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CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE &
PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED FAHY BEG WIND FARM, CO. CLARE

VOLUME 2 – MAIN EIAR

CHAPTER 8 – BIODIVERSITY

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8. BIODIVERSITY

8.1 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 3) may have on 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 10 Hydrology and Water Quality and those contained in the CEMP (Volume 3, Appendix 3.1).

The purpose of this 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 Fahy Beg Wind Farm Site, turbine delivery routes and grid connection routes
- 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 Fahy Beg wind farm site, turbine delivery route and grid connection route.
- Prescribe measures to mitigate the potential negative impact(s) of the project on the ecology of the receiving environment.

A detailed description of the project assessed in this EIAR is provided in Chapter 3 and is comprised of the following main elements:

- The wind farm site (referred to in this EIAR as ‘**the Site’**)
- The grid connection route (referred to in this EIAR as the ‘**GCR**’)
- The turbine delivery route (referred to in this EIAR as the ‘**TDR**’)

Collectively these three elements are referred to as the **proposed project**.

The Site includes the wind turbines, internal access tracks, hard standings, permanent meteorological masts, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm. The Site includes lands in the townlands of Fahy Beg, Fahy More North, Ballymoloney, Ballyknavin, Ballyquin More, Woodpark and Leitrim.

The GCR passes through the townlands of Leitrim, Ballybrack, Fahy More South, Aharinaghmore, Tooreen, Aharinaghbeg, Knockdonagh, Roo East, Blackwater, Rosmadda West, Parkroe, Lackyle and Ballykeelaun.

The TDR begins at Foynes Port, Co. Limerick and runs east along the N69 before joining the N18/M7 travelling east and then north until M7 Junction 27 Birdhill. The route then follows the R494 towards Killaloe. The route will cross the Shannon via the Killaloe bypass bridge and then run south-west along the R463 to O'Briensbridge. At O'Briensbridge Cross and take the R466 until the proposed site entrance (existing quarry entrance). Felling to facilitate the project is assessed as part of the main project, however ongoing commercial forestry operations are assessed cumulatively.

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 Ben O'Dwyer (FT Ecologist, BSc. Wildlife Biology). The desktop study and contributions to survey methodology descriptions were completed by Kate Mahony (FT Ecologist, PhD Zoology, MSc. Marine Biology, BSc. (Hons) Zoology). The chapter was reviewed by Jon Kearney (FT Ecologist, BSc. Applied Ecology, MSc. Ecological Management and Biological Conservation).

Habitat surveys were conducted by Eamonn Delaney (Delichon Ecology Ecologist; BSc. (Hons) Science, MSc. Environmental Science) and Ben O'Dwyer (FT Ecologist; BSc. (Hons) Wildlife Biology).

Ecological walkover surveys and mammal surveys were carried out by Ben O'Dwyer (FT Ecologist; BSc. Wildlife Biology) and Chandra Walter (FT Ecologist; BSc. Ecology, MSc. Organic Horticulture). Annex 1 habitat surveys and botanical surveys were completed by Seán Ronayne (FT Ecologist; BSc. Zoology; MSc. Marine Biology; MSc. Ecological Assessment).

Marsh fritillary surveys were carried out by Ben O'Dwyer (FT Ecologist; BSc. Wildlife Biology).

Bat surveys were conducted by Woodrow Environmental Consultants. Site visits for surveying and static deployments were supervised by specialist bat surveyors including: Oisín O Sullivan (BSc Ecology and Environmental Biology), Sara Fissolo (BCI; QCIEEM), Aoife Moroney (B.Sc. in Eng; M.Sc. Environmental Engineering; completing Post-grad Cert in Ecological Survey Techniques), Louise Gannon (B.Sc. Environmental Science), Rachel Irwin (QCIEEM), Kristi Leyden, and Mike Trewby (B.Sc. Zoology & Botany, PGDip. Environmental Studies). Trainee bat surveyors were also employed under supervision and included Nicole Fleming (BSc. Freshwater and Marine Biology), Patrick Devereux (BSc. Applied Freshwater and Marine Biology) and Joe Kelly (BSc. Wildlife Biology). Manual verification of bat sonograms, data analysis using Ecobat and reporting, was undertaken by Oisín O'Sullivan, Sara Fissolo, and Louise Gannon. The report was compiled by Oisín O'Sullivan and has been reviewed Róisín NigFhloinn (BSc. Natural Sciences ; M.Sc. Ecology and Management of the Natural Environment; MCIEEM).

Bird surveys were conducted by Woodrow Environmental Consultants. The surveyors were Mike Trewby (B.Sc.- Zoology & Botany; PGDip - Environmental Studies), Geoff Oliver (B.Sc. Geography & Biology, PhD Seasonal changes & biological classification of Irish coastal lagoons), Mikee Hoit (B.Sc.- Ecology), Joe Kelly (B.Sc. Wildlife Biology), Daelyn Purcell (B.Sc. Wildlife Biology) and Ken Westman (Diploma in Field Ecology).

Ecofact Environmental Consultants (Will O'Connor; MSc Applied Hydrobiology, PhD Zoology.) undertook surveys of aquatic ecology in 2021 and 2022 (riverine habitat surveys, aquatic macroinvertebrate surveys, salomonid surveys, lamprey surveys)) as well as the evaluation of the impact of the proposed development on aquatic ecology.

Background information and biographies of surveyors listed above are detailed in Table 8-1.

Table 8-1 Surveyor Biographies

Ecologist	Work/Surveys Completed	Biography
Eamonn Delaney	Habitat Surveys (Field and Desk)	Eamonn Delaney undertook desk and field surveys and completed habitat mapping, reporting and evaluation of habitats. Eamonn holds a B.Sc. (Hons) in Science, and M.Sc. in Environmental Science. Eamonn has 14 years' experience in ecological consultancy. Eamonn is a full and Chartered Member of the Chartered Institute of Ecology and Environmental Management (CIEEM).
Ben O'Dwyer	Ecological walkover surveys; mammal surveys; Marsh fritillary survey	Ben O'Dwyer is a senior project ecologist with Fehily Timoney with 6 years' experience. He holds a first-class BSc. (Hons) in Wildlife Biology from IT Tralee. A large portion of Ben's work is focused on survey and assessment of proposed renewable energy development sites, and he has carried out comprehensive ecological work for a number of sites, from plant and animal surveys and habitat mapping to Ecological Impact Assessment, AA Screening Reports, Natura Impact Statements, and Ecological Enhancement plans. Ben is the Author of the Biodiversity chapter and completed a number of ecological surveys for the Fahy Beg Project, including habitat surveys, botanical surveys, marsh fritillary surveys, invasive species surveys and mammal surveys.
Seán Ronayne	Habitat surveys and botanical surveys	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 Annex I habitat surveys at Fahy Beg.
Jon Kearney	Biodiversity Chapter review	Jon is a Principal ecologist with Fehily Timoney and has 17 years' experience in the field of ecological assessment. He holds a BSc (Hons) in Applied Ecology from University College Cork and MSc in Ecological Management and Biological Conservation from Queens University Belfast. In his time as an ecological consultant in both the UK and Ireland, he has worked on a broad diversity of projects including NIS's for several offshore renewable energy projects, wind farms projects, solar farms, road schemes and commercial developments. Jon has been the lead expert witness for biodiversity and Appropriate Assessment at several An Bord Pleanála Oral Hearings.
Oisín O'Sullivan	Bat Surveys	Oisín O'Sullivan is an Ecologist with Woodrow. Oisín has completed a B.Sc. in Ecology and Environmental Biology at University College Cork. His final year thesis involved bat surveys of urban habitats in Cork City. His work is focused on bat data analysis including bat call identification and bat roost/habitat suitability surveys. Oisín has developed a high level of proficiency with Kaleidoscope, Ecobat and BatExplorer, the analysis software used to assess bat calls and activity. In addition, Oisín has experience in marine and freshwater habitat surveying from his time studying at UCC. Since joining

Ecologist	Work/Surveys Completed	Biography
		Woodrow, Oisín has written multiple bat activity reports and coordinates the bat surveys for all sites, including several largescale windfarm sites. Oisín is a Qualifying member of Chartered Institute of Ecology and Environmental Management (CIEEM) and holds a license to survey bat roosts from the Department of Culture Heritage and the Gaeltacht.
Mike Trewby	Bird surveys; Bat Surveys	Mike is the lead ornithologist and field work manager at Woodrow Solutions. Mike worked for Birdwatch Ireland from 2003 to 2010 conducting research on red-billed chough, red grouse and breeding seabirds. Prior to joining Woodrow in 2016, Mike worked as an independent ornithological consultant, and he has over 20 years fieldwork and research experience in the field of ecology. Mike regularly undertakes impact assessments for large scale developments and is a full member of CIEEM. • B.Sc.- Zoology & Botany, University of Namibia, 1997; • PGDip - Environmental Studies, University of Strathclyde, 2002 • Strathclyde, 2002 • Ornithological survey experience: 20 years
Sara Fissolo	Bat Surveys	Sara Fissolo, Seasonal Bat Surveyor with Woodrow. Her main experience lies in carrying out preliminary bat roost assessments and she is competent when undertaking emergence/re-entry bat survey and activity surveys for bats and reporting on the same. She also carries out bat call analysis using Kaleidoscope and BatExplorer software. Sara holds a license to survey bat roosts from the Department of Culture Heritage and the Gaeltacht. She is a qualifying member of CIEEM, and a member of Bat Conservation Ireland (BCI).
Aoife Moroney	Bat Surveys	Aoife Moroney is an Assistant Ecologist with Woodrow. She has completed a B.Sc. in Engineering at University College Dublin and M.Sc. in Environmental Engineering (specialising in Environmental Management) at the Technical University of Denmark and the Royal Institute of Technology, Sweden. She is currently undertaking a Post-graduate Certificate in Ecological Survey Techniques at the University of Oxford. She has also been involved with multiple conservation and research projects in southern Africa. Aoife has developed a high level of proficiency with Kaleidoscope, Ecobat and BatExplorer, the analysis software used to assess bat calls and activity. She is the process of applying for membership of the CIEEM and holds a license to survey bat roosts from the Department of Culture Heritage and the Gaeltacht.
Louise Gannon	Bat Surveys	Louise Gannon is a graduate ecologist with Woodrow. Louise has completed a B.Sc. in Environmental Science. Her main experience lies in carrying out emergence/re-entry bat survey and activity transect surveys for bats, deployment of static bat detectors and reporting on the same. She also carries out bat call analysis using Kaleidoscope and BatExplorer, the analysis software used to assess bat calls and activity. Louise was also developing expertise in conducting roost searches of buildings, bridges and trees under the supervision of licenced members of Woodrow staff - Oisín O'Sullivan and Sara Fissolo.
Nicole Fleming	Bat Surveys	Nicole Fleming is a BSc graduate of Freshwater and Marine Biology with 3 years' experience working in the construction industry. With this background she was hired by Woodrow Sustainable Solutions as a graduate ECoW. Nicole also assists in many surveys (bats, birds and habitats), data collection and

Ecologist	Work/Surveys Completed	Biography
		analysing, this allowing her to be an all-rounder in assisting her senior colleagues in all projects. Nicole's skills range from identification of marine and freshwater species, water and soil analysis, GIS, excel and statistical programmes to knowledge working alongside construction projects allowing her to liaises with project leaders and supervisors on where to enforce mitigation measures and delivering inductions and tool box talks to contractors and workforce with the purpose of ensuring that ecological and environmental impacts are being avoided.
Patrick Devereux	Bat Surveys	Patrick Devereux is a BSc graduate in Applied Freshwater and Marine Biology. He has also completed courses in bird ID and classification. Working with Woodrow he has been heavily involved with bird surveys. Since beginning work, he has gained experience in bats surveys accompanying more experienced staff on transect and roost surveys.
Joe Kelly	Bat Surveys	Joe Kelly has a degree in Wildlife Biology and Environmental science and also qualified with a Diploma in Management & QA Engineering. He has experience across a variety of sectors both public and private. He is a lifelong birdwatcher with excellent bird identification skills and a wide range of bird survey experience also has experienced in assisting bat surveys.
Rachel Irwin	Bat Surveys	Rachel Irwin is a graduate ecologist at Woodrow and has spent two seasons coordinating the company's bat surveys under the direction of Will Woodrow. Over this time, she has developed considerable experience in PRF surveys for bats, emergence/re-entry roost surveys, activity transects and deployment of static bat detectors for numerous large wind farms sites in both the Republic of Ireland and Northern Ireland; as well as other developments including quarries and smaller residential projects. Rachel is also developing expertise in conducting roost searches of buildings, bridges and trees under the supervision of licenced members of Woodrow staff - Róisín NigFhloinn and Will Woodrow. During her time at Woodrow, Rachel has become accomplished at manual identification of bat sonograms utilising Kaleidoscope and BatExplorer. Towards end of each active bat season, she was responsible for compiling bat reports. She also assists senior members of staff with reporting for Ecological Impact Assessment (EcIA), Biodiversity Chapters for Environmental Impact Assessment Reports (EIAR) and to inform the Appropriate Assessment (AA) process. She is a Qualifying member of CIEEM.
Kristi Leyden	Bat Surveys	Kristi Leyden has over five years' experience working as an ecological consultant in Ireland and the UK. During this time, she has led botanical surveys (National Vegetation Classification, Phase 1 habitat, rare plants, invasive alien species) as well as undertaking national scale botanical surveys and assessments of range of Annex I habitats. She has also carried out protected species surveys including bats (preliminary roost assessment, emergence/re-entry and activity surveys), otter, badger, red squirrel and herptofauna (great crested newts and reptiles). Kristi has worked on a wide range of developments, some of which include wind farms, overhead power lines, gas lines, hydro schemes, quarries and commercial and residential developments. Kristi is experienced in producing baseline reports and has undertaken Appropriate Assessment screenings, NIS and inputted into Ecological Impact Assessments.

Ecologist	Work/Surveys Completed	Biography
Geoff Oliver	Bird surveys	• B.Sc. – Geography & Biology, University of Exeter, 1989 • Post-Grad studies – Wetlands Biogeochemistry Centre, Louisiana State University, 1992 • PhD – Seasonal changes & biological classification of Irish coastal lagoons, University College Dublin, 2005 • Ornithological survey experience: 12 years
Mikee Hoit	Bird surveys	• B.Sc.- Ecology, University of East Anglia, 1999 • Ornithological survey experience: 20 years
Joe Kelly	Bird surveys	• B.Sc. – Wildlife Biology & Environmental Science, IT Tralee, 2012 • Ornithological survey experience: 12 years
Daelyn Purcell	Bird surveys	• B.Sc. – Wildlife Biology & Environmental Science, IT Tralee, 2013 • Ornithological survey experience: 3 years
Ken Westman	Bird surveys	• Diploma – Field Ecology, University College Cork, 2017 • Ornithological survey experience: 4 years
Will O’Connor	Aquatic surveys & assessment	Dr. William O’Connor is a senior environmental scientist who has over 20 year’s professional ecological management experience. He is a graduate of the University of Wales, Cardiff where he was awarded an MSc degree in Applied Hydrobiology, and the National University of Ireland, Galway where he received a PhD degree in Zoology. He is a Fellow of the Society of Biology and also a member of the Chartered Institute of Ecology and Environmental Management, and the Institute of Fisheries Management. He was employed as a Senior Fisheries Biologist with the Electricity Supply Board during the period 1992-1998 and has been working as a private environmental consultant since 1999.
Kate Mahony	Desktop study	Kate Mahony is a Project Ecologist with Fehily Timoney. Kate holds a PhD in Zoology, MSc In Marine Biology and a BSc in Zoology from University College Cork. Kate has published research papers in peer-reviewed scientific journals and has a vast knowledge of Irish ecology and GIS. Kate is a Qualifying Member of the Chartered Institute of Ecology and Environmental Management (CIEEM). She has gained experience in Appropriate Assessment Screening reports and Natura Impact Statements for infrastructure projects at Fehily Timoney.
Chandra Walter	Botanical surveys; Mammal surveys	Chandra Walter is a Project 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.

8.2 Methodology

8.2.1 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), '*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)/NatureScot 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)', '*Assessing the cumulative impact of onshore wind energy developments* (SNH, 2012)', '*Disturbance Distances in selected Scottish Bird Species* (NatureScot, 2022) have also been utilised.

The following guidelines in relation to bats were referenced:

- *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH, 2019, 2021)
- *Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland* (NIEA, 2021)
- *Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134.* (Marnell *et. al*, 2022)
- *Bat Survey Guidelines: Traditional Farm Buildings Scheme* (Aughney et al., 2008)
- *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition).* (BCT/Collins, 2016) T
- *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, 2008).

8.2.2 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.

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.

8.2.3 Consultation

The full list of the bodies consulted as part of the proposed development assessment are presented in Chapter 5 (EIA Scoping, Consultation and Key Issues).

It is noted that Bat Conservation Ireland have previously indicated they do not have capacity to consult on projects; they have however provided desktop data for the assessment.

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

- The Development Application Unit (DAU)/ National Parks and Wildlife Service (NPWS)
- Inland Fisheries Ireland
- Birdwatch Ireland
- The Environmental Protection Agency (EPA)
- An Taisce
- Irish Peatland Conservation Council
- Irish Raptor Study Group
- Irish Wildlife Trust (IWT)

- National Biodiversity Data Centre
- Butterfly Conservation Ireland
- Clare Co. Council
- Tipperary Co. Council
- Limerick Co. Council

8.2.3.1 Consultation Responses

NPWS

A detailed response from NPWS was received on 19th April 2021. This included advice on use of relevant guidance and cognisance of county-level strategies. Key points also included the prioritisation of avoidance and mitigation by design, alignment with the National Biodiversity Action Plan (2017-2021), and provision of detailed information to complete EIAR assessments. The risk of slope failure was raised, necessitating careful assessment and management of soils. The provision of detailed information on site drainage was also identified as a key element. The response also noted that tree felling should be included as an intrinsic element of the overall development, and future use and management of all cleared areas should be specified. Details of any tree planting and management carried out as part of the proposed project should be provided.

