species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Local Long-term Not Significant Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Medium (5-20% of habitat/population lost), species sensitivity is High, overall effect significance is High (Criteria: Percival 2003). Magnitude in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests low published avoidance rates of wind farms with habituation; overall significance considered a Local Moderate Long-term Effect but with habituation a Slight Long-term Effect (Criteria: EPA 2022).
Lesser Black-backed Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. Barrier Effect: Species such as gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as Lesser Black-Backed, Herring and Greater Black-Backed Gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude of effects is assessed as Low, species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall significance considered Local Long-term Not Significant Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1% population/habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term Impact (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Linnet (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Barrier Effect: Hoetker et al., 2006 found evidence of a barrier effect in linnet in three cases.	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost); Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated four cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA 2022).
Mallard (Medium)	Disturbance: In a review of the published effects of wind farms on Mallard populations (Hotker et al. 2006), it was found that habituation to wind farms occurred across both winter and breeding seasons. Barrier Effect: Barrier effects on either migration or regular flights of Mallard have been shown for three out of five studies in a European context (Hotker et al. 2006). The overall barrier effect was not shown to be significant.	Disturbance: Magnitude of effects is assessed as Low, species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Overall significance considered a Local imperceptible long-term Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Low (1-5% of habitat/population lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Overall significance considered a Local Imperceptible long-term Effect (Criteria: EPA 2022).
Meadow pipit (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant	Disturbance: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	disturbance effects on passerine species. Hoetker et al., 2006 found evidence of habituation in three cases out of six. Barrier Effect: Hoetker et al., 2006 found evidence of a barrier effect in meadow pipit in two out of three cases.	boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight to Moderate to due to high proportion of suitable breeding habitat and evidence of breeding on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Peregrine (Very High)	Disturbance: Possible disturbance to foraging birds through noise, visual intrusion. No displacement from breeding sites due to none being recorded within the proposed site boundary (SNH 2012). Barrier Effect: Barrier effects on either migration or regular flights of peregrine has not been shown to date in a European context (Hoetker et al., 2006). Recorded infrequent flight activity suggests the wind farm is unlikely to act as a significant barrier to a far-ranging species such as peregrine.	Disturbance: Magnitude of effects is assessed as Negligible; species sensitivity is Very High. Overall impact is Low (Criteria: Percival 2003). Magnitude Not Significant due to low number of sightings within the site; overall significance considered Local Long-term Not Significant Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1% population/habitat lost); species sensitivity is Very High. Overall impact is Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible, long-term effect (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Redwing (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Redwing does not breed in Ireland and is a winter visitor. Barrier Effect: Hoetker et al., 2006 list two cases of a barrier effect in redwing..	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost); Species sensitivity is High, overall effect significance is Very Low (Criteria: Percival 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost), species sensitivity is High, overall effect significance is Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA 2022).
Skylark (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hoetker et al., 2006 found evidence of habituation in three cases out of six. Skylark like open habitats with short vegetation for breeding. This habitat pattern is dominant on site. Barrier Effect: Hoetker et al., 2006 found evidence of a barrier effect in meadow pipit in five out of six cases, however this result was deemed statistically not significant.	Disturbance: Magnitude of effects is assessed as Medium (5-20% of habitat/population lost); Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight to Moderate due to high proportion of suitable breeding habitat and evidence of breeding on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Medium (5-20% of habitat/population lost), species sensitivity is Medium, overall effect significance is Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated five cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Snipe (High)	Disturbance: Possible disturbance during breeding and winter months birds. Literature suggests differences in densities pre- and post-construction of wind farms has a significant impact upon Snipe within an area (Pearce-Higgins et al., 2012). Barrier Effect: The typical low-altitude flight patterns of snipe mean the wind farm is unlikely to act as a significant barrier to this species.	Disturbance: Magnitude of effects is assessed as Medium, species sensitivity is High, overall effect significance is Medium (Criteria: Percival 2003). The proposed impact of disturbance will be a Local Long-term Moderate Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Low (1-5% population/habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Overall significance considered a Local Moderate Long-term Effect (Criteria: EPA 2022).
Sand martin (Medium)	Disturbance: In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on disturbance to sand martin populations post-construction. No swift breeding habitat is present in the proposed site. Barrier Effect: Barrier effects on either migration or regular flights of sand martin has not been shown to date in a European context (Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as Negligible, species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude Imperceptible; overall significance considered Local Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible, species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term Effect (Criteria: EPA 2022).
Sparrowhawk (Low)	Disturbance: In a review of the published impacts of wind farms on Sparrowhawk populations (Hoetker et al., 2006), it was found that overall, impacts on Sparrowhawk populations post-construction, across both winter and breeding season was not significant.	Disturbance: Magnitude of effects is assessed as Medium, species sensitivity is Low, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude Not Significant due to published habituation to wind farms; overall

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Sparrowhawk do show habituation to the presence of wind farms (Hoetker et al., 2006). Barrier Effect: Sparrowhawk is considered to be less sensitive or less willing to change their original migration direction when approaching wind farms (Hoetker et al., 2006). The species also avoided wind farms less often and their local populations were less influenced by wind farms. The overall barrier effect was not shown to be significant.	significance considered Local Long-term Not Significant Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Low, species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term effect (Criteria: EPA 2022).
Starling (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Barrier Effect: Hoetker et al., 2006 found evidence of a barrier effect in starling in three cases, with another three cases of no effect - results deemed statistically insignificant.	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost); Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated three cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Stock Dove (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species.	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost); Species sensitivity is High, overall effect significance is Low (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Barrier Effect: Hoetker et al., 2006 found evidence of a barrier effect in stock dove in two cases.	Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Effect (Criteria: EPA, 2022).
Swallow (Medium)	Disturbance: In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on disturbance to swallow populations post-construction. No swallow breeding habitat is present in the proposed footprint. Barrier Effect: Barrier effects have been shown in a total of four studies within the European context (Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as Negligible, species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude Imperceptible; overall significance considered Local Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as Negligible, species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term Effect (Criteria: EPA 2022).
Swift (High)	Disturbance: In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on disturbance to swift populations post-construction. No swift breeding habitat is present in the proposed site.	Disturbance: Magnitude of effects is assessed as Negligible, species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Magnitude Imperceptible; overall significance considered Local Long-term Imperceptible effect (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Barrier Effect: Barrier effects have been shown in a total of two studies within the European context (Hoetker et al., 2006).	Barrier Effect: Magnitude of effects is assessed as Low, species sensitivity is High, overall effect significance is Medium (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Slight due to recorded foraging activity on the periphery of the 500m buffer; overall significance considered a Local Slight Long-term Effect (Criteria: EPA 2022).
Wheatear (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hoetker et al., 2006 found one case of habituation and zero cases of the contrary. Barrier Effect: Hoetker et al., 2006, found evidence of a barrier effect in wheatear in just one case, with zero cases of no effect. However, this species was recorded once during VP surveys and was not encountered during breeding walkover surveys, and hence it is considered to be an occasional passage migrant on site. Therefore, the resultant barrier effect to this species is considered to be negligible.	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost); Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival, 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated case; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Willow Warbler (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hoetker et al., 2006 found one case of non-habituation and zero cases of the contrary.	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost); Species sensitivity is Medium, overall effect significance is Low (Criteria: Percival, 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Barrier Effect: Hoetker et al., 2006, do not describe cases of barrier effect or a lack thereof.	considered Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost), species sensitivity is Medium, overall effect significance is Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Effect (Criteria: EPA, 2022).
Yellowhammer (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hoetker et al., 2006 found one case of non-habituation and zero cases of the contrary. Barrier Effect: Hoetker et al., 2006, found two cases of barrier effect on yellowhammer. However, this species was recorded once during VP surveys, in winter where this species sensitivity is considered low, and was not encountered during breeding walkover surveys, and hence it is an occasional passage migrant on site. Therefore, the resultant barrier effect to this species is negligible.	Disturbance: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost); Species sensitivity is High, overall effect significance is Low (Criteria: Percival, 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Negligible (<1 % population/habitat lost), species sensitivity is High, overall effect significance is Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Effect (Criteria: EPA, 2022).

5.6.2.6 Aquatic Ecology

Operational wind farms are not normally considered to have the potential to significantly effect on the aquatic environment. The main risk to watercourses is when oils and lubricants are used on the site. If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water pollution. However, the likelihood of this occurring is very low. In addition, the watercourses on the Proposed Development site are of low ecological value. Spills of any oil or fuels from site vehicles onto the access roads may find their way to the local stream network. However, this is unlikely to be a significant effect considering the low numbers of vehicles involved. The potential operational phase effects on aquatic ecology are assessed as being imperceptible negative, temporary and in the local context.

5.6.2.6.1 Other Species

During the operation of the Proposed Development no effects to other species are anticipated.

5.6.3 Decommissioning Phase

Decommissioning activities of the Proposed Wind Farm will take place in a similar fashion to the construction phase. Potential impacts will be similar to the construction phase but on a reduced scale.

5.6.3.1.1 Designated Sites

European Sites

The Stage One Appropriate Assessment Screening report concluded that:

> *In the absence of mitigation measures (which have not been considered at this screening stage), likely significant effects on the qualifying interests of The Gearagh SPA cannot be excluded on the basis of objective scientific information.*

A Natura Impact Statement was therefore prepared. The Natura Impact statement concluded that, in the light of the conclusions of the assessment which it shall conduct on the implications for the European sites concerned, the competent authority is enabled to ascertain that the Proposed Development will not adversely affect the integrity of any European site.

Natural Heritage Areas or Proposed Natural Heritage Areas

On decommissioning, cranes will disassemble the above ground turbine components which will be removed off site for recycling. The foundations will be covered over and allowed to re-vegetate naturally. It is proposed that the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for forestry and agriculture access. Turbine hard standings shall be covered over with topsoil and left to revegetate naturally.

As such, no direct or indirect effects on pNHAs or NHAs within 15 km of the Proposed Development are anticipated at decommissioning stage.

5.6.3.2 Habitats and Flora

The decommissioning of the Proposed Development may result in some temporary loss of habitat, primarily to hedgerows at access points which may require partial removal to facilitate the removal of turbine parts. The impact of this vegetation clearance would result in a Short-term Not Significant Reversible Site Impact.

5.6.3.3 Mammals (excluding bats)

Vehicular traffic during decommissioning along access roads may result in fatalities; however, this is not expected to be significant due to the mainly diurnal requirement for access and speed restrictions which will be in place. It is considered unlikely that direct impacts on Badger during the decommissioning process will be significant; as setts are unlikely to have become established in locations to be affected.

The potential exists for indirect impacts via both visual and noise disturbance, in particular decommissioning works overlapping with periods of activity by Badger. Badgers may also be excluded from foraging areas due to screening/fencing erected during works. Indirect impacts are considered unlikely to be significant due to works primarily taking place in daylight hours and the short duration of works.

It is considered extremely unlikely that direct impacts on otter during the decommissioning process will be significant. Otters may be indirectly impacted through decommissioning works which disturb occupied breeding or resting sites which could become established during the operational phase. This is considered unlikely due to roads and the drain crossing already being in place.

Sediment and/or contaminated run-off entering streams and waterways could reduce water quality within areas where prey items occur, an increase in sediment could also lead to the smothering of spawning grounds if present thereby inducing longer term impacts on prey availability; however, this will be minimal during the decommissioning process. It is considered that indirect impacts on otter are unlikely.

5.6.3.4 Bats

The possible direct impacts on bats during the decommissioning phase of the Proposed Development are greatly reduced compared with the construction phase of the project; works will be limited to turbine removal, resulting in potential disturbance only.

Indirect impacts through limited hedgerow removal for access could occur, however and any sections removed will be short and will not sever foraging or commuting routes.

As such, potential impacts due to decommissioning will be limited to:

- disturbance due to increased human activity.
- Trimming of vegetation and/or limited hedgerow removal to accommodate turbine removal.

5.6.3.5 Avifauna

Potential Direct Impacts

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

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

Momentary: seconds to minutes

- Brief: less than a day
- Temporary: up to 1 year
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

It is likely that the time period for decommissioning of the project would be ca. 6 months.

Passerines

Decommissioning during the breeding season may result in some minimal disturbance to breeding passerine species due to increased human activity and noise. There will be no further habitat loss during the decommissioning phase and the resultant Impact to passerine species is a *Temporary Imperceptible Reversible Impact at the Local scale*.

Birds of Prey

Surveys conducted as part of the Proposed Development did not record any breeding birds of prey at the proposed site and in the surrounding area.

There shall be no further habitat loss during the decommissioning phase. Decommissioning during the breeding or wintering season shall result in some minimal disturbance to breeding birds of prey in the beyond the site due to increased human activity and noise. The resultant Impact to birds of prey is a *Temporary Imperceptible Reversible Impact at the Local scale*.