The likely impacts of grid connection, particularly for birds, sensitive habitats and surface waters, should be given due consideration at the EIA stage. The presence of historical records for nesting hen harrier north-east of the proposed site (2015 National Hen Harrier Survey) and peregrine falcon (possible breeding) north of the proposed development land. The response noted the River Shannon east of the proposed development from Killaloe Bridge to Parteen Weir is an important site for wintering wildfowl, and that I-Webs data is available for this section. The response noted that survey results for bird species need to be referenced back to the overall populations and their dynamics, as in some cases even a small risk to a population of a species could be considered significant. When completing impact assessment for birds, assessment and monitoring results from nearby windfarms must be considered. Cumulative impact on birds from all windfarms in the area needs to be assessed.

The response noted that hedgerows, trees, scrub and uncultivated vegetation (including semi-natural habitats) should not be removed during the nesting season (i.e. March 1st to August 31st), noting the protection afforded under the Wildlife Act 1976-2018. Marsh fritillary surveys should be carried out as per standard Marsh Fritillary Larval Web Survey methodology.

The CEMP should contain sufficient detail to avoid any post construction doubt with regard to the implementation of mitigation measures, timings and roles and responsibilities or same. Any mitigation needs to be included in detail and if being relied upon to reach conclusions must be proved to be achievable and likely to be effective in any given scenario it is needed. The locations of settlement ponds should be detailed and mapped.

IFI

The IFI response (received 16th March 2021) noted that any instream works or other works which may impact directly on a watercourse should only be carried out during the open season for instream works; the 1st July to 30th of September in any year (to avoid impacting on the aquatic habitat during the spawning season.) The Water Framework Directive (WFD) requires that all waters, whether or not they are modified, should comply with good ecological status for unmodified waters or good ecological potential for modified waters. The area drained by the proposed wind farm flows into to the Bridgetown River, currently characterised as 'not at risk' and most recently (2017) achieving Q4 status. This must not be allowed to deteriorate as a result of the proposed development.

The response also noted that sufficient retention time in the settlement ponds is allowed for, particularly during construction, ensure no deleterious matter is discharged to drainage or surface waters. Settlement ponds should be maintained where appropriate during the operational phase to allow for settlement of suspended solids and sediments and to prevent any deleterious matter from discharging. In constructing and designing silt traps particular attention should be paid to rainfall levels and intensity. The silt traps should be designed to minimise the movement of silt especially during intense precipitation events where the trap maybe hydraulically overloaded. It is essential that they are located with good access to facilitate monitoring, sampling and maintenance. Turbidity monitoring should take place at the trap inlets to allow the maximum time for control and mitigation measures to be put in place when silt-laden waters are entering the traps.

The use of sedimentary rocks such as shale should be avoided for road construction. This type of material has poor tensile strength and is liable to be crushed by heavy vehicles thereby releasing fine sediment materials into the drainage system which are difficult to precipitate and may give rise to water pollution. The existing flow patterns must be investigated to ensure that normal flows are maintained both during and after construction. Situations can arise where water transportation is significantly increased in certain watercourses thereby putting additional pressures on watercourses and interfering with the sustained flow of water, particularly during dry weather. This should be avoided. In relation to wind farm structures and infrastructure it is important that a sufficient bank side riparian zone is maintained to watercourses to absorb and attenuate overland flows.

The response raised concerns about soils; in particular, the stability of the soils and the impact that works on both the turbines and access roads will have either directly or by vibration on the stability of the soils. Where it is proposed to construct wind turbines on peat soils especially if these peat soils are located on upland areas, extra caution will be required to prevent deleterious discharges to waters. Specialist personnel should assess soil strength and suitability of the ground at each site and along any proposed access road. From their experiences, they will have serious difficulties with developments on peat soils where there is excessive slope and or where the peat depth exceeds one metre. Excessive slopes will be an issue with all wind farm proposals regardless of soil type. The potential for soil movement and landslides should be assessed fully within the EIS.

Other Responses

Clare Co. Council noted the requirement for a detailed EIA, and specifically noted the presence of locally important Dry meadows and grassy verges (GS2) at the wind farm site, and the presence of habitat of national importance downstream of the proposed wind farm site to the south-west.

The National Biodiversity Data Centre (NBDC) responded that it does not have capacity to consult.

No responses other than acknowledgement were received from other consultees.

8.2.4 Desktop Study

8.2.4.1 Designated Nature Conservation Sites

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

European sites within the potential ZoI (Zone of Influence) of the proposed development namely Special Areas of Conservation (SACs)[1] 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 8.3. 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.

Other categories of designated site such as nature reserves, RAMSAR sites and wildfowl sanctuaries were also considered in the assessment.

8.2.4.2 Flora and fauna

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the natural environment in which the proposed project is situated.

Records available on the NPWS and the National Biodiversity Data Centre (NBDC) websites were reviewed, in addition to records of rare/sensitive species within the 10km grid squares overlapped by a 5km buffer surrounding the wind farm site obtained by request from NPWS (received 21st March 2022). NBDC data for the 1 km grid squares overlapping the GCR provided desktop information for the GCR.

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) and the '*Breeding and Winter Birds of Britain and Ireland Bird Atlas 2007-11*' (Balmar et al., 2013).

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:

- Clare Biodiversity Action Plan 2017-2023
- 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 15/03/2022 and 25/03/2022
- Birdwatch Ireland – Bird Sensitivity to Wind Energy mapping (accessed via NBDC)
- Teagasc Soil area maps
- Bat Conservation Ireland records obtained by request
- 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
- Information on the conservation status of birds in Ireland (Gilbert et. al, 2021)

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[1] 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.

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), SNH (2021) and NIEA (2021), the area covered by the desk-based review was extended to 10 km surrounding the wind farm 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 received from BCI within 10 km of the wind farm site and the results of Biodiversity Maps report for the 10-km squares covering the site [R66 & R67], including species recorded and known roosting sites.

8.2.5 Field Study

The study areas used for different disciplines and different survey types within study areas relative to specific project elements are detailed below in Table 8-2.

Table 8-2 Definition of Study Areas

Discipline/Survey	Project Element		
	Wind Farm	GCR	TDR
Habitat, Botanical and Invasive Species	Habitat survey study area (see Figure 8-13)	GCR footprint and adjacent lands	TDR nodes and adjacent lands
Mammals			
General Mammals	150m buffer[a] around infrastructure in open habitats. Entirety of felling buffers plus 50m buffer	GCR footprint and adjacent lands	TDR nodes and adjacent lands
Otter	150m up and downstream[b] of proposed internal access track crossings, sections within 150m of proposed infrastructure & felling	150m up and downstream of watercourse crossings	150m up and downstream of watercourse crossings were works are proposed
Bats	Core study area was 300m turbine buffer; proposed infrastructure footprint; 30m access track buffer. A known building roost was also surveyed (c. 720m from closest turbine).	Bridges and Trees along GCR	Trees at locations where vegetation trimming/clearance is required

Discipline/Survey	Project Element		
	Wind Farm	GCR	TDR
Avifauna			
VP Surveys	VP viewsheds and 500m turbine buffer. Note 'study area' refers specifically to 500m turbine buffer.	NA	NA
Transect Surveys	500m turbine buffer; quarries to south of 500m buffer; Lackreagh Mt. north of 500m buffer (see Appendix IV of Ornithology Report) (Appendix 8.1)	NA	NA
Breeding Raptor/Hen Harrier Roost Surveys	2km turbine buffer. Note - referred to as 'wider area'	NA	NA
Wintering Waterbirds	5km turbine buffer. Note - referred to as 'wider area'	NA (no offline sections or large waterbodies)	TDR Node 27 (Mac Namara's Lake)
Riverine Birds	Onsite watercourses.	Grid connection crossing points	TDR Nodes 20 & 23
Marsh Fritillary	Areas with larval foodplant (main focus) (see Figure 8-17); Site Boundary	NA	NA
Aquatic Ecology	Survey points on watercourses draining the windfarm and surrounding area	Survey points on watercourses draining the GCR	Survey points on watercourses draining the TDR

a) 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*'.

b) Based on maximum buffering distance recommended for Otter in NRA's '*Guidelines for the treatment of otters prior to the construction of national road schemes'*.

8.2.5.1 Habitats

This section summarises the habitat surveys carried out at the proposed Fahy Beg Wind Farm. The full report is included in Appendix 8-2 The principal aim of the field survey was to identify and map habitats and their component plant species within the study area (land ownership boundary) encompassing the wind farm site, the footprint of the proposed grid connection route and turbine delivery route (TDR) nodes.

A Habitat Survey was undertaken as part of the site walkover survey on 30th July and 16th August 2021. 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 the *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 Phase 1 Field Survey focused on identifying

habitats to Level 3 of the *Guide to Habitats in Ireland*. Any other records of interest (e.g., invasive plant species) were also marked on field maps and locations were recorded using GPS handheld units.
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). All species were readily identifiable during the survey. Plant nomenclature for vascular plants follows 'New Flora of the British Isles' (Stace, 2019), while mosses and liverworts nomenclature follows 'Mosses and Liverworts of Britain and Ireland - a field guide' (British Bryological Society, 2010).

Detailed relevé surveys focused on woodland habitats were undertaken to analyse potential links with Annex I habitat types. The Interpretation Manual of European Union Habitats [EUR28] and Article 17 reports were used to evaluate whether links with Annex I habitats exist. These surveys were carried out on 14th May 2021. Methodology was based on the National Survey of Native Woodlands 2003-2008 (Perrin et. al, 2008). A total of three 10 x 10m relevés were conducted – two (R1: ITM 562829, 670077, R2: ITM 562823, 670031) in woodland along the eastern edge of the quarry where the proposed access track exits the quarry, and one (R3: ITM 563494, 670426) in Ballymoloney woods uphill to the northeast.

Surveys focused on the composition of mature trees making up Ballymoloney woods within the Site were carried out on 23rd March 2022. This survey focused on mapping native species, existing tracks/gaps in the woodland, and categorising tree ages to identify access track route corridors with the lowest ecological impact.

Habitat surveys covering an additional area within the quarry were completed on 20th July 2022. These were required due to a layout change for a section of access track and site compounds.

Habitat surveys along the grid connection were completed during 14th and 19th July 2022. Habitat surveys at proposed accommodation works locations along the turbine delivery route (TDR) were completed during 20th – 22nd July 2022.

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, 2009), see Section 8.2.5.8 and Appendix 8.7.

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.

8.2.5.2 Mammals

Mammal surveys at the proposed wind farm site were undertaken on 30th May, 1st June, and 21st July, and at the TDR Nodes and along the GCR on during 14th July and 19th- 22nd July. During surveys at the wind farm site, 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 felling buffers in wooded areas.

Surveys at TDR Nodes and along the GCR covered the footprint of these elements, plus searches of any potentially suitable habitat within 50m of proposed works.

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 wind farm study area identified above. Trees at TDR Nodes and along the GCR were also examined for their potential to host dreys.

Otter surveys were undertaken along watercourses at the proposed wind farm site, and at grid connection watercourse crossings. See Appendix 8-3 for further details of GCR otter surveys.

Table 8-3: Otter Survey Details

Watercourse	Location	Survey Extent	Date(s)
Broadford	Wind Farm Site	150m infrastructure buffer	01/06/2022
Fahy (Clare)	Wind Farm Site	150m infrastructure buffer	21/07/2022
Black (O'Briensbridge)	Wind Farm Site	150m infrastructure buffer	01/06/2022 21/07/2022
Kilroughil	Wind Farm Site	150m infrastructure buffer	01/06/2022 21/07/2022
Bridgetown (Clare)	Wind Farm Site/GCR/TDR	150m infrastructure buffer/150m up/down-stream	19-20/09/2022
Glenomra Wood Stream	GCR	150m up/down-stream	19-20/09/2022
Blackwater (Clare)	GCR	150m up/down-stream	19-20/09/2022
Glenlon South	GCR	150m up/down-stream	19-20/09/2022
Unmapped tributary of Athlunkard (Shannon)	GCR	150m up/down-stream	19-20/09/2022

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 and dates of trail camera deployments are listed below in Table 8-4 and presented in

Figure 8-1.

Table 8-4: Trail camera deployment details

ID	Location (ITM)	Deployment Period	Habitat
1	562526, 669302	20/07/22 to 03/08/22	Mixed broadleaved woodland
2	564022, 670477	21/07/22 to 11/08/22	Conifer plantation edge/wet grassland
3	563290, 670607	14/07/22 to 19/07/22	Mixed broadleaved woodland
4	563538, 670386	14/07/22 to 19/07/22	Mixed broadleaved woodland

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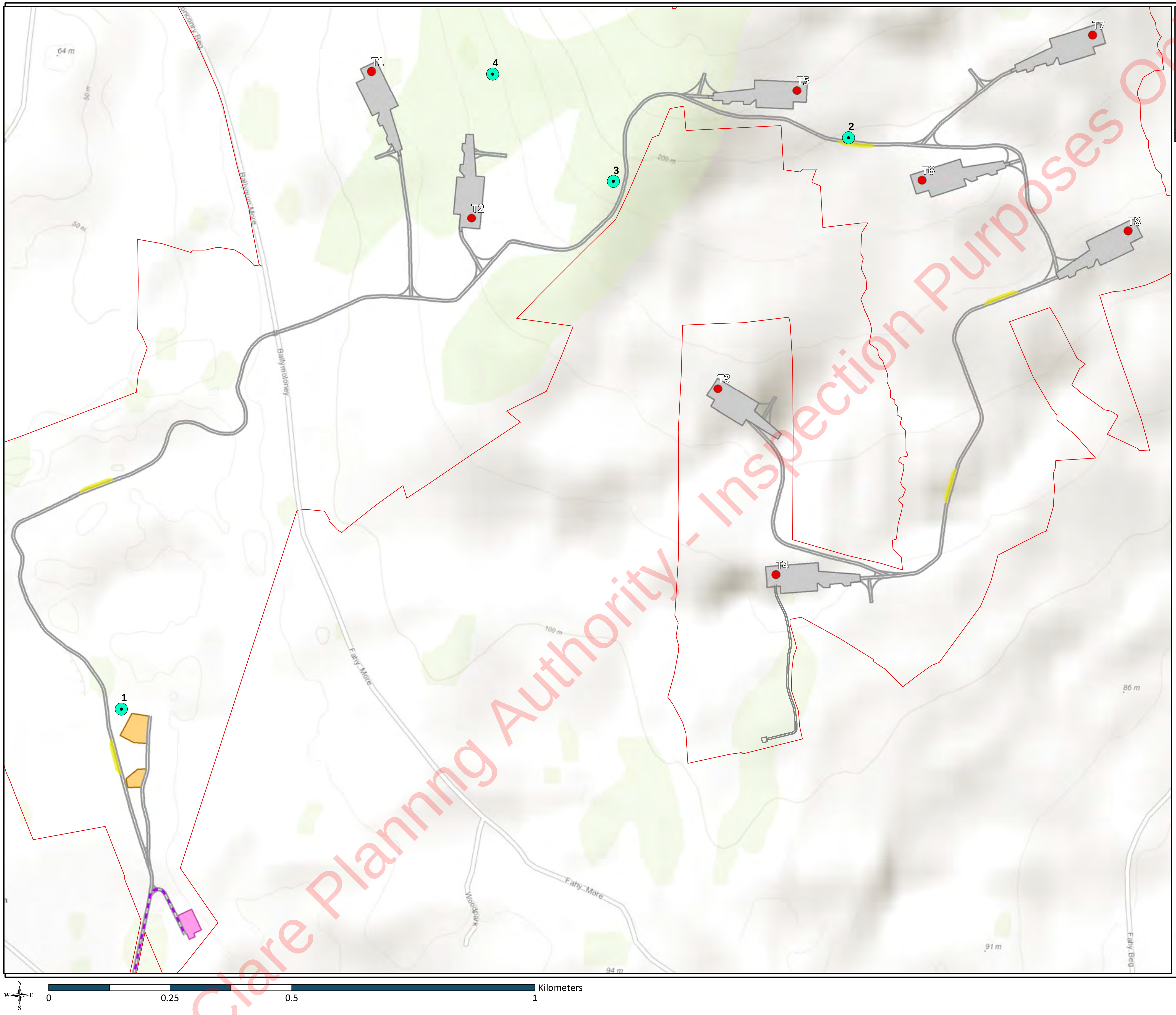

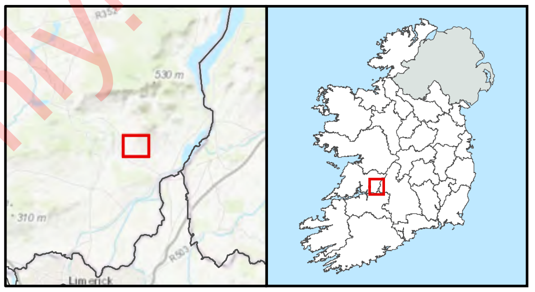

Legend

- 🟥 Wind Farm Site Boundary
- ● Proposed Turbine Layout
- — Onsite Access Roads
- - - Grid Connection Route
- ■ Substation Compound
- ■ Construction Compound
- ■ Turbine Hardstanding Area
- ■ Passing Bays
- ⊙ Trail Camera Locations

id	Deployment Period
1	20/07/2022 - 03/08/2022
2	21/07/2022 - 11/08/2022
3	14/07/2022 - 19/07/2022
4	14/07-2022 - 19/07/2022

TITLE:
Trail Camera Locations

PROJECT:
Fahy Beg Wind Farm, Co. Clare

FIGURE NO: 8.1
CLIENT: RWE Renewables Ireland Ltd.
SCALE: 1:7500 **REVISION:** 0
DATE: 29/11/2022 **PAGE SIZE:** A3

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8.2.5.3 Bats

Bat surveys have been completed within the study area (within 300 m of the potential build area) during the years 2020 and 2021. The surveys encompassed preliminary roost assessments, summer roost and winter roost inspections (focused on buildings), bridge and tree inspections, activity surveys (transects) and static detector surveys. The methodologies for surveys undertaken within the wind farm study area described here are extracted from the 2020/2021 Bat Report (Appendix 8-4).

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' (SNH, 2021).

Bat surveys were also completed at bridges along the GCR. Survey methodologies are detailed in Appendix 8-3. The GCR and TDR nodes were also checked for potential bat roosting features.