Waders and waterfowl

Snipe were noted as being present within the Proposed Development study area during the breeding season. The increase in human activity and noise may result in a temporary disturbance to these species.

There will be no further habitat loss during the decommissioning phase. The resultant impact to waders and waterfowl is a *Temporary Imperceptible Reversible Impact at the Local scale*.

As snipe were heard calling within the Proposed Development during breeding wader surveys, in the event that breeding snipe are present at the time of decommissioning, a *Temporary Significant Reversible Impact could occur at the Local scale*.

Potential Indirect Impacts

The decommissioning phase of the Proposed Development poses similar risks of potential impacts to the construction phase. However, it should be noted that the magnitude of the impact of decommissioning is normally reduced as all infrastructure is already in situ.

5.6.3.6 Aquatic Ecology

The decommissioning phase of the Proposed Development site gives rise to similar potential impacts as can occur during the construction phase; although the magnitude of the impact of decommissioning is normally reduced as all infrastructure is already in place on the site. Potential decommissioning impacts on aquatic ecology, in the absence of mitigation, are assessed as being a *Short-term Slight Reversible and in the Local context*.

During the removal of turbine components will not require accommodation works as the components will be dismantled onsite and removed using standard HGVs. Therefore, it is considered that there is no potential for impacts.

5.6.3.7 Other Species

Impacts to other species will be similar to the construction phase but greatly reduced.

5.6.4 Cumulative Impacts

The EC (2001) guidelines on the provision of Article 6 of the Habitats' Directive state that the phrase 'in combination with other plans or projects' in Article 3(3) of the Habitats Directive refers to the impacts due to plans or projects 'that are currently under consideration together with the effects of any existing or proposed projects or plans.'

A cumulative impact arises from incremental changes caused by other past, present or reasonably foreseeable actions together with the Proposed Development.

The surrounding environment is dominated by agricultural land, with occasional blocks of forestry. The main damaging operations and threats to the greater regions ecological resources are industrialised agriculture and forestry operations. Afforestation and agriculture have shaped the habitats within the study area.

The site is dominated by agricultural grassland, consisting of Improved agricultural grassland and Wet grassland. Grassland where present is interrupted by hedgerows. After grassland, Scrub and Conifer plantation are the next most abundant habitats within the Site.

Forestry and agriculture can create habitat uniformity, negatively impacts river catchments, and alters nesting and feeding habitats for animals. Intensive agriculture is currently likely to be the most detrimental activity onsite. Drainage associated with forestry and farming has also altered the habitats onsite.

In-combination effects may occur should indirect impacts such as a decline in water quality be sufficiently significant to cumulatively add to existing pressures on key species and habitats which form the qualifying interests of European sites. To inform the current appraisal, planning searches were carried out on the relevant planning authority webpages. The already consented AGCR and the enabling TDR works form part of the overall project and these considered cumulatively with other elements of the Proposed Development in this section.

5.6.4.1 Plans

The National Biodiversity Action Plan 2017-2021

Ireland's National Biodiversity Action Plan sets out actions through which a range of government, civil and private sectors will undertake to achieve Ireland's 'Vision for Biodiversity' and follows on from the work of the first and second National Biodiversity Action Plans.

A total of 119 targeted actions are contained in the Plan, underpinned by seven strategic objectives. The objectives lay out a clear framework for Ireland's national approach to biodiversity, ensuring that efforts and achievements of the past are built upon, while looking ahead to what can be achieved over the next five years and beyond.

They include:

1. Mainstreaming biodiversity across the decision-making process in the State;
2. Strengthening the knowledge base underpinning work on biodiversity issues;
3. Increasing public awareness and participation;
4. Ensuring conservation of biodiversity in the wider countryside;
5. Ensuring conservation of biodiversity in the marine environment;
6. Expanding and improving on the management of protected areas and protected species;
7. Enhancing the contribution to international biodiversity issues.

Draft National Biodiversity Action Plan 2023-2027

The policies and objectives of the document were considered in full; one of the most relevant targets outlined in the document is provided below:

Outcome 3D: Planning and development will facilitate and secure biodiversity's contributions to people.

Cork County Development Plan 2022-2028.

The Cork County Development Plan 2022-2028 Objective BE 15-2: Protect sites, habitats and species outlines several objectives relevant to this assessment:

- a) Protect all natural heritage sites which are designated or proposed for designation under European legislation, National legislation and International Agreements. Maintain and where possible enhance appropriate ecological linkages between these. This includes Special Areas of Conservation, Special Protection Areas, Marine Protected Areas, Natural Heritage Areas, proposed Natural Heritage Areas, Statutory Nature Reserves, Refuges for Fauna and Ramsar Sites. These sites are listed in Volume 2 of the Plan.
- b) Provide protection to species listed in the Flora Protection Order 2015, to Annexes of the Habitats and Birds Directives, and to animal species protected under the Wildlife Acts in accordance with relevant legal requirements. These species are listed in Volume 2 of the Plan.
- c) Protect and where possible enhance areas of local biodiversity value, ecological corridors and habitats that are features of the County's ecological network. This includes rivers, lakes, streams and ponds, peatland and other wetland habitats, woodlands, hedgerows, tree lines, veteran trees, natural and semi-natural grasslands as well as coastal and marine habitats. It particularly includes habitats of special conservation significance in Cork as listed in Volume 2 of the Plan.
- e) Encourage, pursuant to Article 10 of the Habitats Directive, the protection and enhancement of features of the landscape, such as traditional field boundaries, important for the ecological coherence of the Natura 2000 network and essential for the migration, dispersal and genetic exchange of wild species.

In the absence of mitigation, the Proposed Development will lead to the loss of existing, wet grassland, hedgerows and treelines onsite. In the absence of mitigation, the Proposed Development will lead to direct and indirect impact to species listed under the Habitats and Birds Directives and the Wildlife Acts, such as on bats, terrestrial mammals as well as avifauna species, identified in Sections 5.6.1, 5.6.2 and 5.6.3. Therefore, it would be contrary to the policies and objectives of the aforementioned plans in the absence of mitigation.

5.6.4.2 Alternative Grid Connection Route (AGCR)

A consented 38kV grid connection cable route (from here on referred to as the AGCR for alternative grid connection route) between the permitted Carrigarierk and Proposed Wind Farm will be developed should the Proposed Substation currently under consideration by An Bord Pleanála (PL04.308208) be unsuccessful and/or unviable at the time of development. The Proposed Substation is located within the red line boundary of the Proposed Development site. The majority of the consented grid connection cable route is located within the public road corridor. The AGCR travels from the substation within the previously permitted wind farm (CCC Pl. Ref. 05/5907 and 11/6605; ABP Pl04.219620) along the public road to location 523,095E 562,474N (ITM) before joining an existing forestry road. The cable route follows this forestry road for 240m and traverses approximately 280m of coniferous forestry to location 522,709E 562,203N (ITM). From here the cable route will be lain in a southwest direction and connect to the internal underground Carrigarierk Wind Farm cables. The works will be undertaken within the road and verge. There are 16 no. main watercourse/culvert crossings along the proposed cable route. The grid connection cable will either be installed over the existing culvert, below the existing culvert by means of an excavated trench or by the use of trenchless technology (i.e., directional drilling) respectively. In-stream works will not be required at any watercourse crossing along the proposed cable route and therefore there will be no potential for direct impacts on surface waters. The AGCR is located within the following sub-catchments:

- Bandon_SC_010
- Lee[Cork]_SC_010
- Lee[Cork]_SC_030
- Lee[Cork]_SC_050

The AGCR is located within the same sub-catchments as the Proposed Development site, and therefore cumulative impacts are likely, discussed below for each potential receptor.

Ecological surveys for the permitted AGCR were carried out between July and September 2014 and revisited in August and September 2015 by ecologists working for McCarthy Keville O'Sullivan Ltd. as part of the work for Carrigareirk Wind Farm. The habitats along the AGCR included the road surface itself with associated verges that are surrounded by hedgerows, scrub, treelines, stone walls and other field boundaries.

Updated ecological walkover surveys were completed by FT Ecologists along the AGCR on 23rd August 2022, noting habitats, rare/protected and invasive plant species, watercourse crossings, general mammals, and potential bat roosts, results of these surveys are presented below in Section 5.6.4.5.

5.6.4.3 Enabling TDR Works

Large components associated with the Proposed Development construction will be transported to the Proposed Development site via the identified TDR.

The point of arrival for the Proposed Development plant has not been identified but the TDR includes the following routes:

- Turn off the N22 national secondary road at Castlemore;
- R585 through Crookstown and Bealnablath;
- R585 / L6008 junction at Gortadinnaghbogh;
- Local road network through Lackereagh;
- Access junction and route through the Site.

A grant of permission by Cork County Council was received for road improvement works at the junction of the R585 and L6088 (reference: 14/6803) to facilitate the delivery of turbine components to the site. The study area and associated existing environment associated with the TDR shall be confined to the public road corridor associated with the above roads. The applicant applied for planning permission for improvements to the public road to facilitate the TDR, as a standalone application (planning reference 14/6803) to Cork County Council. The application was granted permission in May 2015 for 10 years.

The TDR is located within the same sub-catchments as the Proposed Development site, and therefore cumulative impacts are likely, discussed below for each potential receptor.

Ecological walkover surveys were completed by FT Ecologists at TDR nodes on 22nd August 2022, noting habitats, rare/protected and invasive plant species, watercourse crossings, general mammals, and potential bat roosts, see Section 5.6.4.5.

5.6.4.4 Other Developments

Existing or Proposed Wind Farms and Turbines

A number of operational and consented wind farms exist within 20km of the Proposed Development site; these are detailed and discussed below.

There are 11 operational and two consented wind farms within 20 km of the Proposed Development.

The following existing wind farms within 20 km of the Proposed Development were examined for potential cumulative impacts on Biodiversity with the Proposed Development.

Table 5-62: Existing and permitted wind farms within 20km of the Proposed Development

Wind Farm Name	Number of Turbines	Distance and Direction from Proposed Development Site	Status
Garranereagh	4	0.5km E	Operational
Carrigarierk	5	11.3km W	Operational
Kilvinane	3	11.5 km SW	Operational
Bawnmore	5	14 km N	Operational
Cleanrath	9	14km NW	Operational

Wind Farm Name	Number of Turbines	Distance and Direction from Proposed Development Site	Status
Shehymore	10	15.6 km W	Operational
Derrragh	6	17.6 km NW	Operational
Dromleena	9	17 km SW	Consented
Currabwee	7	18 km SW	Operational
Kilpatrick	1	18 km SE	Operational
Knockeenboy	7	18 km SW	Consented
Carriganimma	6	19 km NW	Operational
Coomatallin	4	19 km SW	Operational

The construction phase of the Proposed Development has the greatest potential to contribute suspended solids/pollutants to nearby watercourses due to excavation works and general construction works. All but two of these developments within 20km of the Proposed Development site are already operational and so significant in cumulative impacts to shared watercourses are not likely to occur from the operational wind farms. This is also the case for habitats, flora and non-volant species of fauna. The two consented wind farms which have not yet been built are both a minimum of 17 km to the south-west, which places them in a different catchment area (the Bandon-Ilen catchment) and therefore there is no potential for cumulative impacts on watercourses. The distance of a minimum of the two consented wind farms of 17 km from the Proposed Wind Farm also precludes any likely impacts for habitats, flora and non-volant species of fauna. This is also the case for habitats, flora and less mobile species of fauna. The potential for cumulative impacts to birds, bats and aquatic species is considered further below.

Large Scale/ Infrastructure Projects:

An application for quarrying activities within the red line application area of 40.17ha of an existing permitted quarry (06/13499 and PL04.226347). Development is sought for a period of 20 years. The proposed development will comprise the extension of the existing quarry excavation area vertically by an additional 2 X 18m high benches from the current floor level of ca.4mAOD to -32mAOD and a deepening of the quarry sump from the current level of ca -22mAOD to -36mAOD within the permitted extraction footprint area of 20.2ha granted conditionally 2021 (Planning Ref. 205074), located in Crookstown, Co. Cork, 9km E of the Proposed Development. This project is located within the same sub-catchment, Lee[Cork]_SC_050 and therefore potential cumulative impacts on aquatic ecology are considered likely slight negative, short-term and in the local context, in the absence of mitigation.

Permission for the development of a small-scale quarry with the extraction of rock using ripping and rock breaker and the on-site crushing and screening with mobile plant, and open storage of crushed rock at Carhoo Lower and Coolnagearagh, Coachford, Co Cork, conditionally granted 2022 (Panning Ref. 216514) 12km NE of the Proposed Development. This project is located c.12 km from the site and is located in a different sub-catchment, therefore cumulative impacts with the Proposed Development are unlikely.

A twenty-year permission for the importation and recycling of construction and demolition (C&D) material and inert material and all associated ancillary development works granted conditionally 2022 (Planning Ref. 216514) in Tullig More and, Knockane (townlands), Dripsey, Co. Cork, 18km NE of the Proposed Development. This project is located c. 18 km from the site and is located in a different sub-catchment, therefore cumulative impacts with the Proposed Development are unlikely.

An application for the demolition of an existing 2-storey detached dwelling and ancillary structures and extensions to the main plant and warehouse buildings granted conditionally in 2018 (Planning Ref. 18324), located in Carrigmore, Dromidiclogh West, Ballinneen, Co. Cork, 8.7km S of the Proposed Development. This project is located c. 8.7 km from the site and is located in a different sub-catchment, therefore cumulative impacts with the Proposed Development are unlikely.

An application for the construction of a wastewater treatment scheme for the village of Inchigeelagh granted conditionally in 2021 (Planning Ref. 205438) located Carrigleigh, Inchigeelagh, Co. Cork, 12km NW of the Proposed Development. This project is located c. 12km from the site and is located in a different sub-catchment, therefore cumulative impacts with the Proposed Development are unlikely.

Housing Developments

There are no large housing developments in close proximity to the proposed Barnadivane Wind Farm.

An application for revisions to development previously permitted under Ref No. 05/54023, 06/54047, 06/54059 in Kilnagurteen, Masseytown, Co. Cork details the replacement of 127 No. permitted dwellings with 106 No. new two storey house types granted 17/07/2022 (Panning Ref. 217385) is permitted, located 9.3km north of the Proposed Development site.

Kilnagurteen is within a different sub-catchment (Sullane_SC_010), therefore cumulative impacts with the Proposed Development are unlikely.

Renewable Energy Developments

There is one permitted solar farm applications located in close proximity to the Proposed Development site, and two more within 20km:

1. Cloghmacow, Crookstown, Co. Cork (Ref 196847: conditional) (4km E from Proposed Development)
2. Finnis and Mishells, Co. Cork (Ref: 176111: conditional) (13km SE from Proposed Development)
3. Callatrim, Bandon, Co, Cork (Ref 174098 conditional) (17km SE from wind farm)

The construction phase of the Proposed Development has the greatest potential to contribute suspended solids/pollutants to nearby watercourses due to excavation works and general construction works. Construction phase is also where the greatest impact occurs with solar farms. Cloghmacow solar farm near Crookstown will have an initial negative impact due to loss of hedgerows for the development and a negative knock-on impact on species associated with those hedgerows, and landscaping down the line is expected to have a positive impact on this habitat type. The distance of 4 km precludes cumulative impacts on habitats, flora and less mobile species of fauna in this case. There are management practices put into place to prevent pollutants and suspended solids from entering watercourses which precludes cumulative impacts with the wind farm project. Two of the solar farms are a minimum of 13 km to the south-east from the wind farm and are therefore in a different catchment area (the Bandon-Ilen catchment) and no cumulative impacts can occur on shared watercourses as a result. This distance also precludes any likely cumulative impacts on habitats, flora and less mobile species of fauna. The potential for cumulative impacts to birds and bats is considered further below.

A 10 year permission for Proposed Development consisting of: (1) A 110kV electricity substation (2) 110kV underground electricity cabling connecting the proposed substation to the existing Dunmanway ESB substation (3) 33kV underground electricity cabling connecting the proposed substation to the permitted Carrigarierk Wind Farm granted conditionally in 2019 (Planning Ref. 17431) in Shehy More, Coolcaum, Coolmountain, Tullagh, Lackabaun,, Clogher, Farrannahineeny, Crushterra, Gurteen, Gor, Carrigdangan, Inchincurka, Kilnadur, Aultaghreagh, Co. Cork, 8km SW of the Proposed Development. As this project is constructed and operational, and located c. 18 km from the site and is located in a different sub-catchment, therefore cumulative impacts with the Proposed Development are unlikely.

Farming

Intensive grassland management is prevalent in the Proposed Development site and its surroundings. The diversity of flora within the habitats has been reduced dramatically by drainage, reseeding, fertilisation and intensive grazing by cattle. The main potential impact would be an increase in nutrient levels of local watercourses. There is potential for the Proposed Development to contribute to a cumulative impact on water quality in drains within the site and local watercourses further downstream of the site, through the potential for sediments and other pollutants entering the watercourses as a result of vegetation clearance, construction activities in addition to ongoing farming operations.

The risk of such impacts would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Due to the already degraded state of the watercourses draining the Proposed Development site, any additional pressures such as release of suspended solids and or nutrients as a result of the construction, operational and or decommissioning phases could result in further impacts.

Forestry

A small area of forestry is present within the Proposed Development site and is relatively common within the greater area. Impacts often associated with forestry on the local environment are habitat loss, habitat alteration and potential reduction in water quality.

Plantations exist in intensively managed agricultural areas within the site, where plantations have replaced intensively managed grassland. In this scenario, a lower value habitat has been replaced with a more valuable one in ecological terms. In the less intensively managed wet grassland areas, afforestation and associated drainage may have a neutral or negative effect in the longer term.

While forestry may have resulted in a reduction in water quality very locally the water quality in the majority of the streams within the study area is more closely dependent on agricultural activities.

There is potential for vegetation clearance and construction activities at the Proposed Development site to act cumulatively with other forestry activities in the same catchment, particularly harvesting operations. While it is difficult to quantify the level of impact with certainty, cumulative impacts are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses.

In the absence of mitigation potential indirect cumulative impacts to the Cummer and Bride Rivers could occur and a *Medium-term Moderate Reversible Cumulative Impact* is considered likely.

5.6.4.5 Cumulative Impacts on key receptors

Designated Nature Conservation Sites

Construction phase

The Proposed Development site is not within the boundaries of any designated nature conservation site. The consented AGCR and enabling TDR works does not traverse any designated nature conservation site. Therefore, there will be no direct impacts to designated nature conservation sites for the Proposed Project.

The cumulative assessment in the NIS stated that there is no potential for in-combination effects on European sites resulting from the construction, operation or decommissioning of the Proposed Development.

The Gearagh pNHA and Lough Gal pNHA are considered within the zone of influence for waterbird species flying outside the designated areas, however due to the limited flight activity within the Proposed Development study area, significant impacts are not considered likely, see Section 5.6.1.5. Cumulative impacts for bird species is considered in the Avifauna section below. The remaining pNHAs are outside the potential zone of influence due to the lack of a hydrological connection. Therefore, the project has no potential to impact any nationally designated sites.

Operational phase

As no direct or indirect effects are predicted on European sites during the operation of the Proposed Development then no additive effects due to in combination direct impacts with other existing sources of direct impact are predicted.

An accompanying Natura Impact Statement (NIS) has been prepared for the Proposed Development and accompanies this EIAR. The NIS addresses potential impacts on European sites resulting from the Proposed Development. This conclusion is made in the absence of mitigation measures. There are no hydrological links to any European sites, and the only mobile species from an SPA within core foraging range was mallard. During ornithology surveys, mallard was seen infrequently flying above the site and was not found to utilize the site. For more details see the NIS accompanying the planning application.

The cumulative assessment in the NIS stated that there is no potential for in-combination impacts resulting from the construction, operation or decommissioning of the Proposed Development.

The Gearagh pNHA and Lough Gal pNHA are considered within the zone of influence for waterbird species flying outside the designated areas, however due to the limited flight activity within the Proposed Development study area, significant impacts are not considered likely, see Section 5.6.2.5. Cumulative impacts for bird species is considered in the Avifauna section below. The remaining pNHAs are outside the potential zone of influence due to the lack of a hydrological connection. Therefore, the project has no potential to impact any nationally designated sites.

Habitats and Flora

Construction phase

Potential direct impacts during construction have been identified as land take during construction of the Proposed Wind Farm (including turbine hardstands, compound, substation, sections of new access roads and internal cabling), which will lead to some permanent loss of habitat. Other existing or planned sources of land take in the vicinity of the Proposed Development may result in cumulative impacts. Such developments within 500m of the wind farm include the construction of a dwelling house (Ref 194909) and of three livestock sheds/houses (Refs 215620, 18397, 18440).

No flora listed on the FPO or as threatened on the Irish Red list for vascular plants were recorded during habitat and botanical surveys of the wind farm site or of the AGCR and the TDR all of which were conducted in August 2022.

The dominant habitat along the AGCR outside the Proposed Development site is buildings and artificial surfaces (BL3) represented by road surfaces, bounded by dry meadows and grassy verges (GS2). The buildings are outside the consented AGCR footprint and the existing roads are of no value to wildlife. Although the AGCR will be located primarily within existing roads, it may also enter sections of dry Meadows & Grassy Verges habitat, of *Local* importance. This habitat does not have links with the corresponding Annex 1 habitat 'Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [6510]'. The findings of the recent survey corresponds with the survey carried out in August and September 2015 for the AGCR in connection with the Carrigareirk windfarm. These surveys found that he habitats along the AGCR included the road surface itself (BL3) with associated verges (GS2) that are surrounded by hedgerows (WL1), scrub (WS1), treelines (WL2), stone walls (BL1) and other field boundaries.

The habitats at TDR Nodes include buildings and artificial surfaces (BL3), spoil and bare ground (ED2), recolonising bare ground (ED3), depositing/lowland rivers (FW2), drainage ditches (FW4), improved agricultural grassland (GA1), amenity grassland (improved) (GA2), dry meadows and grassy verges (GS2), wet grassland (GS4), (mixed) broadleaved woodland (WD1), hedgerows (WL1), treelines (WL2), scrub (WS1), immature woodland (WS2) and ornamental/non-native shrub (WS3). Hedgerows and treelines will be affected by trimming and felling at TDR Nodes. No impact is envisaged as a result of habitat loss along the AGCR and at the enabling TDR work as the habitats are highly modified/disturbed and due to the limited footprint of works and therefore cumulative impacts are unlikely.

During 2022 FT surveys, a total of three non-native species with varying levels of invasiveness were recorded along the consented AGCR. These included one Third schedule high impact species giant-rhubarb (*Gunnera tinctoria*), as well as the high-impact Cherry laurel, also recorded within the Proposed Development, and the non-native Weyers butterfly-bush (*Buddleja × weyeriana*). These are present within the road verges and along property boundaries/within properties set back from the roads along the AGCR. No rare or protected plant species were found along the survey route. No third schedule invasive species were recorded at the TDR node locations, however the low impact invasive species Montbretia (*Crocosmia pottsii x aurea*) and non-native (impact not-assessed) Fuchsia (*Fuchsia magellanica*) were recorded at TDR nodes. The potential spread of invasive species recorded within the Proposed Development site may have cumulative impacts with other projects such as the AGCR and enabling TDR works. Cumulatively there is likely to be *a Permanent Moderate Reversible Cumulative Local Impact* without mitigation. Due to a lack of physical connectivity, separation distances and/ or lack of invasive species recorded in planning applications from the remaining projects within 20km, cumulative impacts relating to the spread of invasive species are unlikely.

Operational phase

No cumulative operational stage impacts on terrestrial habitats are predicted. See Aquatic ecology below for details of possible effects on aquatic habitats.

Mammals (excluding bats)

Construction phase

Mammal breeding or resting sites may be cumulatively impacted by other developments, for instance the identified developments within 500m of the wind farm include the construction of a dwelling house (Ref 194909) and of three livestock sheds/houses (Refs 215620, 18397, 18440). These developments have the potential to either remove potential breeding sites such as badger setts, pine marten breeding sites, red squirrel dreys, otter holts and couches etc, and foraging habitats. Farming and forestry activities as well as road building also has the potential to remove or disturb breeding, resting and foraging sites of mammals.

During the mammal survey for the 2015 application for Proposed Wind Farm in June and July 2014 an adult hedgehog was recorded on a local road which borders the study area to the east on the 8th of July 2014, which indicates the presence of hedgehog in the study area. Fox tracks and droppings were frequently seen in the study area and a fox den was found ca. 700m south of the Proposed Development site. Rabbits were also frequently recorded. No other mammal signs were noted during these surveys.

No mammal signs were recorded during the 2022 FT ecology walkovers along the AGCR and the TDR. The habitats along the AGCR and at TDR Nodes are subject to disturbance due to their proximity to roads and dwellings. There is potential for otter to occur at the watercourse crossings along the AGCR. No evidence of otter was found adjacent to any of the watercourse crossings during FT surveys 2022.

Prior to the implementation of mitigation cumulative effects are likely to be *Short-term Moderate Cumulative Local Impacts which are potentially Reversible*.

Operational phase

Mammal breeding or resting sites may be cumulatively impacted by other developments which either remove potential breeding sites (e.g. road construction) or farming or forestry activities which may for example remove Badger setts, Pine Marten or Red Squirrel breeding sites, Otter holts and couches etc. However the vegetation maintenance during the operational phase of the wind farm will be limited and cumulative impacts are likely to be *Short-term Imperceptible Cumulative Site Impacts which are potentially Reversible*.