Roost assessment surveys

The most recent guidelines (SNH, 2021) recommend that *"features that could support maternity roosts and significant hibernation and/or swarming sites (both of which may attract bats from numerous colonies from a large catchment) within 200 m plus rotor radius of the boundary of the proposed development should be subject to further investigation*".

As such, roost assessment surveys were conducted within 300 m of the potential build area to ensure all potential turbine dimensions would be covered by the survey. Features along the access tracks between turbines (within *c.*30 m) were also assessed for roost features. Wide reaching roost and foraging habitat assessment of the wind farm site were undertaken during March 2020, as part of a scoping exercise.

Surveyors utilised the assessment criteria described in Collins (2016), which provides guidelines for assessing potential suitability of habitat features as bat roosts and for foraging bats. This allows surveyors to assign features, a 'negligible', 'low', 'moderate' or 'high' status in terms of their potential for bats, i.e., the presence of Potential Roost Features (PRFs). Based on the features present and the location of the trees or other structures, the potential use of the feature can also be considered, and classified (as in Hundt, 2012):

- Maternity (breeding roost);
- Summer / transitional (to include transitional, occasional, satellite, night and day roosts); and,
- Hibernation roost.

Surveyors initially employed non-invasive external and internal inspection techniques for any building encountered, and trees were assessed from the ground.

Where required, full building/tree inspections were undertaken by NPWS-licensed surveyors. This included the inspection of potential hibernation roosts. Based on the findings of PRF surveys roost inspections were required at the buildings of a derelict farmstead [52.784666, -8.528396] and a mature beech tree with severe butt rot [52.787075, -8.546137], as shown in Figure 7 in the accompanying Bat Report (Appendix 8-4). Three of the buildings within the abandoned farmstead have potential for hibernation roosts.

Though outside the zone of influence for roosts (300m turbine buffer) a house on an organic farm to the south of the site had a bat roost highlighted to Woodrow Solutions (the bat surveyors) by the owners and further surveys were conducted on this building.

Based on the findings of the roost assessment surveys features classed as having moderate to high suitability for bats and/ or demonstrating likely occupancy, (e.g., dropping found) were targeted for further bat activity surveys, including dusk emergence/dawn re-entry surveys. As outlined in survey limitations below, areas to the west of the site were not subject to this due to the presence of livestock. As outlined above, a roost inspection was conducted on the tree with severe butt rot during the active bat season on the 13-May-2021. However, this tree is on the very edge of the precautionary zone of influence buffer (Figure 1 in accompanying bat report included in Appendix 8-4) and will not lie within a 200m buffer to blade tip (SNH, 2021) and will not be removed as part of this development.

In the preliminary roost survey in 2020 the long-established beech woodland was highlighted as a constraint as it contains many trees of 'moderate' roost potential with the occasional presence of 'high' potential features within the woodland. Sample areas were assessed in more depth employing the use of a thermal imaging camera and those with features accessible to surveyors were examined with an endoscope. Emergence and re-entry surveys were also conducted on the best examples of moderate potential trees found during this sampling exercise, as shown in Figure 8 in the accompanying Bat Report (Appendix 8-4). Given the high number of moderate PRFs distributed throughout the long-established woodland, it was not feasible to assess every tree. This sampling exercise allows for the roost potential for the woodland as a whole to be characterised, which then facilitates an assessment of the potential impact and proposals for appropriate mitigation to be formulated.

Roost emergence/re-entry surveys

As summarised in Table 8-5, multiple dusk emergence/dawn re-entry surveys were completed in both 2020 and 2021, typically prior to or after undertaking walkover (transect) surveys of the site. The locations of emergence/re-entry surveys is shown in Figure 8 in the accompanying Bat Report (Appendix 8-4). Transect and dusk emergence/dawn re-entry surveys were undertaken using Elekon Batlogger M bat detectors to collect geo-referenced records of bat activity, which were then analysed using BatExplorer. During the June survey a Wildlife Acoustics EM3 detector was also used, and the data from this detector was analysed using Kaleidoscope. *Appendix 1: Roost survey locations* in the accompanying Bat Report (Appendix 8-4) contains images of the features surveyed.

Winter roost inspections

SNH Guidelines (SNH, 2021) recommend that winter roost surveys should also be carried out for any potential hibernation roost within 200m plus rotor radius of developable area. The survey was conducted on 4th March 2021, within the timeframe in which bats would still be hibernating. Surveys involved searching for and collecting bat faecal samples, closer examination of roost potential, and the use of a thermal imaging camera. The following structures/features of high roost potential - see Figure 8 in the accompanying Bat Report (Appendix 8-4) which were judged to have potential for occupation as a winter roost were examined:

- A derelict cottage and surrounding buildings of the abandoned farmstead in the east of the site. [52.784621, -8.528125]
- A beech tree, with severe butt rot in the west of the site. [52.7868704, -8.54610011]

Bat activity surveys – walked/driven transects

The SNH (2021) guidance considers the application of transect surveys to be discretionary, with survey requirements designed on a site-by-site basis. Transects are complementary to data collected from static bat detectors; and are important for identifying flight lines and for gaining understanding of bat abundance within the survey area. Driven transects can provide useful information on the wider landscape in the vicinity of the proposed development site. If driven transects are undertaken, it is important that appropriate microphones are used and are directed above the vehicle. It is also important to remain at a constant low speed (< 10 km/h). Point counts (of a fixed duration) can be incorporated into transects to survey specific features to provide information on comparative density of use.

Four transects were completed in 2020. Five transects were completed in 2021, which included coverage of the proposed site access track through the Roadstone quarry. Survey dates and weather conditions for transects conducted in 2020 and 2021 are provided in Table 8-5, with the transect routes illustrated
Figure 8-2 and
Figure 8-2: Bat activity transect routes surveyed 2020
, for 2022 and 2021, respectively.

Field records were made of bat species encountered, number of bat passes, activity (where known: e.g., foraging, commuting, advertising), travelling direction and approximate height (where known). Temperature and wind speed were measured at intervals throughout the survey. Batloggers recorded temperature throughout the surveys.

Table 8-5: Summary of emergence and transect survey effort

Date	Start time	End time	Location	Survey type	Weather Conditions
11-Jun-2020 Sunset: 21:59	21:18	23:25	52.784621, -8.528125	Emergence Survey - At abandoned farmstead on the eastern side of the site, *ad hoc* observation that wind increased throughout the survey duration (K. Leyden).	Wind: 3km/h, S Temp: 12° - 14° Precipitation: Dry
12-Jun-2020 Sunset: 22:00	21:55	00:43	Figure 8-2	Transect Survey - Walked transect, first half of transect conducted in the centre of the site, second half of transect conducted moving north in the eastern side of the site (K. Leyden).	Wind: 3km/h, ESE Temp: 13° - 14° Precipitation: Dry
31-Jul-2020 Sunset: 21:26	20:44	22:36	52.784621, -8.528125	Emergence Survey - At abandoned farmstead on the eastern side of the site (M. Trewby).	Wind: 3kmp/h, SE Temp: 13° - 14° Precipitation: Light rain
	22:41	23:51	Figure 8-2	Transect survey - Walked transect from abandoned farmstead to the farmhouse, driven transect from the farmhouse to the west of the site with a walked perimeter transect of the field between T1 and T2 (M. Trewby)	Wind: 3 km/h Temp: 13° - 14° Precipitation: Light rain

Date	Start time	End time	Location	Survey type	Weather Conditions
18-Aug-2020 Sunset: 20:52	20:26	21:57	52.776226, -8.522304	Emergence Survey - The eastern facing side of the farmhouse in the east of site (N. Fleming)	Wind: 2km/h Temp: 16° - 18° Precipitation: Dry
	20:35	22:05	52.784621, -8.528125	Emergence survey - Abandoned farmstead in the east of the site. (A. Moroney)	Wind: 2km/h Temp: 16° - 18° Precipitation: Dry
	22:05	23:35	Figure 8-2	Transect survey - Walked transect in the east of the site with a driven transect to the south of the site (A. Moroney)	Wind: 2km/h Temp: 16° - 18° Precipitation: Dry
01-Sep-2020 Sunset: 20:20	21:11	22:50	52.782603, -8.543186	Emergence survey – Butt rot "mushroom" tree at the southern end of Beech woodland (O. O Sullivan & P. Devereux).	Wind: 10km/h Temp: 10° Precipitation: Dry
	22:50	00:20	Figure 8-2: Bat activity transect routes surveyed 2020	Transect survey – Walked and driven transect of field with T2 and adjacent fields to the south and west along with connecting road. (O. O Sullivan & P. Devereux)	Wind: 10km/h Temp: 10° Precipitation: Dry
23-Jun-2021 Sunset: 22:02	21:45	23:26	52.784621, -8.528125	Emergence survey – Abandoned farmstead, one surveyor on derelict farm house and another on adjacent derelict cattle shed. (O. O Sullivan & S. Fissolo).	Wind: 0km/h Temp:14° Precipitation Dry:
	23:36	00:53	Figure 8-2: Bat activity transect routes surveyed 2020	Transect survey – Walked transect of track to abandoned farmstead. Short driven transect. Walked transect in the fields southwest of T4. (O. O Sullivan & S. Fissolo).	Wind: 0km/h Temp:14° Precipitation Dry
24-Jun-2021 Sunrise: 05:11	03:44	05:26	52.784621, -8.528125	Re-entry survey – Abandoned farmstead, derelict house. (O. O Sullivan & S. Fissolo).	Wind: 0km/h Temp: 12° Precipitation: Dry
12-Jul-2021 Sunset: 21:57	22:00	23:23	52.785244, -8.536020	Emergence survey – Ash tree in conifer plantation. (O. O Sullivan & A. Moroney)	Wind: 2km/h Temp: 17°

Date	Start time	End time	Location	Survey type	Weather Conditions
					Precipitation: Light Rain, stopped at 22:25
	23:23	01:20	Figure 8-2: Bat activity transect routes surveyed 2020	Transect survey – Walked transect through conifer plantation, past abandoned farmstead and down dirt track in the east of the site, second section of walked transect through improved grassland in the south of the site (S. Fissolo & O. O Sullivan).	Wind: 2km/h Temp: 15° Precipitation: Dry
11-Aug-2021 Sunset: 21:10	20:55	22:35	52.784621, -8.528125 52.785084, -8.538532	Emergence survey – Derelict cottage in abandoned farmstead (O. O Sullivan & A. Moroney) Emergence survey – 2 mature beech trees in the Northeast of long-established beech woodland close to its border fence with conifer woodland (S. Fissolo & L. Gannon)	Wind: 0 km/h Temp: 13° Precipitation: Dry Temp: 14°
	22:40	23:30	Figure 8-2: Bat activity transect routes surveyed 2020	Transect survey – Walked transect from abandoned farmstead through conifer plantation in the centre north of the site with a 15-minute point count on western limit of conifer plantation (O. O Sullivan & A. Moroney) Transect survey – Walked transect of long-established beech woodland and adjacent field (S. Fissolo & L. Gannon).	Wind: 0km/h Temp: 12° Precipitation: Dry
12-Aug-2021 Sunrise: 06:11	04:45	07:41	52.785244, -8.536020 52.782603, -8.543186	Re-entry survey – At the mature ash tree in a small clearing of conifer plantation (O. O Sullivan & A. Moroney). Re-entry survey – At mature beech tree with butt rot and complex internal mushroom growth (S. Fissolo & L. Gannon).	Wind: 0km/h Temp: 13° Precipitation: Dry
24-Aug-2021 Sunset: 20:43	20:22	23:03	Figure 8-2: Bat activity transect routes	Transect survey – Walked transect through quarry following grid connection route where possible (S. Fissolo & L. Gannon).	Wind: 6km/h Temp: 19° Precipitation: Dry

Date	Start time	End time	Location	Survey type	Weather Conditions
			surveyed 2020		
25-Aug-2021 Sunrise: 06:32	04:30	06:50	52.783645, -8.540876 52.783672 -8.5409	Re-entry survey – 2 mature beech trees in the long-established woodland (S. Fissolo & L. Gannon).	Wind: 6km/h Temp: 12.5° Precipitation: Dry
14-Sep-2021 Sunrise: 07:08	05:35	07:21	52.784293, -8.539199	Re-entry survey – 2 Mature beech trees in the long-established woodland (O. O Sullivan & P. Devereux).	Wind: 2.2km/h Temp: Temp: 19° Precipitation: Dry
28-Sep-2021 Sunrise: 07:29	05:57	07:45	52.784621, -8.528125	Re-entry survey – Derelict cottage in abandoned farmstead in the east of the site (O. O Sullivan & S. Fissolo)	Wind: 0km/h Temp: 12°C Precipitation: Dry

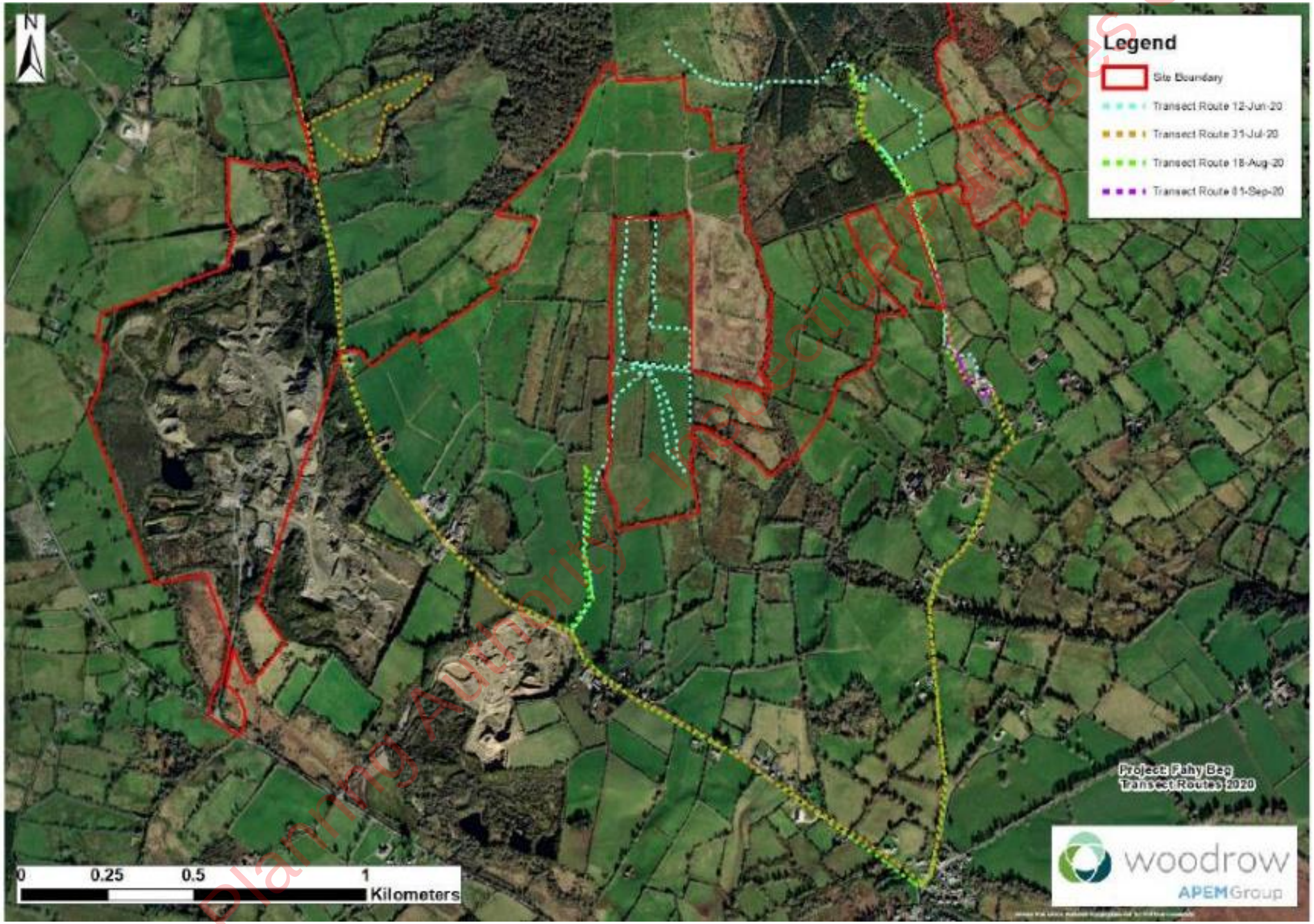


Figure 8-2: Bat activity transect routes surveyed 2020

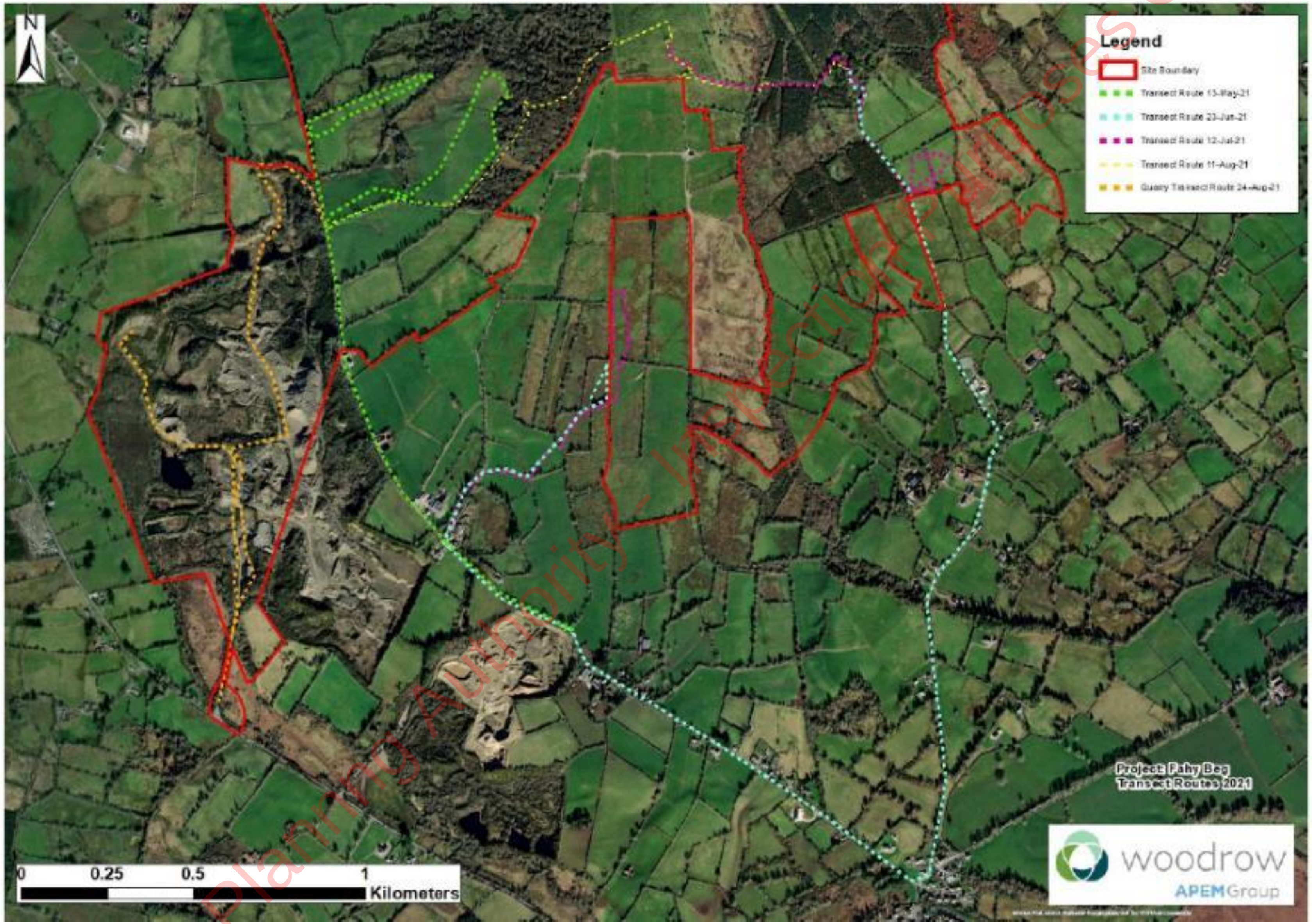


Figure 8-3: Bat activity transect routes surveyed 2021

Static bat detector surveys

Static detector surveys were undertaken using Wildlife Acoustics Song Meters (SM2 and SM4) during three periods each year covering spring, summer and autumn in 2020 and 2021. Static bat detectors were deployed to record the types of bat species present and to provide an overview of how bat activity is broadly distributed over the wind farm site and specifically at selected turbine locations.

In both 2020 and 2021, static monitors were deployed over three periods within the wind farm site. The location of all static detectors for each deployment in 2021 are shown in Figure 8-4**.** Each deployment included two context detectors; detectors used to sample specific habitat features rather than turbine locations. This provides further context to bat activity within the site to supplement and provide a comparison for the turbine locations, for example comparing bat activity along habitat features vs bat activity in open areas removed from features, emulating post-construction conditions around turbines.

The location of all static detectors for each deployment in 2020 is shown in Figure 4 in the accompanying Bat Report (Appendix 8-4), which also displays the movement of detectors from locations D.04a to D.04b and D.07a to D.07b between the spring and summer deployments.

Detectors were deployed to record a minimum of 10 nights of data within each of the survey windows: spring (April-May); summer (June- mid-August) and autumn (mid-August-October).

Monitoring climatic of conditions

Monitoring climatic of conditions was undertaken through the deployment of an on-site fully automated weather station with 3G connectivity.

The Davis Vantage Vue wireless integrated sensor suite weather station deployed, provided data on a real-time basis. This allows weather station functionality to be checked on a daily basis during the survey season and for action to be taken if a station fails or there are concerns regarding the data. This obviates the need for a second (backup) weather station. The weather station collected the full range of weather data, including temperature, wind speed and rainfall, which allows surveyors to determine whether deployment nights were compliant with the prescribed weather parameters (≥ 8°C at dusk, max. ground level wind speed of 5m/s and minimal rainfall). Deployment periods can then be adjusted to ensure 10 nights of compliant data are captured. In addition, site specific weather data can be useful for investigating the recorded patterns of site usage by bats, for instance exposed, open sites can receive an influx of foraging bats during nights that are warm and relatively still, especially towards the end of the summer and into the autumn, as bats disperse from maternity roosts (Woodrow per. obs.).

Calibration and testing of recording equipment

Calibration and testing of recording equipment is required by the SNH (2021) guidelines, and as a standard operating procedure Woodrow have a stringent schedule of testing all bat recording equipment prior to and during deployment in the field. Checks are logged in excel, providing an audit trail to ensure that all data can be relied on and form a robust and defendable data set. Unique numbering of static detectors, SD cards and microphones allows for reverse checking, if any issues arise, e.g., following a microphone failure. Checks undertaken include pre-deployment device setting and battery checks, and post- and pre- deployment microphone sensitivity checks.

Analysis

For data collected using Song Meter 2s (SM2s) and Song Meter 4s (SM4s) analysis of sound recordings was undertaken using Kaleidoscope software to confirm species (or genus for Myotis species) and exact number of bat passes for each transect survey or deployment. For data collected using the Batloggers, analysis of sound recordings was undertaken using BatExplorer software. Russ (2012) and Middleton et al. (2014) were used to aid in identification of bat calls during data analysis.

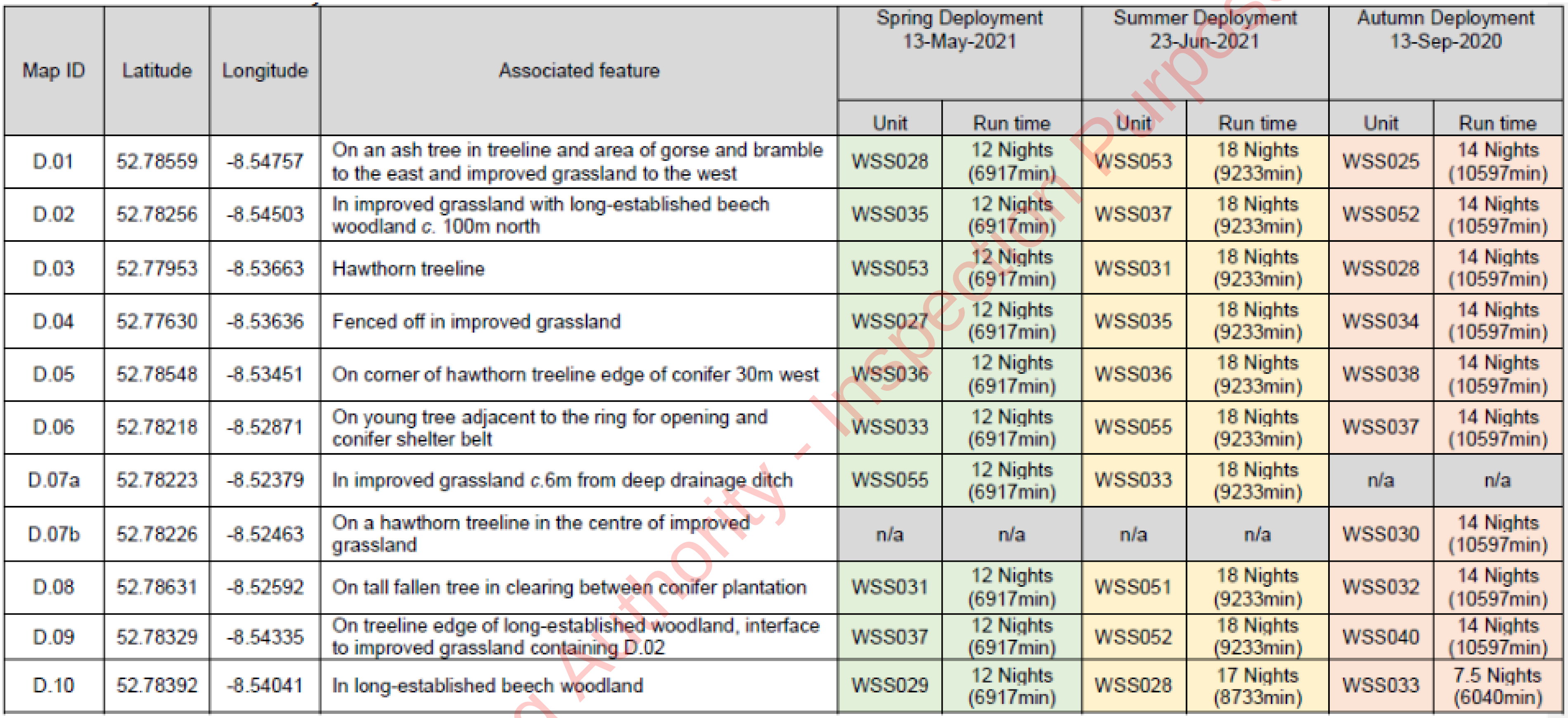
All sounds files were run through auto-identification and then manual verification was undertaken by Woodrow operatives. The settings for signal detection used for analysis with Kaleidoscope are provided in Appendix 2: Kaleidoscope Analysis Settings in the accompanying bat report (Appendix 8-4). Recordings identified as noise were determined to fall outside of the recording parameters for the survey and were manually classified as noise. Common and soprano pipistrelles which Kaleidoscope determined to be a match ratio of 100% (every pulse recorded matched the species call parameters) were considered to be accurate to a level not requiring manual verification. Recordings in which multiple species were recorded were split into separate passes. The number of passes generated were considered synonymous with Registrations, as defined by Ecobat, which is considered to be species presence within a 15 second sound file. SNH et al. (2021) guidelines recommend using the online tool Ecobat to allow for a measure of relative bat activity using a ranking system by comparing the data collected with bat survey information collected from similar areas during similar times of year. Through correspondence with the UK mammal society, it has been established that a Ecobat bases its median pass rates for pipistrelles classified to genus level on all pipistrelle species activity. In order to avoid complications with inflated median levels of pipistrelle activity the small number of calls which could only be classified to a genus level for pipistrelles were not included in the presentation of Ecobat analysis results for 2020. However, updates to the Ecobat app removed this problem in 2021 and those records are presented for 2021.

Up until recently, the reference system for Ecobat was strongly oriented on UK bat populations, and it was not clear whether reference data sets were relevant to Ireland. Comparative Irish data sets are now considered to have surpassed thresholds to allow for more robust assessments. Ecobat allows users to upload activity data and compare it to results within a reference range filtered by geographic location, time of year and the make of bat detector used. This generates robust reports tailored for a dataset's specific location, timeframe and equipment. The continued use of Ecobat improves its future accuracy as the data from each survey uploaded adds to their reference database (Lintott et al. 2017). There is potential for Ecobat to overestimate activity levels based on a lower level of its use on the island of Ireland. The effect of this is not possible to quantify as it is not know to what level other surveyors or consultancy are using the analysis software. It is considered however, that the 2021 results are more accurate estimations of median activity levels given that the 2020 data provides a baseline for the analysis.

Table 8-6: Static detector survey effort 2020

Map ID	Latitude	Longitude	Associated feature	Spring Deployment 25-May-2020		Summer Deployment 31-Jul-2020		Autumn Deployment 01-Sep-2020	
				Unit	Run time	Unit	Run time	Unit	Run time
D.01	52.78523	-8.54662	On ash tree to north of turbine location	WSS036	17 Nights (8894min)	WSS033	17 Nights (11111min)	WSS046	16 Nights (12074 min)
D.02	52.78135	-8.54417	On large semi-mature broadleaf c east of tracks along hedgerow	WSS038	No Data	WSS035	17 Nights (11111min)	WSS043	16 Nights (12074 min)
D.03	52.77957	-8.53664	On hawthorn on edge of grazing field	WSS039	17 Nights (8894min)	WSS024	17 Nights (11111min)	WSS050	16 Nights (12074 min)
D.04a	52.77548	-8.53499	On tree in hedgerow on side of grazing field	WSS028	17 Nights (8894min)	n/a	n/a	n/a	n/a
D.04b	52.77594	-8.53497	On oak tree in hedgerow/ treeline along old road and adjacent to field	n/a	n/a	WSS040	8 Nights (5110min)	WSS044	16 Nights (12074 min)
D.05	52.78525	-8.53598	On ash tree in middle of clearing between young conifer plantation.	WSS034	17 Nights (8894min)	WSS030	18 Nights (11734min)	WSS048	15 Nights (11330min)
D.06	52.78267	-8.53115	On young willow at edge of plantation in small clearing	WSS025	16 Nights (8416min)	WSS054	18 Nights (11734min)	WSS047	No Data
D.07a	52.78239	-8.52439	In open field c 70m from hedgerow	WSS023	17 Nights (8894min)	n/a	n/a	n/a	n/a
D.07b	52.78277	-8.52439	In hedgerow surrounded by improved grassland	n/a	n/a	WSS026	18 Nights (11734min)	WSS045	16 Nights (12074 min)
D.08	52.78636	-8.52576	In alder tree on edge of small clearing between plantations	WSS027	17 Nights (8894min)	WSS052	18 Nights (11734min)	WSS049	16 Nights (12074 min)
D.09	52.78444	-8.54300	Approximately 5m into beech woodland adjacent to improved grassland - open understorey beneath canopy of trees and next to small stream	WSS037	4.5 Nights (2194min)	WSS029	17 Nights (11111min)	WSS042	13 Nights (9654min)
D.10	52.78390	-8.53222	In sycamore adjacent to stream and ride between young plantation and wooded stream valley	WSS031	17 Nights (8894min)	WSS053	18 Nights (11734min)	WSS041	16 Nights (12074 min)

Table 8-7: Static detector survey effort 2021



Map ID	Latitude	Longitude	Associated feature	Spring Deployment 13-May-2021		Summer Deployment 23-Jun-2021		Autumn Deployment 13-Sep-2020	
				Unit	Run time	Unit	Run time	Unit	Run time
D.01	52.78559	-8.54757	On an ash tree in treeline and area of gorse and bramble to the east and improved grassland to the west	WSS028	12 Nights (6917min)	WSS053	18 Nights (9233min)	WSS025	14 Nights (10597min)
D.02	52.78256	-8.54503	In improved grassland with long-established beech woodland *c.* 100m north	WSS035	12 Nights (6917min)	WSS037	18 Nights (9233min)	WSS052	14 Nights (10597min)
D.03	52.77953	-8.53663	Hawthorn treeline	WSS053	12 Nights (6917min)	WSS031	18 Nights (9233min)	WSS028	14 Nights (10597min)
D.04	52.77630	-8.53636	Fenced off in improved grassland	WSS027	12 Nights (6917min)	WSS035	18 Nights (9233min)	WSS034	14 Nights (10597min)
D.05	52.78548	-8.53451	On corner of hawthorn treeline edge of conifer 30m west	WSS036	12 Nights (6917min)	WSS036	18 Nights (9233min)	WSS038	14 Nights (10597min)
D.06	52.78218	-8.52871	On young tree adjacent to the ring for opening and conifer shelter belt	WSS033	12 Nights (6917min)	WSS055	18 Nights (9233min)	WSS037	14 Nights (10597min)
D.07a	52.78223	-8.52379	In improved grassland *c.*6m from deep drainage ditch	WSS055	12 Nights (6917min)	WSS033	18 Nights (9233min)	n/a	n/a
D.07b	52.78226	-8.52463	On a hawthorn treeline in the centre of improved grassland	n/a	n/a	n/a	n/a	WSS030	14 Nights (10597min)
D.08	52.78631	-8.52592	On tall fallen tree in clearing between conifer plantation	WSS031	12 Nights (6917min)	WSS051	18 Nights (9233min)	WSS032	14 Nights (10597min)
D.09	52.78329	-8.54335	On treeline edge of long-established woodland, interface to improved grassland containing D.02	WSS037	12 Nights (6917min)	WSS052	18 Nights (9233min)	WSS040	14 Nights (10597min)
D.10	52.78392	-8.54041	In long-established beech woodland	WSS029	12 Nights (6917min)	WSS028	17 Nights (8733min)	WSS033	7.5 Nights (6040min)

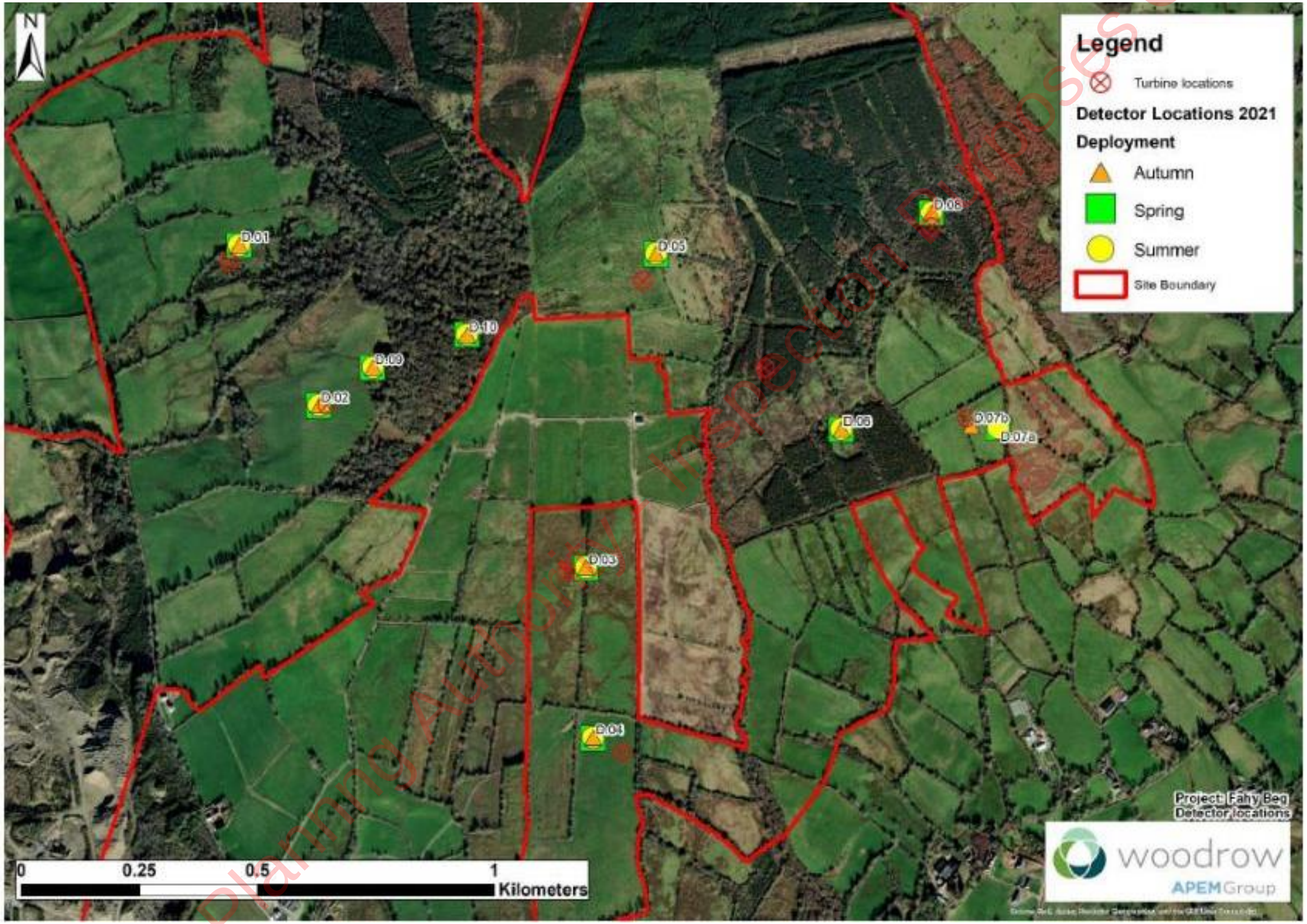


Figure 8-4: Static Detector Locations 2021

Limitations & issues pertinent to interpretation of bat survey results

In the case of bat surveys, survey limitations often relate to weather conditions at the time of the surveying and equipment failing in the field, for example microphones can be damaged by livestock or can lose sensitivity when exposed to prolonged episodes of heavy rainfall.