Bats

Construction phase

Potential cumulative impacts on bats during the construction phase would be as follows:

- Displacement of populations
- Abandonment of young
- Mortality.
- Impacts on water quality - availability aquatic prey species

There are two consented wind farms within 20 km of the Proposed Development. The two consented wind farms which have not yet been built are both a minimum of 17 km to the south-west, which places them in a different catchment area (the Bandon-Ilen catchment) and therefore there is no potential for cumulative impacts on watercourses. All other wind energy developments within 20 km identified by the planning search are existing wind farms. No bat surveys are included in the planning documents for the consented wind farm, Dromleena wind farm (17 km south-west). Common pipistrelle, soprano pipistrelle, and Natterer's bat were recorded during bat surveys for the cable route for Knockeenboy wind farm, 18 km south-west of the Proposed Wind Farm. Along the wider vicinity of the grid route for this wind farm common pipistrelle, soprano pipistrelle, Leisler's bat and Daubenton's bat were recorded. The EIS notes that the provision of the proposed grid cable will not result in the loss of or disturbance to bat habitat and therefore concludes that the construction impact on bats is anticipated to be negligible. No EIAR was prepared for the 2011 application of the Knockeenboy wind farm and no information on the impact on bats is available in the planning documents.

No potential roosting features for bats were recorded within the Proposed Development site. Several potential bat roost features were discovered along the AGCR, outside the Proposed Development, during FT surveys 2022, including bridges at watercourse crossings as well as several large trees which are densely ivy-clad along the route. Several potential bat roost features were discovered along the TDR route, including bridges at watercourse crossings as well as several large trees which are densely ivy-clad along the route. The habitats along the AGCR and at TDR Nodes are subject to disturbance due to their proximity to roads and dwellings. Proposed works at these locations along the TDR are limited to vegetation trimming within the road corridor.

Prior to the implementation of mitigation cumulative impacts are considered to be *Short-term Moderate Reversible Cumulative Local Impacts*.

Operational phase

Potential Cumulative impacts on bats during operation would be as follows:

- Mortality
- Reduction of local populations.

No bat surveys are included in the planning documents for the nearest wind farm, Garranereagh wind farm (0.5 km east). As surveys are not available for Garranereagh wind farm, the levels of bat activity is unknown. However, when the locally observed patterns of activity, species composition, nature of the sites, proximity and ecological connectivity are considered cumulatively. Cumulative impacts to bats during the operational phase could give rise to *a Long-Term Moderate Cumulative Local Impact* prior to mitigation.

An EIS was prepared for Carrigarierk extension wind farm (11.3 km west), with soprano pipistrelle and common pipistrelle Leisler's bat, whiskered/Brandts Bat, brown long-eared bat and lesser horseshoe bat recorded. Impacts of the wind farm on these species is limited as per the planning documents available.

No bat survey results are included in the planning documents for the Kilvinane wind farm (11.5 km south-west).

No bat survey results are included in the planning documents for the Bawnmore wind farm (14 km north).

Common pipistrelle, soprano pipistrelle, Myotis sp., Leisler’s bat, brown Long-eared bat and lesser horseshoe bat were recorded during bat surveys at Cleanrath wind farm, 14km NW of the Proposed Wind Farm. Mitigation consists of felling of conifers and removal of brash around the turbines with a distance of 70m between trees and the base of the turbines to prevent proximity of bat species which are associated with forestry and hedges to turbines. The EIS concludes that with the mitigation measures detailed in place, the residual impact on bats is anticipated to be negligible.

Common pipistrelle, soprano pipistrelle, Myotis sp., Leisler's bat, brown Long-eared bat and lesser horseshoe bat were recorded during bat surveys at Shehymore wind farm, 15.6km W of the Proposed Wind Farm. The impact on bats has been classed as long-term negligible negative impact as the elevated area where wind turbines are to be installed are not attracting large quantities of bats due to commonly gusty wind conditions. Mitigation consists of felling of conifers round the turbines with a distance of 67m between trees and the base of the turbines to prevent proximity of bat species which are associated with forestry and hedges to turbines. The EIS concludes that with the mitigation measures detailed in place, the residual impact on bats is anticipated to be negligible.

Bat surveys for Derragh wind farm (17.6 km NW) found a likely pipistrelle roost within the study area situated in a derelict house with suitable attic space and common pipistrelle were recorded in the vicinity of the building throughout both bat surveys. Species found on site were common pipistrelle with some records of soprano pipistrelle and one record of Leisler's bat. No bat activity was recorded in the open bog area of the site and was low along forestry tracks and the Leisler's bat. The habitat containing wind turbines is not deemed to be important to bats and the impact on bats during the operational phase of the wind farm will be slight according to the EIAR.

No bat survey results are included in the planning documents of 1998 for the Currabwee wind farm (18 km south-west).

No bat survey results are included in the planning documents of 2011 and 2017 for the Kilpatrick wind farm (18 km south-east).

Common pipistrelle, soprano pipistrelle, and Natterer's bat were recorded during bat surveys for the cable route for Knockeenboy wind farm, 18 km south-west of the Proposed Wind Farm. Along the wider vicinity of the proposed grid route common pipistrelle, soprano pipistrelle, Leisler's at and Daubenton's at were found. The EIS notes that the provision of the proposed grid cable will not result in the loss of or disturbance to bat habitat and therefore concludes that the construction impact on bats is anticipated to be negligible. No EIAR was prepared for the 2011 application of the Knockeenboy wind farm and no information on the impact on bats is available in the planning documents.

No bat survey results are included in the planning documents of 2007 for the Carriganimma wind farm (19 km north-west).

No bat survey results are included in the planning documents of 2006 for the Coomatallin wind farm (19 km south-west).

Due to the limited information on bat activity available for the more distant wind farms and the fact the Ecobat analysis tool was not used as standard practice when these applications were submitted, it is not possible to carry out a strictly objective analysis.

However, when the patterns of activity, species composition, nature of the sites, distance between these sites and the Proposed Development, and limited ecological connectivity are considered cumulatively, the potential for effects is very low. Therefore, cumulative impacts to bats during the operational phase would be a *Long-Term Imperceptible Cumulative Impact* for these more distance wind farms.

Avifauna

Construction phase

As noted above, there are two consented wind farms within 20 km of the Proposed Development, all other wind energy developments within 20 km identified by the planning search are existing wind farms.

No bird surveys are included in the planning documents for the consented wind farm, Dromleena wind farm (17 km south-west).

An EIAR was prepared for Knockeenboy cable route, which identified sensitive bird species occurring in the area of the overhead cable route as kestrel, peregrine, kingfisher and mute swan. It did not identify the installation of the cable route as a risk to nesting habitat and quantified collision risk of sensitive bird species with the cable as low. No EIAR was prepared for the 2011 application of the Knockeenboy wind farm and no information on the impact on birds is available in the planning documents.

The habitats along the GCR and at TDR Nodes are subject to disturbance due to their proximity to roads and dwellings. Proposed works at these locations are limited to vegetation trimming within the road corridor, which could disturb nesting birds if completed within the breeding season.

Direct impacts on avifauna during construction are primarily land take related, mainly due to the loss of nesting habitats to key species. In-combination land take is unlikely to result in range loss of any species which frequent the subject site.

Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time.

Based on the evidence available, any cumulative impacts to birds during the construction phase would be a Short-term Not Significant Cumulative Local Impact.

Operational phase

Direct impacts on avifauna during operation which may be cumulatively added to by other existing pressures or Proposed Developments include collision related mortality, ongoing disturbance/displacement and barrier effect.

Table 5-62: details the wind farm development within 20 km of the Proposed Wind Farm development. A total of eleven operational wind farms are present within this search radius.

Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the Proposed Development will combine with additional wind farms to produce additive, synergistic or antagonistic effects. These effects include increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in susceptible species) and increased disturbance to birds utilising foraging grounds whilst on migration.

No bird survey results are included in the planning documents for the nearest wind farm, Garranereagh wind farm (0.5 km east).

No documents are available on cork county council planning website for Kilvinane wind farm (11.5 km south-west), Bawnmore wind farm (14 km north), Currabwee wind farm (18 km south-west), Carrigarierk wind farm (11.3km west), Dromleena wind farm (17 km southwest), Kilpatrick wind farm (18 km south-east), Knockeenboy wind farm 18 km south west, Carriganimma wind farm (19 km north-west) and Coomatallin wind farm (19 km south-west). Therefore no bird survey results are available for these wind farms.

The displacement of wintering birds at Cleanrath wind farm, 14km NW of the Proposed Wind Farm, was not considered significant in the available EIS. The only wader species found on site during breeding wader surveys was snipe and a permanent significant negative impact on breeding snipe was identified in the absence of mitigation. The collision risk for hen harrier, sparrowhawk, peregrine, kestrel, grey heron and golden plover were not considered significant at Cleanrath wind farm, 14km NW of the Proposed Wind Farm.

An EIS was prepared for Shehymore wind farm (15.6km W from the Proposed Wind Farm) significant residual effects on key ornithological receptors concerning direct habitat loss, displacement or collision mortality are not predicted according to collision risk modelling. Hen Harrier was noted to be passing through the wind farm area during the winter months and Kestrel during both winter and summer periods and is also suspected or known to be breeding on site.

The operational disturbance impact of Derragh wind farm on species assemblage of birds in the area is not considered to be significant due to the limited amount of habitat available onsite and the good availability of habitat in the greater area. Bird collision risks for sensitive birds such as raptors, waders and waterfowl was considered to be low, based on the usage patterns observed throughout bird surveys for the site.

Breeding and wintering birds sites may be cumulatively impacted by other developments which either remove potential suitable sites (e.g. road construction) or farming or forestry activities which may for example remove hedgerows or rough grassland areas. However, the vegetation maintenance during the operational phase of the wind farm will be limited and cumulative effects are unlikely.

Based on the evidence available in addition to the fact there is a significant distance to the majority of these wind farms, that the closer wind farms are of limited scale (four turbines each), the lack of migration paths during survey, along with the results of hinterland surveys undertaken for the Proposed Development, any cumulative impacts to birds during the operational phase would be a Long-Term Imperceptible Cumulative Local Impact.

Aquatic Ecology

The AGCR crosses the Lee, Cork Harbour and Youghal Bay catchment 15 times in the form of main watercourse and culvert crossings. The works will be undertaken within the road and verge and no new crossings will need to be established. The cable will either be installed over the existing culvert, below the existing culvert by means of an excavated trench or by the use of trenchless technology (i.e. directional drilling) respectively. In-stream works will not be required at any watercourse crossing along the proposed cable route and therefore there will be no potential for direct impacts on surface waters.

The TDR crosses several watercourses. It crosses through the Lee[Cork]_SC_050 catchment, the Bride [Cork], the River Poularick, and the River Farranduff. The survey sites described in Section 5.3.8 are located on the River Bride [Cork]. Some of the sites recorded the presence of salmonids (including Annex II Atlantic salmon), high-quality salmonid habitat and good status water quality, in addition to Annex I floating river vegetation (3260), with an aquatic ecological evaluation of local importance (higher value). Works proposed at TDR nodes near watercourses are limited to tree branch trimming, utility pole removal and installation of a load bearing surfaces. One other wind farm, Garranereagh Wind Farm, is located within the same sub-catchment (Lee[Cork]_SC_030) as the Proposed Development. This wind farm has been constructed and is operational. As stated in Section 5.6.3.6, operational wind farms are not normally considered to have the potential to significantly effect on the aquatic environment. Therefore, cumulative impacts on aquatic species are not considered likely.

Therefore, in the absence of mitigation, cumulative impacts with the Proposed Development are considered Short-Term Slight Cumulative Local Impact.

Construction phase

Agricultural practices and potentially commercial forestry activities will continue to occur during the construction activities of the Proposed Development.

Effects on aquatic ecology during the operational phase of the enabling TDR work are considered low. Once the turbines have been delivered and installed onsite there will be no further operational works to the TDR, except in the event of turbine replacement being required.

While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses. In the absence of mitigation, a Significant Negative, Short-term Cumulative Impact is considered likely.

Operational phase

Operational wind farms are not normally considered to have the potential to significantly impact on the aquatic environment. The main risk to watercourses is via water quality impacts, when oils and lubricants are used on the site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent impacts to aquatic ecology. Potential operational phase effects on aquatic ecology are assessed as being imperceptible negative, temporary and in the local context.

However, the likelihood of this occurring is very low is and unlikely to be a significant impact considering the low volumes of vehicular traffic involved in typical wind farm operations and the high standards that are implemented on a well-managed site.

Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage. Potential cumulative operational phase impacts on aquatic ecology are considered Short-term Slight Cumulative Reversible Impacts and in the Local Context, in the absence of mitigation.