The following sections provide details for any potential limitations to bat surveys conducted in 2020 and 2021. Overall, it considered that the combined survey approach and coverage over the 2020 and 2021 survey seasons, provides robust data from which a full insight into the use of the proposed development by bats can be obtained. As such, this information can be used to assess the potential impacts of the proposed wind farm development on the local bat population. Given the survey methodologies used to ensure full coverage of proposed development across the bat activity season 2020/2021, it is considered that the data obtained complies, in full, with the recommend guidelines set out within Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (SNH et al. 2021). Please note that the NIEA guidance document NIEA, Natural Environment Division (2022) Guidance on Bat Surveys, Assessment & Mitigation for Onshore Wind Turbine Developments was first released during August 2021, towards the end of the final survey season. Applying this guidance, survey effort is compliant to the guidance for a medium risk site.

Coverage

At the time of deployment turbine locations were known to be subject to change and detectors were placed with the intention of producing the best coverage of potential turbine locations. For the most part, detectors placed at provisional turbine locations remained within approximately 100m of revised turbine locations with the exceptions of D.02 and D.06.

In 2020 D.02 was positioned on a treeline adjacent to a field of pasture and was located c. 150m to the south of the proposed turbine location, while in 2021 the detector was positioned within the open field, closer to the proposed turbine location.

In 2020 the location of D.06 was c.73m away from the associated proposed turbine location and in 2021 the detector was c.204m from the proposed turbine location due to changes in site layout. However, it is situated in a very similar environment to the proposed turbine location, on plantation edge lined with young broadleaf treelines, in close proximity to improved grassland. It is also a similar approximate distance from the river running north of south to the east of both locations (c.100m to D.06 in 2021). Given that the proposed turbine location is within conifer plantation, while during 2021, D.06 sits on the interface of plantation to open field and is closer to the river, it is considered that the activity recorded at D.06 in 2021 will likely be higher than the activity that would be recorded at the associated proposed turbine location.

Livestock

During the 2020 survey season in Fahy Beg two detectors had to be moved due to livestock interference. Detectors at D.04 and D.07 were both moved in between the spring and summer deployments. Throughout the report, for the initial spring deployment these detectors are referred to as D.04a and D.07a, while subsequent deployments are referred to as D.04b and D.07b. The location of D.07b is c.40m from D.07a and remains within c. 80m of the proposed turbine location. The distance from D.04a to D.04b is c. 50m however the detector was moved closer to the proposed turbine location (moved to within c. 32m of T4, between spring and summer deployments as noted above). During the 2021 survey season there was only one detector movement. The detector at D.07 was moved for the autumn deployment after the fence protecting the detector location was breached by livestock. The relocations of these detectors are shown in Appendix 8-4 and Figure 8-4, while the coordinates of the different locations are provide in
Table 8-6 and Table 8-7.

Areas holding features of moderate and high roost potential were identified in the west of the site. However, there was limited access during the survey season due to the presence of a bull in the field adjacent to this area of woodland, which limited the number of emergence/re-entry surveys that could be undertaken. Specifically in the case of the large tree with PRFs, including butt rot, at ITM 563166 670809. For this tree a roost inspection with an endoscope was carried out during the active bat season. Based on the final site layout this tree lies on the edge of the precautionary 300m zone of influence buffer around turbines (Figure 1) and will not be removed as part of the proposed development, therefore the lack of emergence/re-entry surveys is not considered to limit the baseline data.

Equipment

Equipment failures/technical issues in 2020 was limited to the following four detectors over the course of the survey:

- The detector at D.02 during the spring deployment suffered a technical issue in which the data files were corrupted and recorded bat calls were rendered unidentifiable.
- The context detector at D.09 during the spring deployment stopped recording on night 5 of its deployment, likely due to increased battery drain from recording high activity.
- The detector at D.04b during the summer deployment stopped recording after 8 nights likely due to the battery draining faster as a result of high activity being recorded there.
- The detector at D.06 during the autumn deployment suffered a data corruption issue and produced no data.

Despite these technical issues its is considered that the data collected during this survey remains robust and compliant with SNH (2021) guidelines. Limitations were mitigated by the use of two additional context detectors per deployment, which exceeds the minimum number of detectors required, as stipulated by the SNH et al. (2021) guidelines, along with an extended duration in deployment period during the summer deployment (17 to 18 nights recorded on nine detectors).

During the 2020 active season the weather station was placed in a sheltered location to avoid interference from livestock. Therefore, the wind speeds recorded are considered to below the actual wind speeds likely to be experienced across more open areas within the site. For this reason, the weather analysis in baseline conditions investigating bat activity relative to weather conditions did not include weather data from 2020.

For added protection from wildlife and livestock, the weather station installed on the site in 2021 was placed behind the client's fencing, used also to protect their Lidar equipment. This was along a conifer plantation edge in a gap between the plantation and a treeline, bordering improved grassland. Subsequently, it is considered that the wind speed measurements recorded in 2021 were potentially lower than those experienced on the site as a whole. For this reason, the 2021 wind speed recordings are presented using the highest wind speed recorded per hour rather than the mean value, as it is considered that this provides a more accurate context for wind speeds experienced on the site, when compared to data collected from Shannon airport historical data (available on request). This also produces a more precautionary model for the analysis of bat activity relative to weather conditions displayed in Baseline conditions (Appendix 8-4).

As can be seen in Appendix 3: Weather Data in the accompanying bat report (Appendix 8-4), there also appears to be multiple one-to-two-hour periods during the autumn 2021 deployment for which the weather station did not record, and the reason for this could not be ascertained. However, a probable cause is the increase in night duration in autumn, and the weather station being unable to charge fully using its solar panel. This was surmised as the gaps in data most frequently occurred in the last few hours prior to sunrise of the next day (05:00 and 06:00).

8.2.5.4 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; the quarries to south of the 500m buffer and the southern slopes of Lackreagh Mountain north of the 500m buffer (see Appendix IV of Ornithology Report) (Appendix 8.1). Breeding raptor surveys encompassed a 2 km buffer around the proposed turbine locations. Wintering waterbird (I-WeBS) surveys encompassed a 5 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)

Note: During the study swifts were moved to the red list (Gilbert et al., 2021); and therefore, in the second breeding season (2021) swifts were included as target species during VP surveys.

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 4 VPs (winter 2019/20, winter 2020/21, summer 2020, summer 2021)
- Transect surveys (winter 2019/20, winter 2020/21, summer 2020, summer 2021)
- Breeding Raptor Surveys (summer 2020, summer 2021)
- Hen Harrier Roost Searches (winter 2019/20, 2020/21, 2021/22)
- Wintering Waterbird Surveys (winter 2019/20)

Vantage Point (VP) Watches / Flight Activity Surveys

VP watches record flight-line activity in relation to the 500 m turbine buffer to provide data on selected target species for assessing avian collision risk. Four VPs were used to cover the study site the locations of which are shown in Figure 8-5. These four VPs provide complete coverage (99.66%) of the 500 m buffer around proposed turbine locations – see Appendix II of the Ornithology Report (Appendix 8.1) for viewshed map and Table 8-8 below. The VPs selected to cover the study area are compliant with the SNH (2017) guidelines, which stipulate that viewsheds from VPs should not extend more than 2 km and that the angle of view should also not be extended beyond an arc of 180 degrees.

The VP locations used were the same during all survey periods. Viewshed spatial coverages for each VP were calculated using ArcGIS Pro. The lowest minimum swept height of the turbine models is 36 m (N133, 102.5 m hub height). The viewshed analysis was performed using a surface offset of 15 m and this mapped what airspace is visible to surveyors (height 1.75m) above 15m. This was considered a precautionary estimate of the visible area based on the presence of mature forestry and woodland within the site, while ensuring a full view of the CRZ. Spatial coverage of these VPs, both in relation to the spatial area of the viewshed within the study area and proportion of the study area, is given in Table 8-8. The locations of the VPs and their viewsheds are mapped in Appendix II of the Ornithology Report (Appendix 8.1).

Based on viewsheds extending 2 km, the viewsheds of the VPs all overlap somewhat. Therefore, it is acknowledged that as a function of coverage (survey effort), the flight seconds reported cumulatively for all the VP watches will provide an overestimate for flight times. This is corrected for in the CRM. The conducting of VP watches simultaneously by two or more surveyors was therefore avoided in order to avoid any duplication of flight records. To limit observer fatigue, surveyors did not typically undertake VP watches of more than 3-hours in duration without a break, unless inclement periods of weather meant watches were paused for short durations until conditions improved.

VP watches involve the surveyor observing birds from a stationary position using binoculars and a telescope. In accordance with SNH (2017), the viewshed of the VP is scanned at 5-minute intervals. When a target species is seen, the surveyor estimates the height of the bird and its usage of the area by drawing its flight path on a map and noting its behaviour. Flight heights are estimated visually. Other data collected includes the number of birds, time of detection and duration of flight, as well as sex and age class if relevant. A list of all non-target species encountered within the environs of the development area is also compiled during watches, though priority is given to recording target species in the case of busier survey days.

As detailed in Table 8-8, a minimum of 36 hours of survey time have been completed per VP per season.

Table 8-8: Spatial visual coverage of 500 m buffer and collision risk zone (CRZ) & Overall Survey Effort

Vantage Point (VP)	Area of CRZ visible within 500m turbine buffer (ha)	% Coverage	VP survey effort non-breeding season (hrs)	VP survey effort breeding season (hrs)
VP1	152.03	42.81%	72.00	72.00
VP2	59.65	16.80%	72.00	75.00
VP3	192.46	54.19%	72.00	72.00
VP4	204.4	57.55%	72.00	72.00

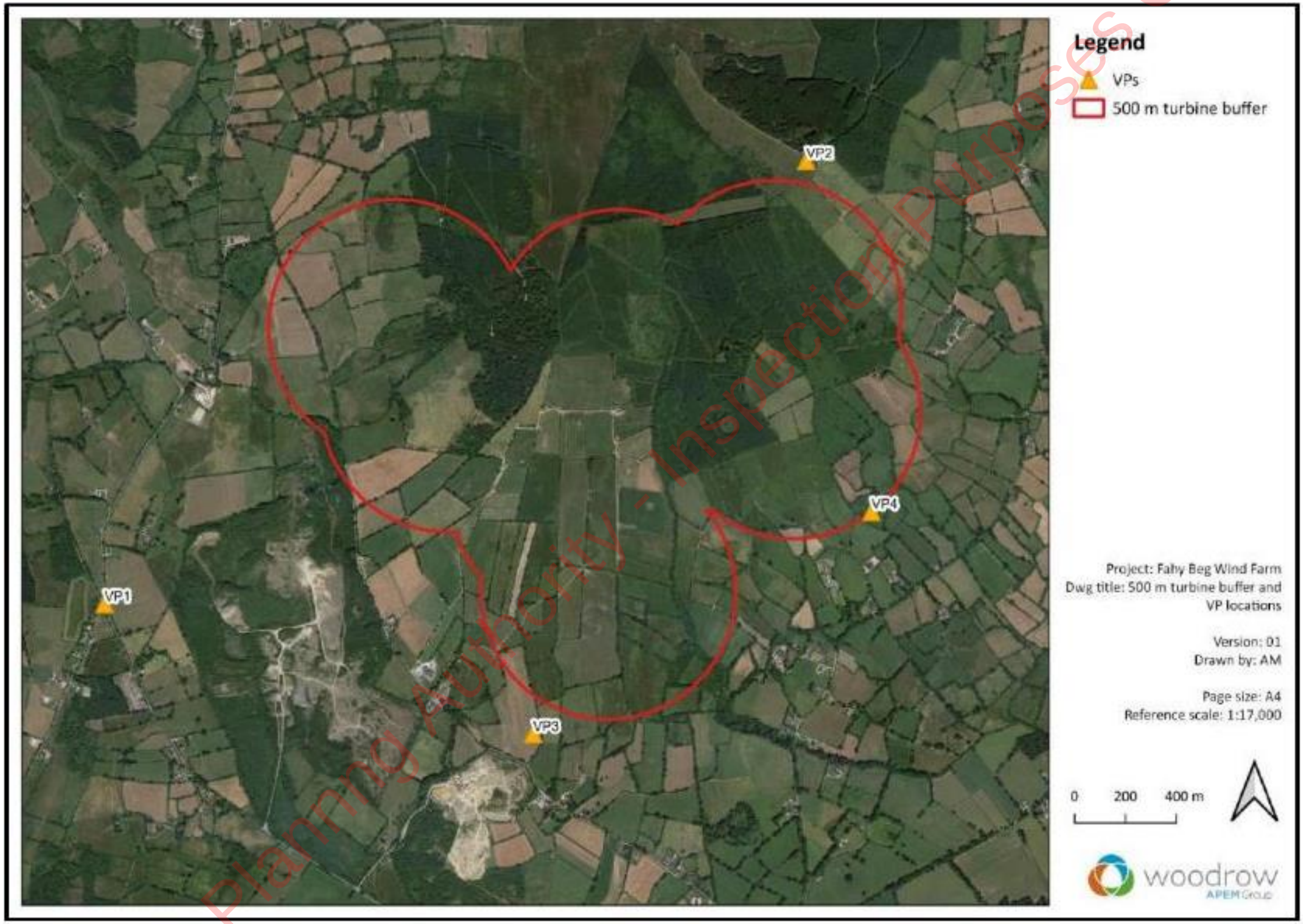


Figure 8-5: Vantage Point Locations

Collision Risk Modelling

VP watches are conducted to collect flight line data which can then be used to model collision risk. For target species generating sufficient levels of flight time within the zone of collision risk, data sets are run through a CRM, as detailed in SNH (2000) and Band et al. (2007), employing avoidance rates as given in SNH (2016, 2018). This provides estimates of the number of collisions per annum and for the lifetime of the proposed wind turbines (30 years). A detailed methodology of the CRMs used, along with results, is provided in Appendix VI of the Ornithology Report (See Appendix 8.1).

Hinterland Surveys

Wider Area Breeding Raptor Surveys

SNH (2017) recommends surveying the wider area (hinterland) for up to 2 km from the proposed turbines for most breeding raptor species, including hen harrier and merlin. This can be extended if the site lies within the potential zone of influence to Special Protection Areas – SPAs (SNH, 2016). In this instance, the site was not in close proximity to any SPAs designated for raptors (the closest being >11 km south-east) and the 2 km search radius was considered appropriate – see Figure 8-6 and Figure 8-9.

A combination of 'mini-VPs', as well as driven and walked transects were used to search potential nesting habitat within the hinterland over the breeding seasons of 2020 and 2021. Survey methods for breeding raptors follow those outlined in Hardey et al. (2013). As noted in Section 2, suitable breeding habitat for hen harrier and merlin was identified within the 2 km turbine buffer in the form of open bog habitat adjacent to woodland and conifer plantation. A total of 6 visits were carried out during summer 2020 and 8 visits were carried out during summer 2021. These surveys are detailed in Table 8-9.

Table 8-9: Wider area breeding raptor survey effort

Breeding 2020		Breeding 2021	
Date	**Surveyor**	**Date**	**Surveyor**
26/05/2020	JK	24/03/2021	DP
28/05/2020	JK	25/03/2021	DP
09/06/2020	JK	03/04/2021	DP
15/06/2020	JK	25/04/2021	DP
21/07/2020	JK	17/05/2021	DP
30/07/2020	JK	31/05/2021	DP
-	-	21/06/2021	DP
-	-	26/06/2021	DP

Hen Harrier Roost Searches

During the initial desk review, the habitat to the north of the 500 m turbine buffer was assessed as having the potential to be utilised by roosting hen harrier and a raised bog north of O'Briensbridge also had the potential to provide some cover. Therefore, speculative hen harrier roost searches were undertaken.

SNH (2017) guidance stipulates in relation to surveying for communal raptor roosts, including those of hen harriers, that roost sites within 2 km of a proposed wind farm should be identified.

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

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

SNH (2017) defers to Hardey et al. (2013) for specific roost survey methodology requiring surveyors to employ professional judgement in identifying and targeting potential roosts based on observed flight activity within or adjacent to a site. Hardey et al. (2013) recommend locating birds in the late afternoon and then attempting to track them back to roosts. O'Donoghue (2019) notes that the best time to conduct a roost watch is at least 40 minutes before sunset until dark or 30 minutes before sunrise until at least 30 minutes after sunrise.

Hen harrier roost watches were continued on for a third season in winter 2021-22. The dates of these surveys are given in Table 8-10, along with their corresponding VP locations that are mapped in Figure 8-6.

Table 8-10: Hen harrier roost searches

Non-breeding 2019-20			Non-breeding 2020-21			Non-breeding 2021-22		
Date	**Surveyor**	**VP**	**Date**	**Surveyor**	**VP**	**Date**	**Surveyor**	**VP**
06/02/2020	GO	VP1	26/10/2020	JK	VP2	26/10/2021	JK	VP2
12/02/2020	MH	VP1	02/11/2020	JK	VP2	28/10/2021	JK	VP3
26/02/2020	KW	VP2	25/11/2020	JK	VP3	30/10/2021	JK	VP4
-	-	-	05/12/2020	JK	VP3	02/11/2021	JK	VP2
-	-	-	15/12/2020	JK	VP4	07/11/2021	JK	VP3
-	-	-	04/01/2021	JK	VP4	16/11/2021	JK	VP3
-	-	-	30/01/2021	JK	VP3	02/12/2021	JK	VP4
-	-	-	05/02/2021	DP	VP5	09/12/2021	JK	VP3
-	-	-	13/02/2021	JK	VP3	14/12/2021	JK	VP2
-	-	-	-	-	-	03/01/2022	JK	VP2
-	-	-	-	-	-	11/01/2022	JK	VP4
-	-	-	-	-	-	27/01/2022	JK	VP3

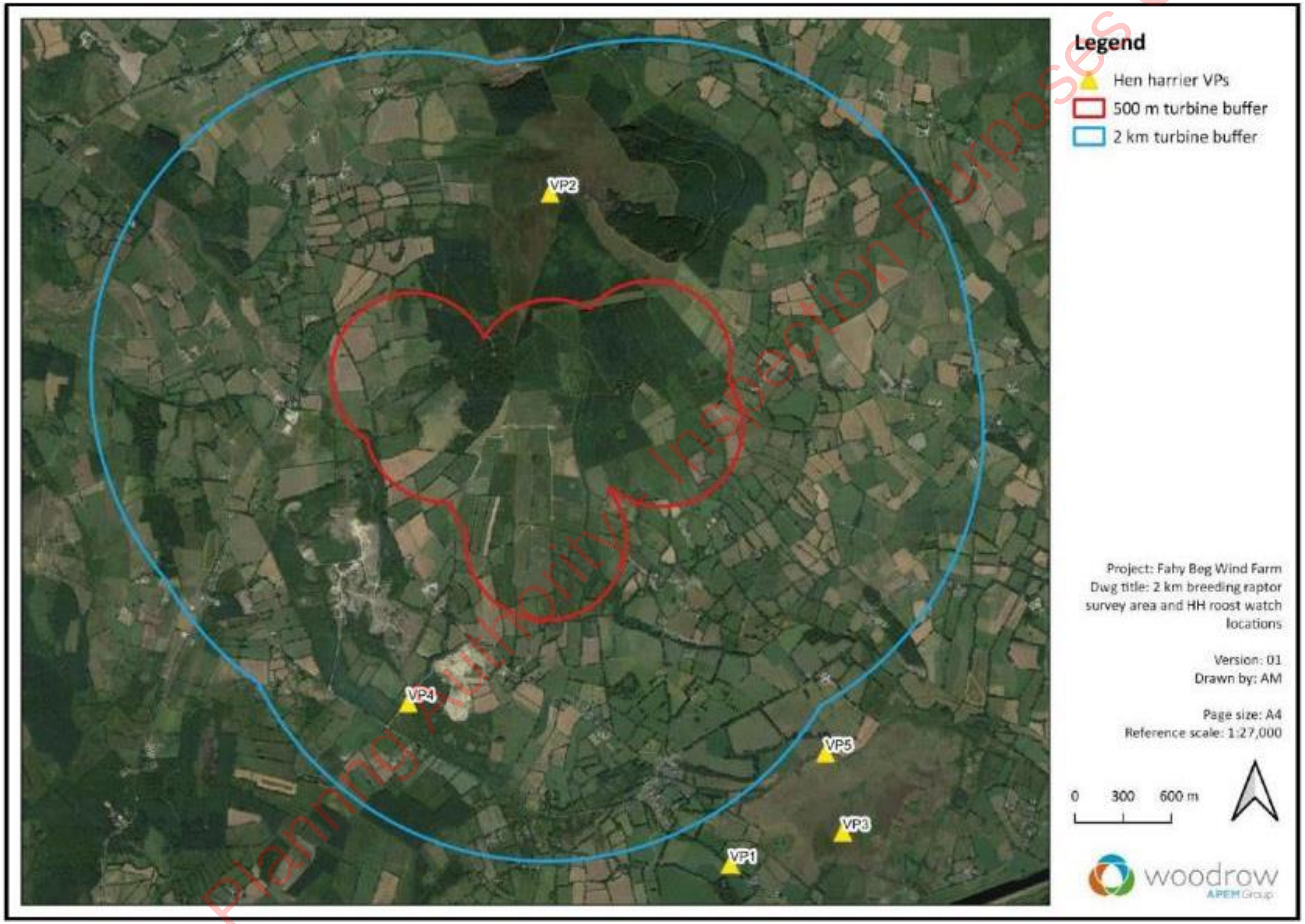


Figure 8-6: Survey area (2 km turbine buffer) for breeding raptors and hen harrier roost watch VPs

Wider Area Wintering Waterbird Surveys

In assessing the impact of the proposed wind farm, it is important to provide contextual data on the numbers of waterbirds (target species) in the wider area relative to the usage of the site by these species. SNH guidelines require monitoring of swan and geese foraging and roosting locations when occurring in the environs of the site, and specifically where SPAs are designated for these species. Study areas of up to 500 m from the site for foraging locations and up to 1 km from the site for roost locations are recommended, although this may be extended where high levels of activity are anticipated.

In Ireland, swan and goose distribution is often not well documented beyond designated sites. In addition, many wintering waterbirds occur outside of SPAs. As such, the number of surveys undertaken was subject to the results of the initial scoping visits and how much waterbird activity was noted within the site. The surveys were based on the approach employed by IWeBS (Irish Wetland Bird Surveys) and the survey area was extended up to 5 km from the site to cover the banks of the River Shannon.

Three wider area wintering waterbird surveys were conducted over winter 2019-20. Surveys were conducted on 17 October 2019, 13 December 2019 and 16 & 17 March 2020. During these surveys, counts were undertaken of waterbird species at all publicly accessible/viewable bogs, ponds, canals, rivers and other wetland habitats within a 2.5 km, 5 km and 2 km buffer of the proposed turbine locations on the respective survey dates. Other species, notably raptors, present during the survey were also recorded. The desk-based study identified that the agricultural fields along the banks of the River Shannon and Ardnacrusha Canal were the most likely area to support wintering waterbirds, including whooper swans and migratory grey geese. This area could be viewed for VP2 and any swans in green fields would be particularly evident.

Wider area winter waterbird surveys covered features along the final stretch of the turbine delivery route, including Mc Namara's Lake, located c. 2.5 km from the closest proposed turbine and is a small fishing lough (c. 4 ha) on the north bank of the Ardnacrusha Canal between O'Briensbridge and Bridgetown. In October 2019, species recorded here were limited to small numbers of grey heron (1), mute swan (1), mallard (3) and black-head gulls (5), with no birds were records at this location in December. There was no March 2020 visit to the lough.

As highlighted in the desk-based study, the limited habitat availability on the upland slopes of the site, means it was considered unlikely the area would consistently support any significant numbers of wintering waterbirds. This was confirmed by the surveys undertaken in winter 2019-20, which revealed very low densities of wintering waterbirds in the wider area. Consequently, it was assessed that it would not be necessary to repeat these surveys in Year 2 (winter 2020-21).

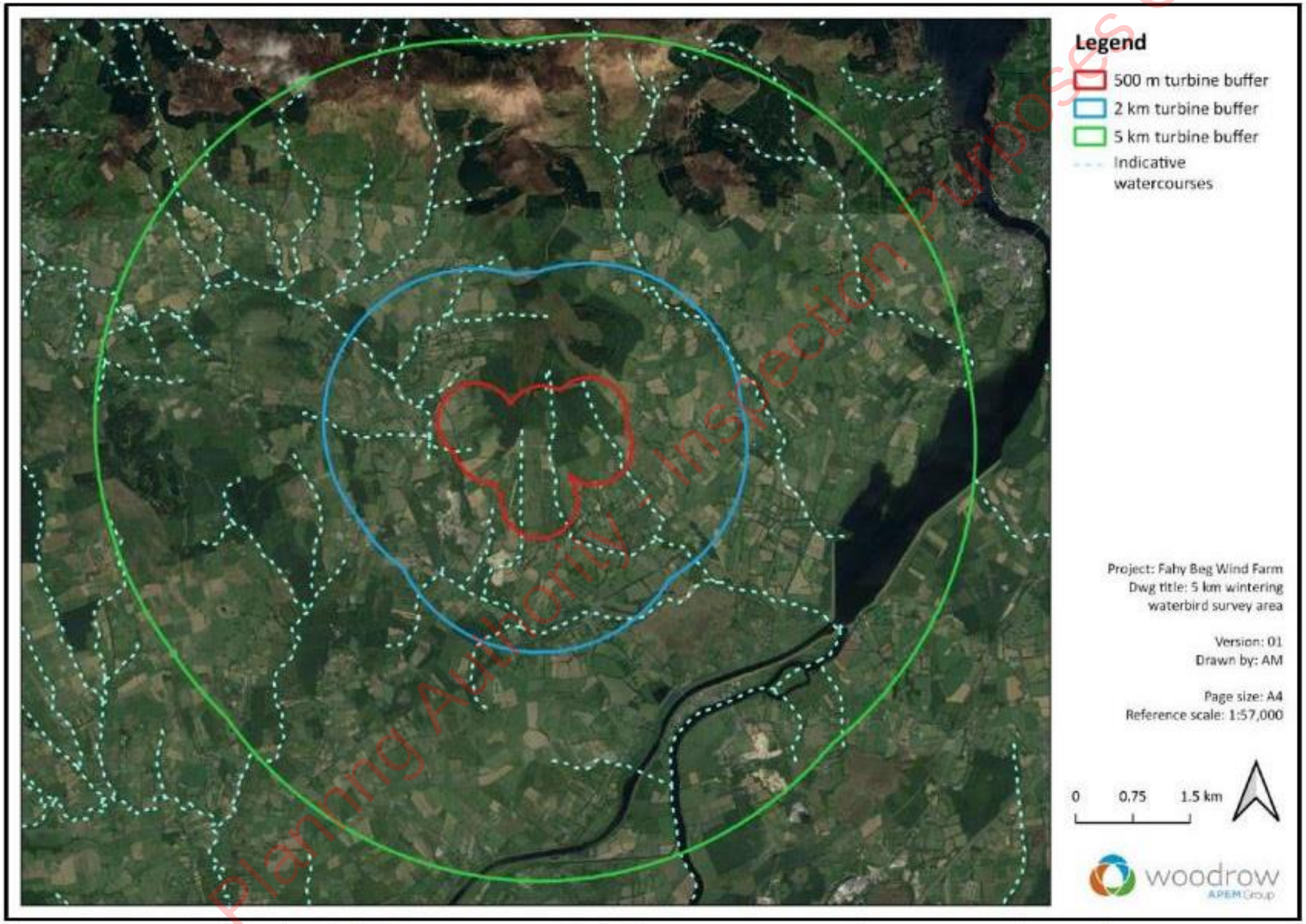


Figure 8-7: Survey area (5 km turbine buffer) for wintering waterbirds, showing watercourses and connectivity to the River Shannon

Breeding Bird Surveys

The purpose of the site walkovers or point counts, according to SNH guidelines, is to give a broad overview of bird activity in the study area using a route which is representative of the important ornithological features/habitats present (SNH, 2017). Breeding bird surveys aim to provide information on the distribution of breeding birds throughout the proposed development site and ornithological study area, highlighting the locations of potentially sensitive species to be flagged as ecological constraints, e.g. breeding waders or raptors. Various methods are employed depending on the habitat type and the expected species. Walkovers through the proposed development site (including the 500 m turbine buffer) employed a range of surveys determined by desk-based study such as proximity to designated sites, habitat availability and associated avian assemblages.

Based on topography and habitat availability, the desk-based study determined that the 500 m turbine buffer had the potential to support a range of target species, including upland breeding birds (e.g. hen harrier, merlin, red grouse, golden plover, curlew and snipe), lowland breeding waders (e.g. snipe, curlew and lapwing) and crepuscular/nocturnal woodland species (e.g. woodcock and long-eared owls).

For upland areas the Brown & Shepherd survey technique, as modified by SNH guidance (2005 rev 2010) was employed, which requires an increase in the number of visits per season from two to four. According to SNH (2017), breeding wader surveys should be at least 7 days apart, covering the whole breeding season. A search radius covering suitable habitat within 800 m of the proposed turbine locations is recommended, especially for breeding curlew. During these surveys, all other bird species encountered were also noted, along with behaviour to provide an indication of breeding status. The dates of these surveys are shown in Table 8-11.

The woodland edge in the northern part of the 500 m turbine buffer, facing out into the surrounding bog, was judged to provide a limited area of potential nesting habitat for tree nesting merlin. These areas within the 500 m turbine buffer were covered during walkovers, when surveyors looked for merlin signs, such as plucking posts. This area was also covered during wider area surveys when surveyors employed targeted VPs to cover suitable habitat. Additional breeding raptor surveys were undertaken in the wider area to increase coverage of suitable merlin and hen harrier habitats – see Section 3.4. As detailed in the desk-based study, within the 500 m turbine buffer suitable nesting habitat for merlin and hen harrier occurring in combination with sufficient expanses of foraging habitat was limited and likely to preclude the occurrence of these species within this buffer.

Suitable wet areas within the 500 m turbine buffer were covered for breeding snipe. Surveys running from dawn to three hours after or late afternoon to dusk (as detailed in O'Brien & Smith, 1992) were employed to increase the chances of detecting breeding behaviour, including chipping or drumming snipe.

Dusk surveys were carried out at woodland areas to identify roding woodcock (territorial males), as detailed in Gilbert et al. (1998). These surveys were carried out roughly 15 minutes before sunset and 60 minutes after sunset between May and June, as recommended by the UCC Irish Woodcock Project (UCC Ornithology Group, 2021). During dusk surveys, surveyors also listened for other crepuscular and nocturnal species, including owls and nightjars. Four dusk surveys were carried out per season, as shown in Table 8-11. See Appendix IV of the Ornithology Report (Appendix 8.1) for mapping of transect routes.

Table 8-11: Breeding bird survey effort

Breeding 2020			Breeding 2021		
Date	**Survey**	**Surveyor**	**Date**	**Survey**	**Surveyor**
19/05/2020	Breeding woodcock survey	JK	05/04/2021	Dawn snipe survey/upland breeding bird survey	DP
20/05/2020	Dawn snipe survey/upland breeding bird survey	JK	26/04/2021	Dawn snipe survey/upland breeding bird survey	DP
28/05/2020	Breeding woodcock survey	JK	23/05/2021	Breeding woodcock survey	DP
08/06/2020	Breeding woodcock survey	JK	24/05/2021	Breeding woodcock survey	DP
15/06/2020	Breeding woodcock survey	JK	26/06/2021	Breeding woodcock survey	DP
17/06/2020	Dawn snipe survey/upland breeding bird survey	JK	27/06/2021	Upland breeding bird survey	DP
25/06/2020	Dawn snipe survey/upland breeding bird survey	JK	27/06/2021	Breeding woodcock survey	DP
23/07/2020	Dawn snipe survey/upland breeding bird survey	JK	29/06/2021	Upland breeding bird survey	DP
30/07/2020	Dawn snipe survey/upland breeding bird survey	JK	30/06/2021	Upland breeding bird survey	DP

Winter site walkovers

Winter walkovers of the study area were undertaken during winter 2019-20 and winter 2020-21, during which surveyors walked the study area noting down all species encountered, ensuring to cover a sample of all habitats present. As such, winter walkovers provide useful information on the distribution of winter bird species within the site and how they are utilising each habitat type. As mentioned in Section 2, walkovers are also a more suitable survey method for species which are difficult to detect during VP watches, such as wintering woodcock. The dates of the winter site walkovers carried out during winter 2019-20 and winter 2020-21 can be found in Table 8-12.

See Appendix IV of the Ornithology Report (Appendix 8.1) for mapping of transect routes.

Table 8-12: Non-breeding season site walkover survey effort

Non-breeding 2019-20		Non-breeding 2020-21	
Date	**Surveyor**	**Date**	**Surveyor**
12/02/2020	MH	02/11/2020	JK
25/02/2020	KW	24/11/2020	JK
-	-	25/11/2020	JK
-	-	08/01/2021	DP
-	-	05/02/2021	DP
-	-	07/03/2021	DP
-	-	15/03/2021	DP

Survey limitations

Survey limitations included:

- Due to delays obtaining landowner permissions to access lands, surveyors only completed two walkovers in winter 2019-20, when ideally three visits would have been undertaken. This was compensated for in Year 2 with more extensive coverage.
- Access to the full ornithological study area for walkover surveys could only be undertaken on lands where permission had been granted. It is noted that the footprint of the entire development was accessible.
- In winter 2019-20, hen harrier roost surveys were only carried out in February, as opposed to the recommended monthly surveys in O'Donoghue (2019). This was accounted for by carrying out a third season of hen harrier roost watches in winter 2021-22.
- In summer 2021, upland breeding bird surveys carried out in June were <7 days apart, diverging from SNH (2017) recommendations.

Despite these limitations, it is considered that sufficient data was collected over the study period to identify any ornithological constraints that may arise for the proposed wind farm and inform the ornithological impact assessment.

8.2.5.5 Aquatic Ecology

The following section summarises the methodology of aquatic surveys carried out for the proposed Fahy Beg Wind Farm. The full report is included in Appendix 8-5.

Surveys to inform the aquatic ecology assessment were completed during 2021 and 2022. The surveys included walkover surveys, salmonid surveys (electro-fishing), and juvenile lamprey. Figure 8-9 gives the location of the proposed Fahy Beg Wind Farm and GCR with respect to Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA.