Other Species

Construction phase

Frogs are known to occur within the site and may be affected by land take; however, given the amount of displacement and alternative habitats available as well as the retention of semi-natural areas within the adjacent/nearby solar farms, the overall in combination effect is assessed as a Short-term Slight Cumulative Impact which is Reversible.

Operational phase

Frog forage and breed in areas abutting the site and may also do so within the site. As such this species may be affected by land take however given the large amount of displacement and alternative habitats available the overall in-combination effect is assessed as being likely to result in a *Short-term Imperceptible Cumulative Reversible Impacts*.

A similar impact is predicted for the invertebrates present on site.

Cumulative Impacts during decommissioning on key receptors

The potential cumulative effects during decommissioning are considered to be the same as those described for the construction phase of the Proposed Development.

5.7 Mitigation Measure for Ecology

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

5.7.1 Mitigation by Avoidance and Design

The following measures are incorporated into the Proposed Development design to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the Proposed Development has been kept to the minimum necessary for the maximum turbine envelope proposed, including all site clearance works to minimise land take of habitats and flora.
- Site design and layout deliberately avoided direct impacts effects on designated sites.
- All cabling for the project will be placed underground; this significantly reduces collision risk to birds over the lifetime of the Proposed Development (Drewitt and Langston, 2006).
- There will be no watercourse crossings within the Proposed Development. The access tracks will cross one manmade agricultural drain using 450mm diameter pipes.

5.7.2 Mitigation measures during the construction phase of the project

Introduction

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

Project Ecologist

A Project Ecologist/Ecological Clerk of Works (ECoW) will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will advise on environmental effects and communicate with the project owner and contractor to ensure the required actions to implement the mitigation prescribed in this EIAR are carried out. The ECoW will undertake a toolbox talk to all personnel before they commence work on-site.

Habitats and flora

The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the Proposed Development has been kept to the minimum necessary, including the use of layout design methods including existing roads and drain crossings to minimise excavation works.

No disturbance to habitats or flora outside the Proposed Development area will occur. Works will be restricted to the immediate footprint of the development (see CEMP; Appendix 2.2). Machinery, and equipment will be stored within the site compound. Designated access points will be established within the site and all construction traffic will be restricted to these locations. Access to the site will be via the existing regional road R466.

Hedgerow and Treeline Reinstatement

Hedgerow and treeline planting will be carried out for the Proposed Development. This will reinstate or replace linear habitat loss to ensure no net loss of these habitats occurs.

A total of 8 new hedgerows or treelines totalling c. 1,804m in length will be planted, and 670m of existing hedgerow to be enhanced at the Proposed Development site to mitigate linear wooded habitat loss and enhance connectivity in the landscape, leading to an overall biodiversity net gain. Details are included in the Biodiversity Enhancement & Management Plan (Appendix 5.7). The species proposed to be planted at these locations are detailed in Table 5-66.

Table 5-63: Species to be planted in new hedgerows/ treelines

Linear Feature	Species
1	Oak, rowan, holly, grey willow
2	Oak, rowan, holly, grey willow
3	Oak, rowan, birch, grey willow, hawthorn, holly
4	Oak, rowan, birch, grey willow, hawthorn, holly
5	Holly, grey willow, rowan, bilberry
6	Holly, grey willow, rowan, bilberry
7	Hawthorn, elder, holly, grey willow
8	Hawthorn, grey willow, holly

Management of the spread of non-native invasive species

Where invasive non-native species are present within the Proposed Development site, measures will be implemented to ensure spread of these species is prevented, and where feasible eradicated as described below in Section 5.7.2 and in the invasive species management plan (Appendix 5.8)

- Prior to works an invasive species survey will be undertaken in the area to reconfirm the findings of the EIAR.

The invasive species plan and management plan (Appendix 5.8) will be adhered to for the works.

According to Invasive Species Ireland (ISI) invasive non-native species are the second greatest threat (after habitat destruction) to worldwide biodiversity. Invasive species negatively impact Ireland's native species; changing habitats and ultimately threatening ecosystems which impacts on biodiversity as well as economics as they are costly to eradicate.

- Halting the spread of non-native invasive species can be achieved via prevention, containment, treatment and eradication.
- Cordoning off the area – this shall include a buffer of 5m surrounding the area of infestation to ensure that seeds are not transported to other sections of the site via vehicular traffic, equipment or PPE.

- No machinery or personnel shall be allowed within this restricted area. Similarly, there shall be no storage of materials within or adjacent to this restricted area.
- There shall be no vegetation clearance or trimming within the cordoned area (except were undertaken in accordance with the invasive species management plan) as this can lead to the species recolonising other areas via the wind, water if displaced into drains, or soil and vegetation attached to machinery, vehicles or personnel.
- If schedule III species are present, no soil or vegetation shall be removed from this area unless it is securely contained and is transported under licence to a suitably licenced facility for treatment.
- For non-schedule III species, no soil or vegetation shall be removed from this area unless it is securely contained and is to be disposed of appropriately onsite or transported to a suitably licenced facility for treatment.
- Informing all site staff through toolbox talk as part of site inductions.
- Any new sightings of the species shall by relayed to construction staff and the developer via the project ecologist/ECoW. These areas shall follow the same protocol as described above.
- Reporting sighting(s) to the NPWS and NBDC and liaising with the NPWS.

Mammals

A preconstruction mammal survey will be undertaken to reconfirm the findings of the EIAR.

An ecologist will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate. This will ensure that any site-specific issues in relation to wildlife not currently present (e.g. badger setts, red squirrel dreys) on site will be reconfirmed prior to commencement of works so as to allow appropriate mitigation measures to be put in place.

In the event that an issue arises, the NPWS will be updated, consulted with, relevant guidelines shall be followed and any licences/amendments to licences will be sought from NPWS.

Construction operations will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Some works may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the site which avoid sensitive features (e.g. mature treelines and hedgerows).

Badger

No evidence of badger setts was observed within the study area, and no badger signs were recorded at the Proposed Development site.

A pre-construction mammal survey including a badger survey will be undertaken within the mammal survey study area to reconfirm the existing environment as described in the EIAR and, in the event that a badger sett should be encountered at any point, then NPWS will be informed and NRA *Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes* will be followed.

There is the potential for setts to be discovered during vegetation clearance works. Care will need to be taken during this early stage of the development and a competent ecologist will be required on-site for these works. If setts are discovered all works within 30m of the sett shall cease including vegetation clearance. NPWS shall be contacted, and the mitigation plan shall be amended as required. An activity survey shall be carried out to assess the potential for the sett to be used by badgers.

In the event that a badger is found injured during the proposed mitigation measures, it is important to realise that injured badgers will be frightened and can be very dangerous. They are strong animals and are not used to being handled, so no attempt will be made to touch an injured badger, as this could result in workers being bitten. NPWS shall be contacted along with ISPCA and potentially a vet specified by NPWS capable of treating the species.

Otter

No evidence of otter holts was observed within the study area, and no otter signs were recorded at the Proposed Development site.

A pre-construction mammal survey will be undertaken (no earlier than 12 months prior to construction) within the mammal survey study area to reconfirm the existing environment as described in the EIAR and, if an otter holt should be encountered at any point, then NPWS will be informed and NRA *Guidelines for the Treatment of Otters Prior To the Construction of National Road Schemes* will be followed.

Red Squirrel

Where possible, any required removal of trees along the edges of the small stands of conifer plantation (WD4) will be limited to time periods outside which Red Squirrel may have young in dreys (peak period January to March).

If this is unavoidable, then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any occupied dreys are present. A derogation/disturbance licence will be sought if dreys are found within the footprint or adjacent areas.

Pine Marten

Where possible, removal of trees in along the edges of the small stands of conifer plantation (WD4) will be limited to time periods outside which pine martens may have young in dens (March and April). If this is unavoidable, then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any occupied pine marten dens are present. A license under the Wildlife act will be applied for should any sites have to be disturbed.

Irish Hare, Pygmy Shrew and Hedgehog

These species are mobile and will disperse, however, hibernating hedgehogs and the young of Irish hare, pygmy shrew or hedgehog are vulnerable during clearance of vegetation. An ecologist will check for the presence of hibernating hedgehog and or young mammals as appropriate, prior to vegetation clearance works prior to or during construction (as necessary).

Where habitat is too dense the ecologist will supervise vegetation removal and grassland trimming / maintenance during clearance works as appropriate.

- Outside of the bird breeding season (March 1st to August 31st inclusive) attention will be paid to the removal of vegetation, scrub and hedgerow with regards to leverets, October to March for hibernating Hedgehog and September to October for breeding Pygmy Shrew as is appropriate.
- Within the breeding bird season and outside of it, attention will be paid to the removal and/or maintenance of dense grassland for breeding hare (all year), pygmy shrew (April to October) and Hedgehog (April to July).

Bats

Buffer Zone

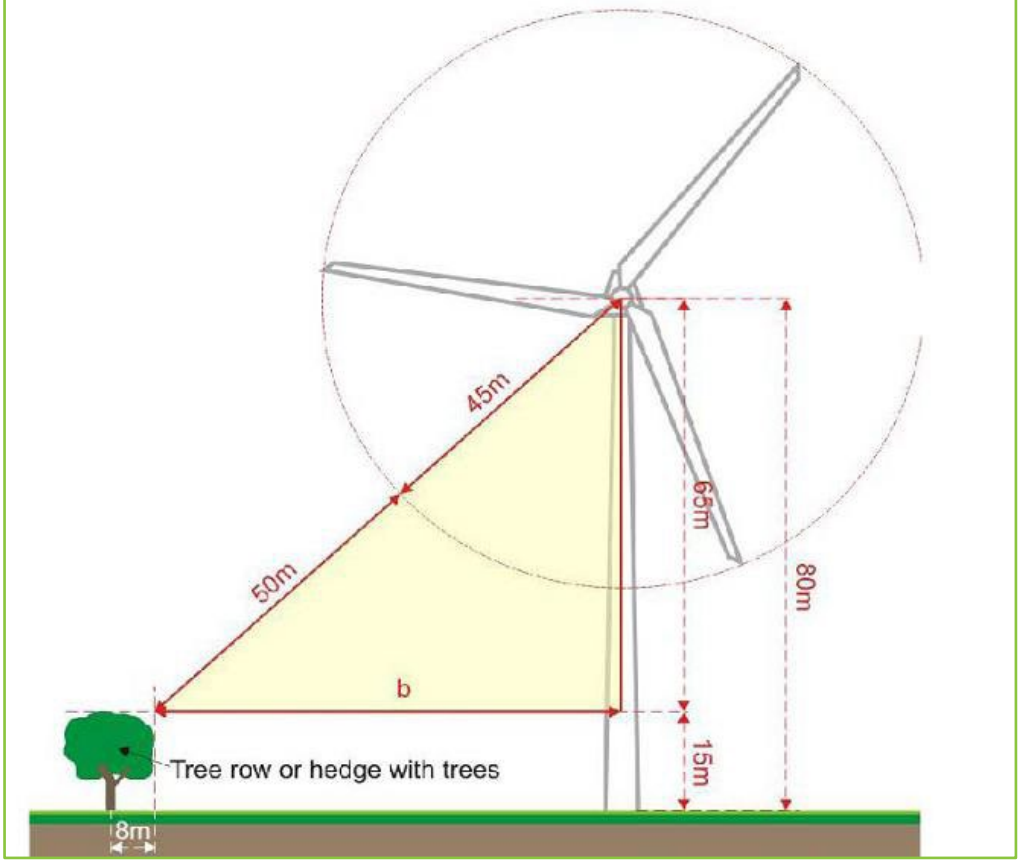
To minimize risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude.

According to NatureScot (2021) guidance:

> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning."*

These distances were taken into account during the design phase of the Proposed Wind Farm Development.

The following formula was used to calculate the required bat buffer for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



$$b = \sqrt{\{(50 + bl)2 - (hh - fh)2\}}$$

where: b = the distance on the ground
between the edge of the canopy and the turbine (m)
bl = blade length (m)
hh = hub height (m)
fh = feature height (m)

Locations representative of the habitat types and features at turbine locations were surveyed, and the bat activity survey findings recorded informed the application of the 50m blade tip buffer described above at all six proposed turbine locations. Surrounding habitats, height of surrounding hedgerows and bat buffer calculated using the above equation.

To minimise risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. The buffers for each turbine location is based on a blade length of 58.5m,a hub height of 72.5m and a feature height of 5m. The bat buffer zone for vegetation clearance is therefore **84.9m** radius surrounding all six turbines.

Existing hedgerows and scrub will be cleared around all six turbines to provide a vegetation-free buffer zone around each turbine in accordance with above calculations. All buffers will be maintained throughout the lifetime of the Proposed Development. Additionally, a section of drainage ditch will be cleared of vegetation extending beyond the bat vegetation clearance buffer of T2, to discourage bats travelling along this drainage ditch towards T2 and to redirect them along existing hedgerows onsite, see Figure 3-2 in Appendix 5.7 for location. Vegetation will be cleared along c. 132m of this drainage ditch. The maintenance of vegetation within bat buffers will be cared out by mechanical means. No chemicals including herbicide are permitted.

The following additional mitigation measures for bats are proposed:

Supervision of vegetation clearance:

An ecologist/ECoW will supervise areas where tailored discreet vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g., bat roost locations) on site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the event that an issue arises, the NPWS will be informed and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

Retention of trees

Several species of bats roost in trees. No trees offering potential bat roosting habitat were found within the Proposed Development site.

Retained trees will be protected from root damage by an exclusion zone of at least 7 metres or equivalent to canopy height. Such protected trees will be fenced off by adequate temporary fencing prior to other works commencing.

Pre-construction Surveys

If three years lapse from between planning-stage surveys in 2022 and installation of the wind turbines, it will be necessary to repeat one season of static detector surveys during the activity period (EUROBATS, 2014). Future survey work will be completed according to best practice guidelines available (Hundt, 2012; Collins, 2016; NatureScot, 2019; 2021) and includes static detector, activity and roost inspection surveys.

Compensation for loss of commuting routes/Diversion from vegetation clearance buffers

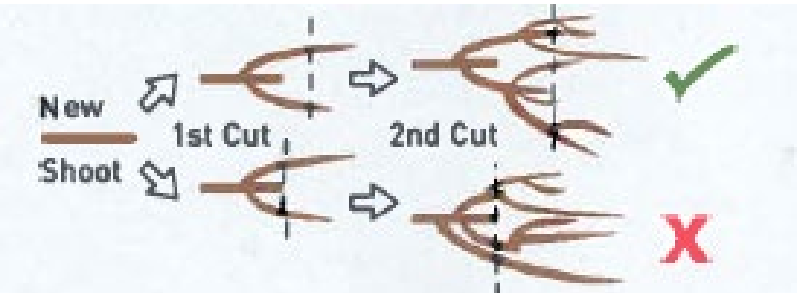
Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). The magnitude of habitat loss is Imperceptible. Approximately 1,642m (equating to 18% of this habitat within the study area) of hedgerows is anticipated to be lost within the development footprint. Approx. 337m (equating to 14.1% of this habitat within the study area) of treelines is anticipated to be lost under the development footprint. Vegetation buffer clearance around turbines will alter commuting and foraging routes associated with existing hedgerows and woodland edges to avoid bats entering the rotor sweep zone of turbines.

Where hedgerows and treelines are affected by turbine clearance buffers, bats will be directed away from tree-free buffers along an alternative commuting route, Figure 5-13. This will be achieved by planting new pollinator-friendly hedgerows. Willow and Alder will also be included in these hedgerows due to their rapid growth. It is proposed to create double lines of hedgerow, with Willow on one side, and pollinator-friendly hedgerow species listed below on the other. Planting of these species will be staggered to prevent excessive shading and aid establishment of the hedgerows.

All hedgerow planting is required to use plants of native provenance. The landscaping contractor is required to be informed well in advance to allow the acquisition of suitable native stock. 2–3-year-old alder and willow trees are required for hedgerows to help accelerate establishment. These will be supplemented with planting of whips.

The following fast-growing damp tolerant species are to be planted along the inner edges of these hedgerows: grey willow *Salix cinerea* and alder *Alnus glutinosa*. The following native fruiting hedgerow species are to be planted along the outer edges of these hedgerows: whitethorn *Crataegus monogyna*, elder, Holly *Ilex aquifolium* and rowan *Sorbus aucuparia*.

Tightly cut hedgerows with flat tops provide little benefit to wildlife, taller and bulky hedgerows are required as this provides more shelter for wildlife. When the hedgerows are maintained, stems will be cut a little above the last cut (see Plate 5-11) as cutting back to the exact same point depletes the energy of the hedgerow, forms a build-up of scar tissue which discourages new growth.



Source: Teagasc

Plate 5-22: Hedgerow Level of Cut

Light annual cutting of hedgerows is not good for wildlife as it limits the production of flowers and fruit. The sites hedgerows will be cut every three to four years in rotation if cutting is required, as this will leave areas of undisturbed hedgerows. Cutting equipment used will be sharp so as not to shatter or fray the hedge. Shattering and fraying allows for disease to enter plants and can lead to decay and weaken the vigour of the hedgerow. A finger-bar cutter is recommended as the most appropriate tool to minimise fraying and smashing of branches (Heritage Council, 2017). A flail-type hedge cutter is unsuitable for hedge trimming in situations where hedgerow health is a priority.

Hedgerow maintenance will not be carried out between the 1st of March and 31st of August as this is the nesting period for birds and any maintenance at this time will disturb breeding; this is in keeping with the Wildlife Act 1976 (as amended).

Lighting restrictions

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Construction operations within the Proposed Development site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works may occur at night but the project ecologist/ECoW shall limit night-time works to sections of the route / site which avoid sensitive features (e.g. streams, treelines and hedgerows). Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill.

This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

Avifauna

Subject to other environmental concerns (e.g., run-off), the removal of vegetation and scrub will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt, A. L. and Langston, R. H., 2006).

The clearance of vegetation at the Site should only be carried out in the period September to February inclusive, i.e. outside the main bird nesting season. Where vegetation removal is required outside this period, vegetation will be inspected for nesting birds by a suitably qualified Ecologist. In the event of birds nesting within areas required to be felled suitable mitigation (implementation of buffer zones and/or seasonal constraints; nest monitoring) will be put in place and felling will only proceed upon agreement with NPWS and receipt of a wildlife licence.

Planting new pollinator-friendly hedgerows, with willow included in these hedgerows due to it's rapid growth rate which will accelerate establishment. Wildflower strips will be planted to provide habitat analogous to rough grassland for raptor hunting. These strips will be located along access tracks away from proposed turbine locations (see Figure 5-13).

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures with regard to birds and wind farms (Drewitt and Langston, 2006).

Re-instated hedgerows will be planted with locally sourced native species. This will result in habitat enhancement for local species of conservation importance such as Greenfinch. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms (Drewitt and Langston, 2006).

Grey Wagtail: Implement mitigation measures outlined in Chapter 7 - Hydrology and Water Quality of this EIAR, the CEMP and Aquatic Ecology Mitigation, section below, to minimise and prevent the identified indirect impacts to water quality.

Re-confirmatory surveys (March/April) of the proposed turbine locations, Roads and hard standings will be conducted to assess any evidence of Buzzard, Kestrel, Sparrowhawk and Snipe activity or taking up of new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

If construction commences during snipe breeding season, a survey to locate breeding territories and nests will be completed to reconfirm the findings of the EIAR, and any nest locations in the potential ZoI will be cordoned off, with a no works zone of 500m around the nests, until breeding activity is finished.

If construction commences during meadow pipit breeding season, a survey to locate breeding territories and nests will be completed to reconfirm the findings of the EIAR, and any nest locations in the potential ZoI will be cordoned off until breeding activity is finished.

Aquatic Ecology

Construction phase mitigation for hydrology will follow that outlined in Volume 2 Main EIAR Chapter 7-Hydrology and Water Quality, and the mitigation measures outlined will be adhered to in conjunction with those outlined in this section. Construction phase mitigation measures for aquatic ecology predominantly involve the preservation of water quality.

All measures for the protection of water quality within the Proposed Development site, as detailed in the CEMP, will also protect the aquatic ecology and fisheries value of downstream watercourses. The measures adopted within the CEMP will ensure effective protection of aquatic ecological interests downstream of the Proposed Development, particularly the habitats supporting sensitive aquatic species and with connectivity to the downstream watercourses.

Vegetation Clearance

It is estimated that a cumulative 1,643m of existing hedgerow and 337m of existing treeline habitats will be cleared to ground level at specific discreet locations to facilitate development of the Proposed Development infrastructure (e.g., turbine hardstands, bat buffers and associated access tracks. There are potential source-receptor pathways from felling areas to the streams draining the Proposed Development site.

Check dams/silt fences will be installed within any drainage channels within vegetation clearance buffers prior to commencement of works. In addition, silt fencing will be installed along the eastern perimeter of the T6 buffer which abuts the riparian corridor of unnamed tributary of River Bride. Silt fencing will be installed along both sides of the un-named streams at T2 and T6. Drains and silt traps will be maintained throughout all vegetation clearance works, ensuring that they are clear of sediment build-up and are not eroded. Provision will be made for bog mats along all off-road routes in wet grassland (GS4), notably around the met mast, T4 and T6, to prevent soil erosion and potential water quality impacts from. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.

Where vegetation clearance within the riparian corridor is required, this will be carried out by hand only to prevent disturbance of stream banks. The use of machinery to collect felled trees is permissible where grab arms may reach into these areas, but no tracked machinery is permitted to enter streams.

To ensure vegetation clearance methodology that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following best practice guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- Forestry Service (2000a). Forest Service Forestry and Water Quality Guidelines;
- Forestry Service (2000b). Forest Harvesting and Environmental Guidelines;

Additional mitigation measures for the protection of aquatic ecology and receptors during vegetation clearance activities will follow those outlined in section 10.7 of Chapter 10 (e.g. minimum buffer zone widths along watercourses).

Given the sensitivity of aquatic ecological receptors in the downstream receiving environment (e.g. salmonids, lamprey species, otter), it is proposed to undertake vegetation clearance in the spring period to facilitate the sowing of grass seeds post-harvest to aid sediment filtration and nutrient absorption, using native grass species *Holcus lanatus* and *Agrostris capilaris* (DAFM, 2018). Machine operations will not take place in the 48-hour period before predicated heavy rainfall, during heavy rainfall (>10mm/hour) or in the 48-hour period following heavy rainfall (DAFM, 2018). Removal of branch lop-and-top and other debris (brash) from vegetation clearance areas within 20m of drainage channels will reduce nutrient seepage immediately post-clearance works and in the proceeding years after clearance has occurred (DAFM, 2019).

Wind Farm Construction

A Surface Water Management Plan is included in the CEMP. This has regard to guidelines included in '*Guidelines for the crossing of watercourses during the construction of national road schemes*' (NRA, 2008b) and '*Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*' (IFI, 2016). This is considered to be the key mitigation measure for the protection of aquatic species located in downstream receiving waters. The Surface Water Management Plan sets out measures to avoid siltation, erosion, surface water run-off and accidental pollution events which all have the potential to adversely affect water quality within the site during the construction phase. It also includes preparatory works on the site, including installation of silt fences and bunds.

All access tracks will be designed to minimise excavation on the site and reduce the risk of sediment runoff. A sealed silt fence will be placed at both sides of points where rivers or streams are crossed and to a minimum of 10m upstream and downstream of each crossing at both sides of the road. Swales for turbine bases and hard standings will be constructed.

There are no stream crossings proposed within the Proposed Development site. Where access tracks pass close to watercourses, silt fencing will be used to protect the streams. The maintenance and monitoring of such silt fences will be subject to an on-site quality management system which is set out in the CEMP.

The internal access track will cross one manmade agricultural drain using 450mm diameter pipes. Installation will only be completed during a dry period between July and September (as required by Inland Fisheries Ireland for in-stream works) to avoid the salmonid spawning season and sensitive life stage period. The drain crossing will be constructed during low flow conditions and within a 5-day weather window.

Silt fences will be placed downstream of all works and regularly maintained. Spoil heaps from the excavations for the turbine bases and trenches (where cables are to be buried) will be covered with geotextile and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Any berms will be covered with a geo-textile matting to avoid sediment runoff; berms will be surrounded by silt fencing until vegetation has been established in the following growing season. Underground cables will be located underneath and directly adjacent to access tracks as far as possible. Trenches will be excavated during dry periods where possible in short sections and left open for minimal periods to avoid acting as a conduit for surface water flows. Clay bunds will be constructed within any cable trenches at intervals.

An Emergency Erosion and Silt Control Response Plan is included as a contingency in the CEMP, the final version of which will be distributed for consultation, which will detail the required measures for the Contractor to implement in the event of a 'worst case' scenario on the site.

Secure concrete washout areas are designated on site and detailed in the CEMP. Concrete washout of chutes only will be permitted onsite and designated lined area greater than 50m from a stream.

Standing water in the excavations at the turbine bases will contain an increased concentration of suspended solids. The excavations will be pumped into temporary settlement basins as necessary which will be lined and which will drain into existing or proposed drainage channels on site. The velocity of water entering sedimentation basins must be controlled to ensure that sediment settled within these existing settlement basins is not washed out due to the increased velocity of water pumped into the system. A suitable setback distance is required for water pumped into settlement basins and check dams must be installed to maintain a low flow rate for water entering this system. The settlement ponds/basins will be constructed in advance of any excavations for the turbine bases.