Strict biosecurity measures were followed during all fieldwork (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. drain areas close to the site) were considered as part of the current appraisal. Aquatic surveys were completed on all watercourses draining the proposed wind farm site, grid connection and turbine delivery route (TDR) locations where works are proposed near natural watercourses.

A total of 23 sites were surveyed, and 19 were selected for detailed assessment[2]. The purpose of these surveys is to provide baseline information and can also be used for monitoring during the construction of the proposed wind farm project. The location of the sites is given in Table 8-13 and shown in Figure 8-8. This is considered to be a very high-resolution survey for the study area in question. The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare/protected/notable aquatic species at each site.

All watercourses selected for survey were visited during the September 2021. An additional visit to some sites was carried out at the end of March 2022 to search for brook lamprey spawning activity. All watercourses which will be affected by proposed crossings were assessed.

Table 8-13: Location of the aquatic ecology sites assessed for the proposed Fahy Beg Wing Farm project

Site No.	Catchment	Sub-catchment	Watercourse Name	Order	Segment Code	EPA Code	X (ITM)	Y (ITM)
1	Lower Shannon	Shannon[Lower]_SC_080	River Black [O'Briensbridge]	3rd	25_1163	25B22	567244	668210
2	Lower Shannon	Shannon[Lower]_SC_080	River Black (O'Briensbridge)	2nd	25_2293	25B22	565823	668960
3	Lower Shannon	Shannon[Lower]_SC_080	River Black (O'Briensbridge)	2nd	25_2648	25B22	564598	668978
4	Lower Shannon	Shannon[Lower]_SC_080	River Black (O'Briensbridge)	2nd	25_2648	25B22	564106	670511
5	Lower Shannon	Shannon[Lower]_SC_080	Kilroughil Stream	1st	25_2711	25K69	565257	669714
6	Lower Shannon	Shannon[Lower]_SC_080	River Bridgetown (Clare)	2nd	25_1163	25B23	564568	668105
7	Lower Shannon	Shannon[Lower]_SC_080	River Bridgetown (Clare)	2nd	25_474	25B23	562898	668428

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[2] All watercourse crossings along the TDR after exiting the M7 were surveyed, however this was in excess of requirements to complete the assessment as a total of four sites were located at watercourses where TDR works are not required. As such an additional four aquatic survey sites are listed in the methodology section but not considered further within the assessment. These are sites A16, A19, A20 and A21.

Site No.	Catchment	Sub-catchment	Watercourse Name	Order	Segment Code	EPA Code	X (ITM)	Y (ITM)
8	Lower Shannon	Shannon[Lower]_SC_080	River Bridgetown (Clare)	1st	25_2517	25B23	562332	668063
9	Lower Shannon	Owenogarney_SC_010	Broadford River	2nd	27_1315	27B02	562464	670544
10	Lower Shannon	Owenogarney_SC_010	Broadford River	1st	27_380	27B02	563002	670242
11	Lower Shannon	Shannon[Lower]_SC_100	River Blackwater [Clare]	4th	25_3883	25B06	560238	661766
12	Lower Shannon	Shannon[Lower]_SC_100	River Blackwater [Clare]	3rd	25_3221	25B06	559377	662468
13	Lower Shannon	Shannon[Lower]_SC_100	River Blackwater [Clare]	3rd	25_13109	25B06	558947	665665
14	Lower Shannon	Shannon[Lower]_SC_100	Glenomra Wood Stream	3rd	25_3221	25B06	559962	665790
15	Lower Shannon	Shannon[Lower]_SC_100	Glenomra Wood Stream	3rd	25_13111	25B06	560039	666002
16	Lower Shannon	Kileengarrif_SC_010	River Ballyard 25	1st	25_3408	25B77	572139	667621
17	Lower Shannon	Shannon[Lower]_SC_080	River Ardcloony	2nd	25_2596	25A03	567587	669129
18	Lower Shannon	Shannon[Lower]_SC_080	River Ardcloony	2nd	25_2596	25A03	567416	669376
19	Lower Shannon	Shannon[Lower]_SC_080	River Kilmastulla	5th	25_3881	25K04	570875	669195
20	Lower Shannon	Shannon[Lower]_SC_080	River Kilmastulla	5th	25_3881	25K04	571697	669397
21	Lower Shannon	Shannon[Lower]_SC_080	River Roolagh	1st	25_2679	25R20	570794	671064
22	Lower Shannon	Shannon[Lower]_SC_080	River Ballyteige 25	2nd	25_2794	25B17	569543	671527
23	Lower Shannon	Shannon[Lower]_SC_080	River Ballyteige 25	2nd	25_2794	25B17	569231	671710

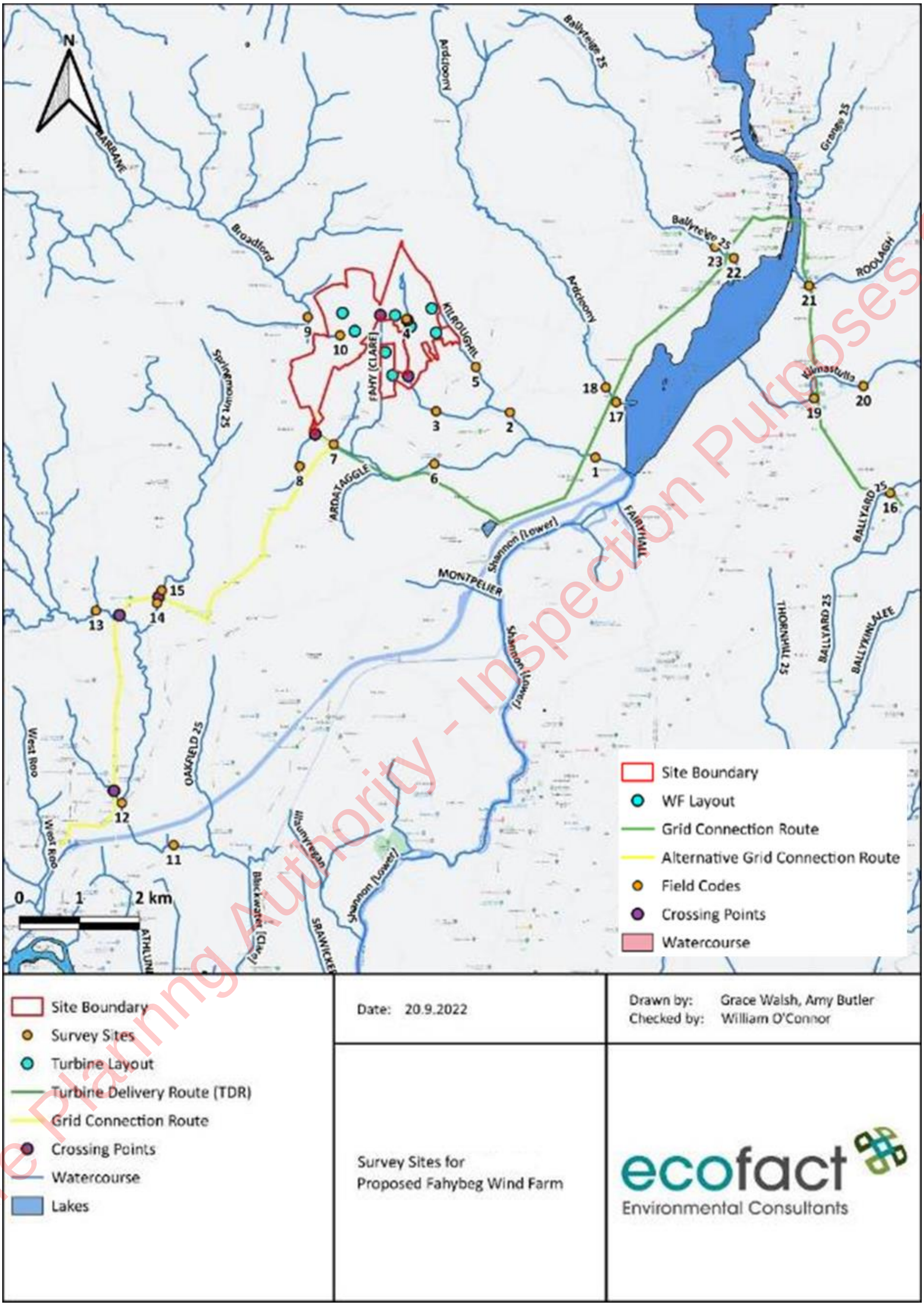

Figure 8-8: Aquatic Ecology Survey Sites

Habitat Surveys

Habitat Surveys were carried out on the entire study area. Survey Site locations are illustrated in Figure 8-8. 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:

- Stream width and depth and other physical characteristics
- Substrate type, listing substrate fractions in order of dominance, i.e., large rocks, cobble, gravel, sand, mud etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area
- Instream vegetation, and percentage coverage of the stream bottom at the sampling site (as applicable) and on the bankside
- Estimated cover by bankside vegetation, giving percentage shade of the sampling site.

Aquatic Macroinvertebrate Surveys

Qualitative sampling of benthic (or bottom dwelling) macroinvertebrates was undertaken at the suitable survey sites using kick-sampling (Toner et al., 2005). Survey Site locations are illustrated in Figure 8-8. This procedure involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the riverbed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. This procedure was undertaken at three points along/across the watercourse. Vegetation sweeps were also undertaken over a further 1-minute period to ensure a representative sample of the fauna present at the site was collected. Specific sweep netting assessments were completed to determine presence / absence of white-clawed crayfish and juvenile lamprey species.

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.

Table 8-14: 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*

Salmonid Surveys

Each survey site was assessed for potential salmon nursery and fishery habitat. Survey Site locations are illustrated in Figure 10. An electrical fishing survey was undertaken at selected sites during September 2021.This was completed under authorisation from the Department of Environment, Climate and Communications under Section 14 of the Fisheries (Consolidation) Act (1959). Sites were surveyed following the methodology outlined in the CFB (2008) guidance "*Methods for the Water Framework Directive-Electric fishing in wadable reaches*". A portable electrical fishing unit (Smith Root-LR 24backpack) was used to carry out the survey. The sites were fished continuously for 5 minutes each. Captured fish were collected into a container of river water using dip nets. The fish were released alive and spread evenly over the sampling area. No mortalities were recorded. During this survey any other fish species recorded were also noted.

Juvenile Lamprey Surveys

Each survey site was assessed for potential lamprey nursery and fishery habitat. Juvenile lamprey surveys generally followed the methodology for ammocoete surveys given in the manual *'Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri* and *Petromyzon marinus'* by Harvey & Cowx (2003). Electrical fishing for juvenile lampreys was carried out at selected sites. Lamprey identification followed '*Identifying Lamprey. A Field Key for Sea, River and Brook Lamprey'* by Gardiner R (2003).

An additional visit to some sites was carried out at the end of March 2022. These were sites 4, 9, 12, 14, 19, 21 and 22. This was carried out to search for brook lamprey spawning activity.

8.2.5.6 Marsh Fritillary Surveys

Areas of higher floristic diversity were assessed for possible occurrence of marsh fritillary *Euphydryas aurinia*. In particular, any areas of wet grassland or mosaics containing wet grassland were checked for the presence of the butterfly's foodplant, devil's-bit scabious *Succisa pratensis.* The most extensive areas of *S. pratensis* in the site are located in the fields east of proposed turbine T05, and in the northern-western part of the field where the proposed turbine T02 is located (northwest of T02) (see

Figure 8-17).

Scattered patches of *S. pratensis* were found locally on the site, including a field west of the T02 field, the existing track/woodland ride through Ballymoloney Wood, and along the existing track south of the fields east of T05.

The survey was carried out during 19th – 20th September 2022 during calm, clear weather. All occurrences of *S. pratensis* were inspected in detail. Larval web searches were carried out along transects through the areas supporting high densities of *S. pratensis*, and searches were also carried out opportunistically wherever this plant was observed. Surveys were completed in accordance with NRA methodology (*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*) (NRA, 2009). Further details are available in Appendix 8-6.

8.2.5.7 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.

8.2.5.8 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. Key ecological receptors (for assessment) are those deemed to be above the 'Local Importance (lower value) evaluation. Evaluation criteria are outlined in Table 1 in Appendix 8-7.

8.2.5.9 Avifauna Receptor Evaluation

Avifauna resources are initially evaluated as to whether they constitute key receptors for the assessment following NRA guidance as outlined in Section 8.2.5.8 and Appendix 8.7. 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 2 in Appendix 8-7 illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors.

8.2.6 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 10 km square but can be operationally defined to reflect the character of the area of interest. This scheme, taken from NRA (2009a) is detailed in Appendix 8-7 and in Appendix 2 of the Aquatic Ecology Report (Appendix 8-5).

8.2.7 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 8-15 to Table 8-20 outline 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 8-15: 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 8-16: 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 8-17: 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
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

Significance of Effect	Description
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 8-18: 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 8-19: 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.
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

Type of Effect	Description
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 8-20: 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

Geographic context

Accrdign to CIEEM (2019) EcIA Guidelines, the importance of an ecological feature should be considered within a defined geographical context. This guidance recommends that the following frame of reference be used, or adapted to suit local circumstances:

- International and European
- National
- Regional
- Metropolitan, County, vice-county or other local authority-wide area
- River Basin District
- Estuarine system/Coastal cell
- Local.

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 8-21 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 8-21: 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 8-22.

Table 8-22: Significance matrix: combining magnitude and sensitivity to assess significance (Percival, 2003)

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

8.3 Description of Existing Environment

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

8.3.1 Designated Sites

8.3.1.1 Defining the Zone of Influence

The potential zone of influence (ZoI) for the wind farm 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 wind farm and the conservation interests of individual sites (source-pathway-receptor/SPR analysis). All sites identified in the initial search are detailed here.

The potential ZoI for the GCR and TDR is defined by a 500m buffer around the TDR Nodes and GCR alignment. The 500m buffer is informed by the limited scale of works required at TDR Nodes (vegetation clearance/trimming and placement of temporary load bearing surfaces are the most invasive works required) and the limited works footprint associated with the GCR. The 500m buffer has also been selected as this distance encompasses the buffering distances required for the most sensitive group (wetland and waterbirds) associated with designated sites.

The 500m buffer has been applied at all TDR Nodes and the GCR to maintain a consistent approach. Any sites outside the 500m buffer with potential hydrological linksor other ecological links such as mobile species are also within the potential ZoI of the TDR and GCR. The ZoI is then refined further based on the potential impacts associated with works at particular TDR Nodes and the conservation interests of individual sites. All sites identified in the initial search are detailed here.

8.3.1.2 Sites of International Importance

Candidate Special Areas of Conservation (SACs)

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

There are three SACs within the potential Zone of Influence (ZoI) of the proposed Fahy Beg Wind Farm project. Two of these sites are within the ZoI of the Site, one is within the ZoI of the GCR, and one is within the ZoI of the TDR. See Table 8-23 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').

There are four SPAs within the potential Zone of Influence (ZoI) of the proposed Fahy Beg Wind Farm project. Three of these sites are within the ZoI of the Site, one is within the ZoI of the GCR, and one is within the ZoI of the TDR. See Table 8-23 for details

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

An Appropriate Assessment (AA) Screening Report has 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 (Screening) and a Natura Impact Statement (NIS) to ascertain if the project (either alone or in-combination with other plans or project) will adversely affect the integrity of a European site. These assessments accompany this planning application.

Figure 8-9 and
Figure 8-10 show the location of the designated sites in relation to the proposed turbine locations. The closest European site to the wind farm is Slieve Bernagh Bog SAC (located c. 2.3 km from the nearest proposed turbine); see Table 8-23 for details.

8.3.1.3 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.

A total of one NHA and eight pNHAs are present within the potential ZoI of the proposed project (wind farm, grid connection & TDR) (Table 8-24). No NHAs or pNHAs beyond the initial wind farm search radius of 15 km were identified as falling within the potential ZoI.

Of these sites, one NHA and six pNHAs are within the potential ZoI of the proposed wind farm. Two pNHAs are within the potential ZoI of the proposed TDR. There are no additional NHAs or pNHAs within the potential ZoI of the proposed grid connection.

Within these sites, four pNHAs overlap European sites (one SPA and two SACs) (See Table 8-24).

Figure 8-9 and
Figure 8-10 show the location of the designated sites in relation to the proposed turbine locations. The closest (national) designated site to the wind farm is Glenomra Wood pNHA (also an SAC) (located c. 2.8 km from the nearest proposed turbine). See Table 8-24 for more information.