Wheel washing facilities will be provided at the site entrance draining to silt traps. Additional silt fencing will be kept on site for the ongoing maintenance of the structures provided. Portaloos will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor and will not be discharged on site.

Any diesel or fuel oils stored on site will be bunded to 110 % of the capacity of the storage tank. Such facilities will not be located near any drain or watercourse. Refuelling of plant during construction will be carried out in an appropriately designed designated area, 50m away from watercourses. Drip trays and spill kits will be kept available on site. Appropriate containment facilities will be provided to ensure that any spills from the vehicle are contained and removed off site.

Appropriate preventative measures are detailed in the ISMP, Appendix 5.8, to ensure that non-native aquatic/riparian species are not introduced into the site. These measures follow the manual 'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' by NRA (2010).

Strict biosecurity measures will be implemented if plant and machinery working in areas with invasive species along the grid route is used at the Proposed Development site. All machinery shall be disinfected and visually inspected before leaving works areas where invasive species are present.

Strict measures shall also be implemented to prevent potential the spread of aquatic pathogens.

Operatives will be required to disinfect clothing and equipment prior to and after working near watercourses. For the purposes of this measure, watercourses include both include both drainage ditches and rivers.

An invasive species management plan which details management measures for each invasive plant species is included in Appendix 5.8.

5.7.3 Mitigation measures during the operational phase

Designated nature conservation sites

Implement mitigation measures outlined in section 5.7.2 and Chapter 7 - Hydrology and Water Quality of this EIAR, in addition to the NIS to minimise and prevent the identified indirect impacts effects on water quality as outlined previously.

Habitats and flora

Implement mitigation measures outlined in Chapter 7 - Hydrology and Water Quality of this EIAR, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

Invasive species will continue to be monitored, and where required, treated within the project area according to the invasive species management plan for as long as they persist within the site.

Bats

Feathering of Blades

Turbines will operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed (NatureScot, 2021). This is achieved by feathering the blades during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power.

Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning (Horn et al., 2008). The reduction in speed resulting from feathering compared with normal idling may reduce fatality rates by up to 50% (NatureScot, 2021).

As such, the feathering of blades to prevent 'idling' during low wind speeds is proposed for all turbines.

Cut-in Speeds/Curtailment

Increasing the cut-in speed above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett et al., (2011) showed a 50% decrease in bat fatality can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, soprano and common pipistrelle) in particular would benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

While bat activity varied considerably by species, all turbine locations had medium impact levels for the high risk bat species, Table 5-62. Therefore, increased cut-in speeds will be implemented for all turbines from commencement of operation. From the commencement of operation of the Proposed Wind Farm cut-in speeds will be increased during the bat activity season (April-October) and/or where weather conditions are optimal for bat activity (see below) from 30 minutes prior to sunset and to 30 minutes after sunrise at all turbines.

Cut-in speeds restrictions will be operated according to specific weather conditions:

1. When the air temperature is above approximately 8°C at nacelle height.
2. Generally, bat activity peaks at a wind speed range of 5.0 to 6.5m/s (at nacelle height).

Intensive monitoring will be carried out during the operational phase of the Proposed Development. These monitoring surveys will be carried out during years 1, 2, and 3 post construction. Post-construction surveys will be undertaken for the first three years of operation to confirm if blanket curtailment restrictions can be amended in line with post-construction activity levels. If it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (from baseline levels present in this EIAR) then a derogation will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures. In relation to the monitoring / fatality surveys, these may indicate a peak period of activity (i.e. a particular month or window during the bat activity season) where cut-in speeds / curtailment measures would be required only, rather than implementing them for the full season.

The post construction surveys will be used to update the current curtailment regime (blanket curtailment) designed around the values for the key weather parameters and other factors that are known to influence collision risk. This will include all of the following:

- Wind speed in m/s (measured at nacelle height)
- Time after sunset
- Month of the year
- Temperature (ºC)
- Precipitation (mm/hr)

Post Construction surveys

Monitoring will take place for at least 3 years after construction, providing sufficient data to detect any significant change in bat activity relative to pre-construction levels. It will assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment.

During years one to three of operation (under blanket curtailment restrictions) bat activity will be measured continuously between April and mid-October at each turbine location, in combination with carcass surveys. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.

Modern remotely operated wind turbines as proposed here allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful impacts to bats.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (Adams et al., 2021, Arnett et al., 2008, 2011, 2013; Baerwald et al., 2008). The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021).

Monitoring Curtailment

If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently medium and carcass searches indicate fatalities are occurring (refer below), increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15 and 20 with further review after each monitoring period. An annual report (for years 1, 2, 3, 5, 7, 10, 15 and 20) detailing the results of this monitoring shall be submitted to the planning authority and the National Parks & Wildlife Service. Data from a Supervisory Control and Data Acquisition (SCADA) system, or its equivalent, showing compliance with this measure shall be made available to the planning authority and the National Parks & Wildlife Service

Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then consent will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures.

Where post construction acoustic surveys are undertaken, they will utilise full spectrum automatic detectors deployed, as a minimum, for one complete bat activity season.

Acoustic monitoring will be supplemented with thermal imaging cameras etc. to provide more detailed information on bat activity in the vicinity of turbines. Due to the level of Leisler's activity within the study area, nacelle-level surveys are also proposed for the post construction surveys. These will be used to identify the level of Leisler's bat activity above the tree canopy and within the height of the rotor-swept area.

An assessment of static data gathered during operational surveillance will be completed using the online analysis tool Ecobat as recommended by NatureScot (2021) as a minimum, or other equivalent guidance as dictated by up-to date standards and practices.

Lighting

It appears that the lighting on top of wind turbines may affect the likelihood of bats colliding with turbines. Research on this topic, which is reviewed in Powelsland (2009), indicates that intermittent lighting is less likely to cause species to collide with turbines.

As such, flashing red aviation obstruction lights will be provided on perimeter turbines, subject to approval by the IAA. These will not negatively impact bats (Bennett and Hale 2014).

Buffer zones

The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the development. These will be kept clear by mechanical means only (no chemicals / herbicides) and maintained on an annual basis in the same condition as during first clearance.

Due to mitigation by design, turbines are proposed to be sited at a suitable separation distance from trees and trees or vegetation are to be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines will be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundance is affected elsewhere on the site). This will be achieved through physical management of habitats in the turbine buffers without the use of toxic substances.

A buffer zone of 84.9m surrounding each turbine location will be implemented. Precautionary buffer options for vegetation management have been applied. These will apply in the case that regular grazing of this area ceases, and targeted intervention is required to keep vegetation short. Similarly for the remaining turbine locations, which are located in agricultural land, management in of surrounding grassland within buffers (in addition to tailored clearance of hedgerows) will be required in the event of cessation of grazing.

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project shall be monitored for a period of no less than three years post construction and appropriate measures taken to enhance these if and where required.

Bat fatality monitoring

Whilst no significant residual impacts on bats are predicted, the Proposed Development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 7, 10, 15 and 20 as part of the additional curtailment monitoring schedule. A comprehensive onsite avian fatality monitoring programme is to be undertaken following published best practice. This fatality monitoring programme will be extended and duplicated for bat fauna.

The primary components of the bird mortality programme are outlined below, and an assessment of bat mortality will essentially follow the same methodology:

- Carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials will be used for subsequent fatality monitoring.
- Turbine searches for fatalities will be undertaken following best practice in terms of search area (focusing on the hard standing) (NatureScot, 2021) while also encompassing the wider search radius defined by bird fatality monitoring requirements, and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above.
- A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

- Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 5-64: Monitoring schedule proposed for bat mitigation measures

Mitigation measure	Monitioring required	Description	Duration
Newly planted hedgerows	Ensure viable growth of planting	Planted material shall be checked periodically over the growing season to remove dead material. Any dead material shall be replaced within the same season with viable stock according to age/height specifications already specified in mitigation.	Years 1, 2, 3, 5, 10, 15 and 20, post construction
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the impact of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 7, 10, 15 and 20 post construction.

Table 5-65: Summary of operational-phase mitigation measures for bats

Moderate-High Level Bat Mitigation	Category
A buffer zone free of hedgerows/trees within 50m of turbine blade tips will be created. Hedgerows and treelines will be planted to create corridors around the turbines, and link up with existing hedgerows, see Figure 5-13.	Habitat alteration
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Feathering
Implement curtailment all turbine locations during year 1-3 while post construction surveys are undertaken.	Blanket curtailment
The curtailment will involve operating the selected wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.0 to 6.5 m/s (at nacelle height) during specified weather conditions and during the active bat season (April to October).	Post construction monitoring
Implement a monitoring programme during years 1 – 3 post construction to detect any large-scale changes in bat activity including carcass surveys. Bat activity will be measured continuously between April and mid-October at each turbine location. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.	Smart curtailment
If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring, increased cut-in speeds will continue. This will subsequently be monitored in years 5, 7, 10, 15 and 20with further review after each monitoring period.	Carcass monitoring
Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then a derogation will be sought from Cork County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures through SCADA (or equivalent) operating systems.	Maintain vegetation free buffer

Avifauna

A post-construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the local authority and NPWS. Published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

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

1. Fatality Monitoring (to be conducted during for years 1, 2, 3, 5, 7, 10, 15 and 20 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practice; the primary components are as follows:
    - Initial carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn et al., 2010). No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring. Carcass removal trials shall be continued for the duration of fatality searches.
    - Turbine searches for fatalities are to be undertaken following best practice (Fijn et al., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height = 102.5 - 110m around turbine bases) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 1 per month).

      To be conducted during for years 1, 2, 3, 5, 7, 10, 15 and 20 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.
    - A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
    - Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

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

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

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

3. Monthly Wildfowl Census (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period.

   This will:

   - Assess displacement levels (if any) of wildfowl such as swans post construction
   - Assess overall habitat usage changes within the vicinity of the Proposed Wind Farm Development post construction.

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

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

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

Lighting

Flashing lights are believed to be less attractive to birds than steady lights (NatureScot, 2020). Therefore, the use of flashing red lights will reduce the likelihood of birds being attracted to turbine locations.

It is also noted that red light is believed to be more attractive to birds than white light (NatureScot, 2020), however red light is known not to increase the attractiveness of turbine locations for bats (Bennett and Hale, 2014) and due to the level of bat activity onsite this ecological receptor takes precedence and red flashing lights will be used subject to the agreement with the IAA.

Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

Aquatic Ecology

The operational wind farm will have a negligible effect on aquatic ecological interests and fisheries, as there are no further potential impacts on surface water run-off or watercourses within the site. During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site.

It is not envisaged that maintenance will involve any significant impacts on the hydrological regime of the area. Weekly inspections of the erosion and sediment control measures on site will be required during the construction period, followed by fortnightly inspections until the risk of erosion or siltation has declined following the successful establishment of vegetation during the operational phase.

Sediment control measures for vegetation clearance buffers shall be maintained and replaced as required throughout the lifespan of the wind farm.

5.7.4 Mitigation measures during the decommissioning of the project

The same mitigation measures for the Proposed Development will apply for the decommissioning phase as for the construction phase. This will include a mammal survey to check if any setts or holts have become established during operation, in addition to breeding or resting places of any other protected mammals.

In relation to aquatic ecology, the same mitigation measures will apply for the decommissioning phase as for the construction phase. In the event of decommissioning of the Barnadivane wind farm, the access tracks may be used in the decommissioning process. Mitigation measures applied during decommissioning activities will be similar to those applied during construction but potential impacts will be of reduced magnitude.

It is proposed that turbine foundations and hardstand areas should be left in place and covered with local soil/topsoil to revegetate at the decommissioning stage. It is considered that leaving the turbine foundations, access tracks and hardstand areas in-situ will cause less environmental damage than removing them. The grid cable, ducting and substation will be left in situ as part of the national grid, therefore no potential impacts during decommissioning stage are likely to occur. Hence no mitigation measures are required for these elements.

5.8 Enhancement Measures

A series of enhancement measures are proposed to increase the biodiversity value of the proposed site. These are detailed in the Biodiversity Enhancement & Management Plan (see Appendix 5.7). A summary is provided below.

Pollinator Planting

Meadow planting will be carried out along access track margins in the areas shown on Figure 5-13. These areas will be seeded with a native wildflower meadow seed mixture. Wildflower seed mixes are required to be of native provenance; mainstream commercially available mixes are not acceptable.

Mechanical mowing will be used to maintain the wildflower/meadow access track in margins. One cut and lift per year between October – February is required. This can be split into rotational mowing where half is cut late in the year and half is cut early the following year, however all areas will only be cut once per year.

Wildlife Ponds

Wildlife ponds will be created within the footprints of the settlement ponds along the access tracks, outside the bat vegetation clearance buffers.

The ponds will include a broad (5m) undulating drawdown zone around the margins. Common reed *Phragmites australis* and soft rush *Juncus effusus* will be planted in these margins. This will create an optimal habitat for spawning frogs and aquatic insects.

Shelter habitats

Bee Nest Boxes

Nest boxes for above-ground cavity nesting bees are created by drilling 10-30 holes in a piece of a wood and hanging this on a tree, at least 1m above ground facing east, south or west. The holes should be between 4 and 10mm in width and 10cm in depth. The boxes (no.=15) will be placed on trees near the pollinator planting strips..

Log Piles

A proportion of the timber being removed (substantial pieces of timber-tree trunk/branches) will be salvaged by cutting into logs to create log stacks/piles in the areas specified in Figure 5-13. These piles will be used by insects as the timber decays. Logs of different sizes can be stacked on top of each-other or positioned vertically in a pile. It is important to ensure that the logs remain damp and do not dry out by part-burying (some) logs and placing in a partly shaded location within the site.

Refugia/Hibernacula

Refugia piles and hibernacula will be created. These provide sheltering locations for a wide range of wildlife, including reptiles, amphibians, small mammals and invertebrates. Refugia piles are produced by piling natural materials such as logs, sticks and leaves; that can be supported by additional materials such as rubble and bricks to form a structure with many cracks and crevices for sheltering. Hibernacula are produced in a similar way, but often require setting into the ground in a shallow pit and topping with soil to enclose the structure and creating a more stable microclimate suitable for hibernating species. These structures will be installed near hedgerows and in areas of woodland within the site, where they are less likely to be disturbed. Locations are specified in Figure 5-13.

Bat Boxes

Bat boxes will be located at three different locations, at a minimum of 500m from the closest turbine. Five boxes will be installed at each location at different facing different directions (south, south-east and south-west). These should be placed at least 4m above ground on a tree or building, with a clear fly path free from overhanging branches and away from artificial light sources.

Mammal Boxes

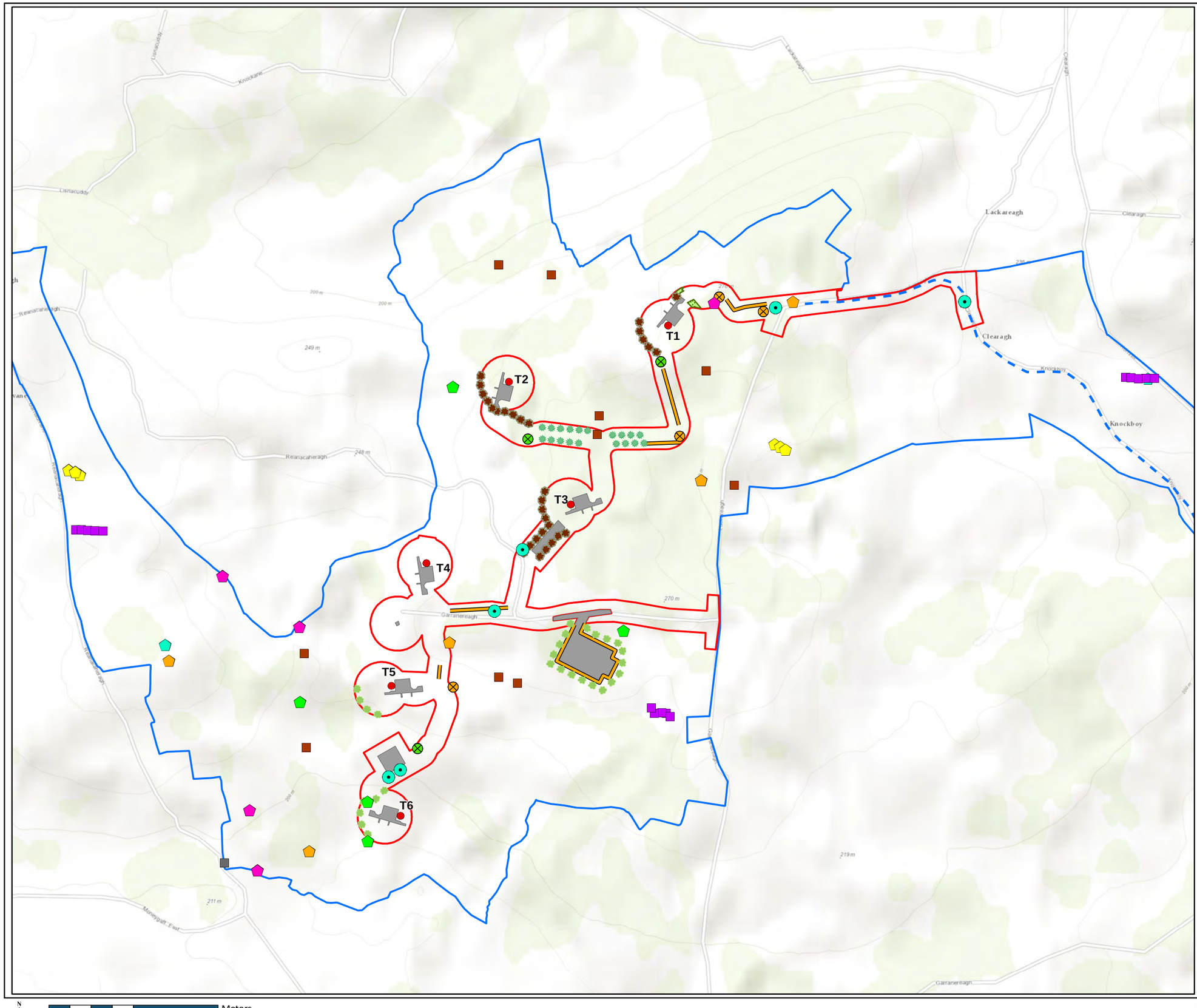
Red squirrel nest boxes (no.=5) will be placed in suitable habitat, within woodland or along treelines. These boxes will be placed in trees at least 3 metres from the ground, facing away from direct sunlight.

Hedgehog houses will (no.=5) will be placed in suitable habitat, within scrub or along treelines.

Bird Boxes

A variety of bird boxes will be used onsite to accommodate the different birds species onsite, including grey wagtail, starling, goldcrest, linnet, skylark, yellowhammer and kestrel.

Path: R:\Map Production\2021\P21-143\Workspaces\EIAR\Ecology\P21-143_GIS_Fig5-13_Locations_of_Enhancement_Features_A3.mxd



Legend

- Development Planning Boundary
- Lands in control of Applicant
- Proposed Project Infrastructure
- Proposed Turbine Layout
- Turbine Delivery Route
- Scrub

Habitat Enhancement Measures

Measure

- Bat box
- Bird box
- Bird box - grey wagtail
- Goldcrest nest roost
- Hedgehog house
- Kestrel nest box
- Log pile
- Red squirrel nest box
- Refugia/ hibernacula
- Starling nest box
- Wildlife pond
- Existing Hedgerow Enhancement
- New hedgerow
- New treeline
- Pollinator planting

TITLE: Locations of Enhancement Features			
PROJECT: Barnadivane Wind Farm and Substation, Co. Cork			
FIGURE NO:	5.13		
CLIENT:	Barna Wind Energy Ltd. & Arran Windfarm Ltd.		
SCALE:	1:11000	**REVISION:**	0
DATE:	23/02/2023	**PAGE SIZE:**	A3

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5.9 Residual Ecological Impacts

5.9.1 European Sites

The Natura Impact statement concluded that, on the basis of objective scientific information, the Proposed Development site will not, either alone or in combination with other plans or projects, adversely affect the integrity of the Gearagh SPA (or any other European site).

5.9.2 (proposed) Natural Heritage Areas

No significant residual impacts have been identified for the pNHAs overlapping European sites.

No significant effects or residual effects are predicted for the remaining national sites within 15 km and the potential ZoI of the Proposed Development.

As such no significant residual impacts to designated sites will occur.

5.9.3 Habitats and flora

Construction of the Proposed Development will lead to some permanent loss of habitat. The habitat loss will be the total area covered by the roads plus the footprint of each of the proposed turbines and all other wind farm infrastructure and associated vegetation clearance buffers. For clarity, associated infrastructure includes the construction compounds and a substation.

Not all land take is permanent as vegetation clearance areas will become different habitats rather than being lost within the development footprint. Any hedgerows to be re-instated will utilise locally sourced native species which shall minimise residual impacts. The construction compound supporting improved agricultural grassland will be allowed to recolonise naturally following construction.

Mitigation measures as outlined in the current chapter and Chapter 7 - Hydrology and Water Quality' shall ensure no significant loss of aquatic habitat.

The implementation of the invasive species management plan (Appendix 5-8) will avoid the spread of invasive species as a result of the Proposed Development and will have a benefit locally of reducing the extent of invasive plant species.

With the application of the mitigation measures as outlined, it is considered that the impacts of the Proposed Development will be minimised for other habitats to an acceptable level, resulting in no Significant residual effects.

5.9.4 Mammals excluding bats

Measures to protect red squirrel and pine marten include restricting tree removal along the edges of the small conifer plantation stands to outside their breeding periods, and pre-felling surveys where this cannot be facilitated. Pre-clearance vegetation checks to protect Irish Hare, Pygmy Shrew and Hedgehog will be carried out by an ecologist as required.

While no setts of evidence of badgers was recorded within the any future occupation of the site by badgers will be protected through the implementation of pre-construction survey to re-confirm the finding of this EIAR.

Some permanent loss of areas of grassland, hedgerow and treeline habitats which could be used by foraging and breeding mammals for shelter/breeding will occur. While scrub may develop in these areas, this will be periodically disturbed during the course of operation of the Proposed Wind Farm due to the maintenance of bat mitigation buffers around turbines. The implementation of mitigation measures will reduce residual impacts to Long-term Imperceptible Negative Reversible Impacts in the local context.

For otters, by implementing the mitigation measures outlined in section 5.7 and accompanying Chapter 7 Water Quality and Hydrology, residual impacts are considered to be Non-Significant, Short-Term and in the local context (i.e. sub-catchment scale).

The habitats used by protected mammal species within the Proposed Development footprint and felling areas represent a small amount of the total available within the study area and are also present within the wider landscape.

5.9.5 Bats

With the implementation of extensive mitigation outlined above (sections 5.7.2 and 5.7.3) potential risk of fatality from collision and/or barotrauma events to foraging and/or commuting high risk species such as pipistrelle and Leisler's will be significantly reduced (Behr, O. et al., 2017).

The assessment has been undertaken in regard to all the latest available guidance and the mitigation proposed include those that have been previously described in guidance relating to wind farms and/or have direct evidence supporting their efficacy at reducing / avoiding impacts.

The resulting impact of the Proposed Development on local bat populations, with implemented mitigation measures, is considered to be a *Not Significant-Slight Residual Negative Reversible Impact* and in the Local Context with the favourable conservation status (FCS) of bat species being unaffected and all species confirmed or expected within or near the study areas predicted to persist.

5.9.6 Avifauna

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

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

It is considered that with the implementation of mitigation, the Proposed Development will have a *Slight-Imperceptible Reversible Residual Impact* on birds.

Residual impacts on Snipe are Imperceptible at the national scale, but at the local level are predicted to be Slight.

5.9.7 Aquatic Ecology

The Proposed Development will have an overall slight negative impact on aquatic ecology and fisheries during the construction phase in the local context in the absence of mitigation measures. The watercourses on the Proposed Development site are all small streams without sensitive ecological receptors. Impacts will be effectively reduced to an imperceptible negative impact with the mitigation measures proposed. The limitation through mitigation of impacts arising from water quality pollution events such as siltation and run-off of suspended solids will significantly reduce the potential for impacts affecting aquatic ecological interests within the site, see CEMP (Appendix 2.2).

Localised water quality impacts as a result of construction phase will be reduced by undertaking the most sensitive elements of the works outside the salmonid close season and protection of water quality following the implementation of the water management measures. Sensitive elements or work include the proposed drain crossing, in addition to works near watercourses where significant releases of silt / sediment could occur.

All mitigation measures provided for the protection of aquatic ecology and fisheries within the Proposed Development site will effectively protect aquatic ecological interests downstream of the Proposed Development.

It is noted that with the implementation of mitigation measures, the Proposed Development will not cause any WFD Waterbody to deteriorate and will not in any way prevent any WFD Waterbody meeting the biological and chemical characteristics for good status. This is equally applicable to both categorised and uncategorised WFD Waterbodies.

5.9.8 Other Species

Residual impacts for other species are identified as *Short-term Slight Reversible Residual Impact at a Site level*.

5.9.9 Overall residual impact

With the implementation of the detailed mitigation measures (outlined in the Natura Impact Statement, Chapter 5 Biodiversity, Chapter 6 Soils, Geology, and Hydrogeology, Chapter 7 Hydrology and Water Quality and the CEMP) there will be no significant residual impacts from the Proposed Development site on biodiversity.

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