Table 8-23: Summary of European Sites within the potential ZoI of the windfarm, GCR and TDR

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest node) (m)	In Potential ZoI?
Slieve Bernagh Bog SAC	002312	• Northern Atlantic wet heaths with *Erica tetralix* [4010] • European dry heaths [4030] • Blanket bogs (* if active bog) [7130]	2.3 km	> 500m	> 500m	No
Glenomra Wood SAC	001013	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]	2.9km	> 500m	> 500m	No
Lower River Shannon SAC	002165	• Sandbanks which are slightly covered by sea water all the time [1110] • Estuaries [1130] • Mudflats and sandflats not covered by seawater at low tide [1140] • Coastal lagoons [1150] • Large shallow inlets and bays [1160] • Reefs [1170] • Perennial vegetation of stony banks [1220] • Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] • *Salicornia* and other annuals colonising mud and sand [1310] • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)* [1330] • Mediterranean salt meadows (*Juncetalia maritimi*) [1410] • Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	3.2 km Hydrological connectivity	> 500m Hydrological connectivity	67m (PoI 18) Hydrological connectivity	Yes

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest node) (m)	In Potential ZoI?
		• *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] • Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] • *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] • *Petromyzon marinus* (Sea Lamprey) [1095] • *Lampetra planeri* (Brook Lamprey) [1096] • *Lampetra fluviatilis* (River Lamprey) [1099] • *Salmo salar* (Salmon) [1106] • *Tursiops truncatus* (Common Bottlenose Dolphin) [1349] • *Lutra lutra* (Otter) [1355]				
Lough Derg (Shannon) SPA	004058	• Cormorant (*Phalacrocorax carbo*) [A017] • Tufted Duck (*Aythya fuligula*) [A061] • Goldeneye (*Bucephala clangula*) [A067] • Common Tern (*Sterna hirundo*) [A193] • Wetland and Waterbirds [A999]	6.1 km	> 500m	> 500m	Yes
Danes Hole, Poulnalecka SAC	000030	• Caves not open to the public [8310] • Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	9.2 km	> 500m	> 500m	Yes
Slievefelim to Slivermines Mountains SPA	004165	• Hen Harrier (*Circus cyaneus*) [A082]	11.5 km	> 500m	> 500m	Yes

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest node) (m)	In Potential ZoI?
Clare Glen SAC	000930	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] • *Trichomanes speciosum* (Killarney Fern) [1421]	13.2km	> 500m	> 500m	No
River Shannon and River Fergus Estuaries SPA	004077	• Cormorant (*Phalacrocorax carbo*) [A017] • Whooper Swan (*Cygnus cygnus*) [A038] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Shelduck (*Tadorna tadorna*) [A048] • Wigeon (*Anas penelope*) [A050] • Teal (*Anas crecca*) [A052] • Pintail (*Anas acuta*) [A054] • Shoveler (*Anas clypeata*) [A056] • Scaup (*Aythya marila*) [A062] • Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Lapwing (*Vanellus vanellus*) [A142] • Knot (*Calidris canutus*) [A143] • Dunlin (*Calidris alpina*) [A149] • Black-tailed Godwit (*Limosa limosa*) [A156] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Greenshank (*Tringa nebularia*) [A164] • Black-headed Gull (*Chroicocephalus ridibundus*) [A179] • Wetland and Waterbirds [A999]	14.3km Hydrological connectivity	> 500m Hydrological connectivity	367m Node 9 Hydrological connectivity	Yes
Kilkishen House SAC	002319	• *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303]	14.4 km	> 500m	> 500m	No

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest node) (m)	In Potential ZoI?
Silvermines Mountains West SAC	002258	• Northern Atlantic wet heaths with *Erica tetralix* [4010] • European dry heaths [4030] • Calaminarian grasslands of the *Violetalia calaminariae* [6130]	14.4km	> 500m	> 500m	No
Slieve Aughty Mountains SPA	004168	• Hen Harrier (*Circus cyaneus*) [A082] • Merlin (*Falco columbarius*) [A098]	15.8 km	> 500m	> 500m	Yes
Curraghchase Woods SAC	000174	• Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] • Taxus baccata woods of the British Isles [91J0] • Vertigo moulinsiana (Desmoulin's Whorl Snail) [1016] • Rhinolophus hipposideros (Lesser Horseshoe Bat) [1303]	28.8 km	> 500m	100m	Yes
Askeaton Fen Complex SAC	002279	• Calcareous fens with Cladium mariscus and species of the Caricion davallianae [7210] • Alkaline fens [7230]	26.6 km	> 500m	> 500m	No
Barrigone SAC	000432	• *Juniperus communis* formations on heaths or calcareous grasslands [5130] • Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) [6210] • Limestone pavements [8240] • Euphydryas aurinia (Marsh Fritillary) [1065]	38.2 km	> 500m	> 500m	No

Table 8-24 Summary of National Sites within the Potential ZoI of the windfarm, GCR and TDR

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest Node) (m)	In Potential ZoI?
Glenomra Wood pNHA (Overlaps SAC)	001013	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	2.8 km	> 500m	> 500m	No
Lough Derg pNHA (Overlaps SPA & SAC)	000011	• *Cladium* fen, • Alluvial woodland • Yew woodland • Limestone pavement • Alkaline fen • Juniper scrub formations on heath and calcareous grasslands • Cormorant (*Phalacrocorax carbo*) • Tufted Duck (*Aythya fuligula*) • Goldeneye (*Bucephala clangula*) • Common Tern (*Sterna hirundo*) • Wetland and Waterbirds • Sea Lamprey • Brook Lamprey • Pollan	5.7 km	> 500m	> 500m	Yes
Doon Lough NHA	000337	• Peatlands	6.5 km Hydrological connectivity	> 500m	> 500m	Yes

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest Node) (m)	In Potential ZoI?
Gortacullin Bog NHA	002401	• Peatlands	6.5 km	> 500m	> 500m	No
Cloonlara House pNHA	000028	• Leisler's Bat (*Nyctalus leisleri*)	7.9 km	> 500m	> 500m	Yes
Castleconnell (Domestic Dwelling, Occupied) pNHA (within SAC)	000433	• Daubenton's Bat (*Myotis daubentonii*)	8.3 km	> 500m	> 500m	Yes
Danes Hole, Poulnalecka pNHA (within SAC)	000030	• *Rhinolophus hipposideros* (Lesser Horseshoe Bat)	10.0 km	> 500m	> 500m	Yes
Knockalisheen Marsh pNHA (Overlaps part of SAC)	002001	• Marsh	10.1km	> 500m	> 500m	No
Cloonloum More Bog NHA	002307	• Peatlands	11.3 km	> 500m	> 500m	No
Woodcock Hill Bog NHA	002402	• Peatlands	11.8 km	> 500m	> 500m	No
Lough O'Grady pNHA	001019	• Wet woodland • Wet grassland • Wildfowl (notably Greenland White-fronted geese) • Open water	12.4km	> 500m	> 500m	No
Loughanilloon Bog NHA	001020	• Peatlands [4]	12.8 km	> 500m	> 500m	No
Castle Lake pNHA	000239	• Open water • Hazel scrub • Ash/oak woodland	13.0 km Hydrological connectivity	> 500m	> 500m	Yes

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest Node) (m)	In Potential ZoI?
Clare Glen pNHA (Overlaps SAC)	000930	• Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles • *Trichomanes speciosum* (Killarney Fern)	13.1 km	> 500m	> 500m	No
Fergus Estuary and Inner Shannon, North Shore pNHA (Overlaps parts of SAC & SPA)	002048	• Wetland and Waterbirds • Estuary • Triangular club-rush (*Scirpus triqueter*)	13.2km Hydrological connectivity	> 500m	> 500m	Yes
Lough Cullaunyheeda pNHA	001017	• Tufted Duck • Coot • Wigeon • Teal • Goldeneye • Pochard • Lapwing	14.1 km	> 500m	> 500m	No
Derrygareen Heath pNHA (Within SPA)	000931	• Heathland	14.2 km	> 500m	> 500m	No
Ayle Lower Bog NHA (Overlaps part of SPA)	000993	• Peatlands [4]	14.7 km	> 500m	> 500m	No
Inner Shannon Estuary-South Shore pNHA (Overlaps parts of SAC & SPA)	000435	• Mudflats • Wetland and Waterbirds • Triangular Club-rush • Summer Snowflake	14.8 km	> 500m	0m Overlaps Node 9	Yes
Curraghchase Woods pNHA (Overlaps SAC)	000174	• Alluvial forests with Alnus glutinosa and	28.8 km	> 500m	100m	Yes

Designated Site	Site code	Features of Interest	Distance to closest turbine (km)	Distance to grid connection (m)	TDR (Distance to closest Node) (m)	In Potential ZoI?
		Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] • Taxus baccata woods of the British Isles [91J0] • Vertigo moulinsiana (Desmoulin's Whorl Snail) [1016] • Rhinolophus hipposideros (Lesser Horseshoe Bat) [1303]				

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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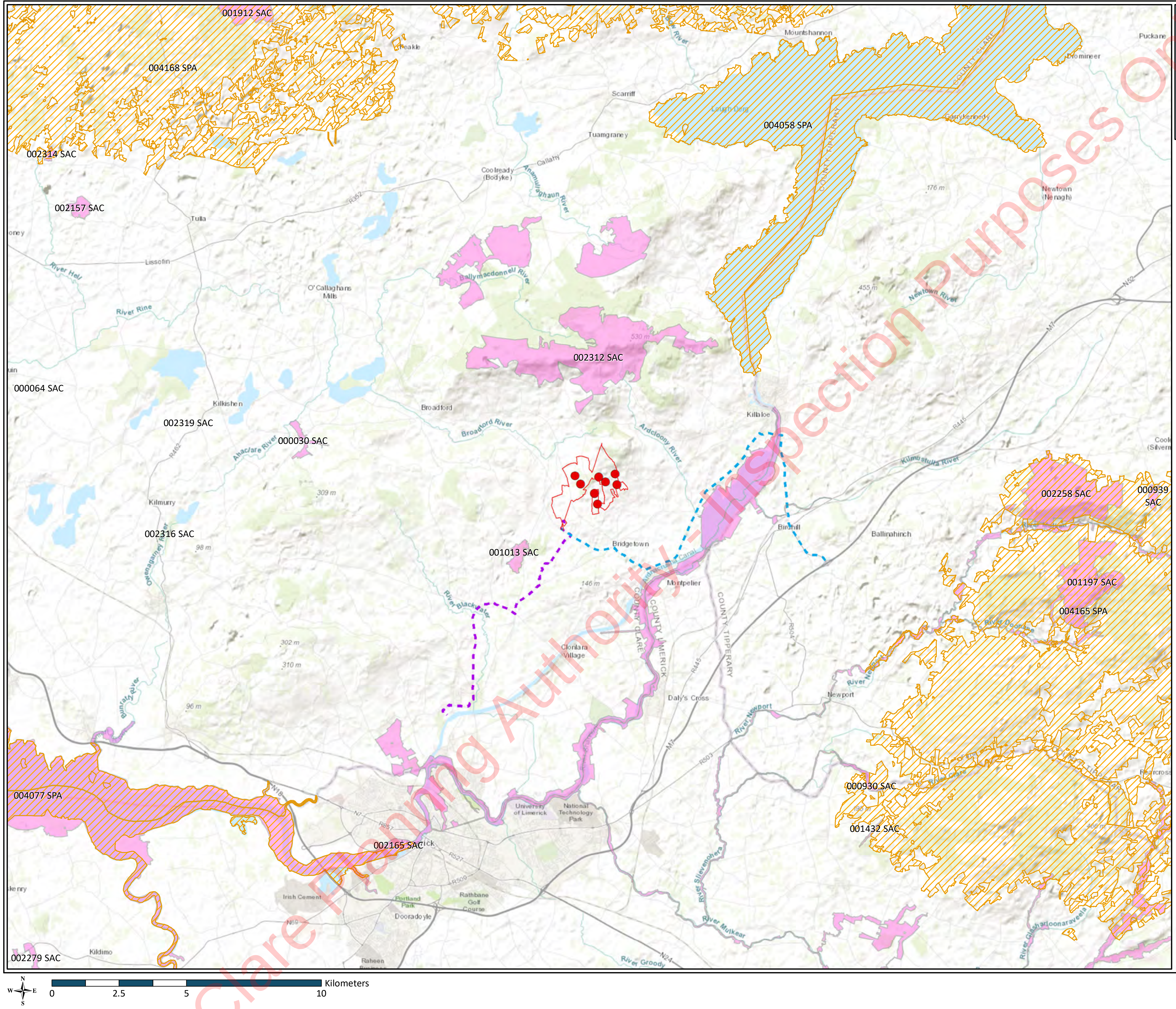

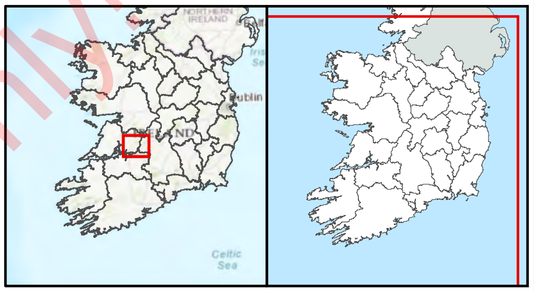

Legend

🟥	Wind Farm Site Boundary
●	Proposed Turbine Layout
- - -	Turbine Delivery Route
- - -	Grid Connection Route
▨	Special Protection Area (SPA)
▩	Special Area of Conservation (SAC)

SPAs within potential ZoI

Site Code and Site Name - Distance to closest turbine:

004058: Lough Derg (Shannon) SPA - 6.0km to T7

004077: River Shannon and River Fergus Estuaries SPA - 14.3km to T6

004168: Slieve Aughty Mountains SPA - 15.1km to T2

004165: Slievefelim to Silvermines Mountains SPA - 11.5km to T8

SACs within potential ZoI

Site Code and Site Name - Distance to closest turbine:

000030: Danes Hole, Poulnalecka SAC - 9.2km to T2

002165: Lower River Shannon SAC - 3.2km to T8

TITLE:
European Sites within Potential ZOI

PROJECT:
Fahy Beg Wind Farm, Co. Clare

FIGURE NO: 8-9
CLIENT: RWE Renewables Ireland Ltd.
SCALE: 1:135000 **REVISION:** 0
DATE: 02/12/2022 **PAGE SIZE:** A3

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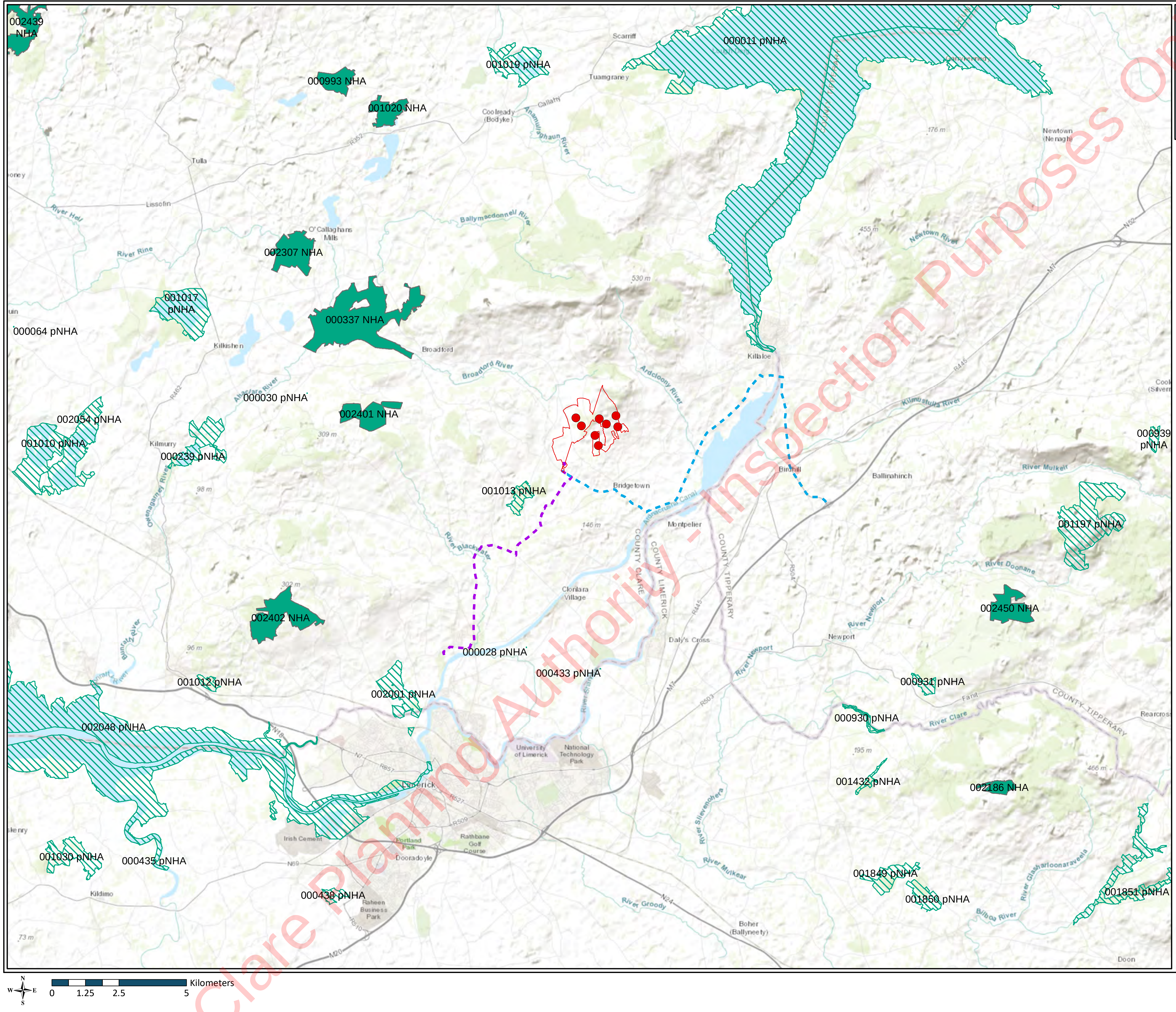

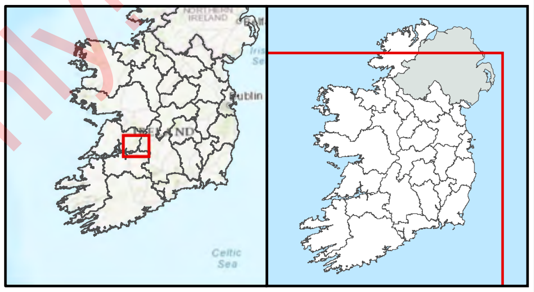

Legend

🟥 Wind Farm Site Boundary

● Proposed Turbine Layout

Turbine Delivery Route

Grid Connection Route

Natural Heritage Areas

🟩

Proposed Natural Heritage Areas

▨

NHAs within potential ZoI

Site Code and Site Name:

000337, Doon Lough NHA - 6.5km to T2

pNHAs within potential ZoI

Site Code and Site Name - Distance to closest Turbine:

000239, Castle Lake - 13km to T1

000433, Castleconnell (Domestic Dwelling, Occupied) - 8.25km to T4

000028, Cloonlara House - 7.9km to T4

000030, Danes Hole, Poulnalecka - 10.0km to T1

002048, Fergus Estuary And Inner Shannon, North Shore - 13.2km to T6

000435, Inner Shannon Estuary - South Shore - 14.8km to T6

000011, Lough Derg - 5.7km to T7

TITLE: pNHA's and NHA's within Potential ZOI	
PROJECT: Fahy Beg Wind Farm, Co. Clare	
FIGURE NO: 8-10	
CLIENT: RWE Renewables Ireland Ltd.	
SCALE: 1:135000	**REVISION:** 0
DATE: 06/12/2022	**PAGE SIZE:** A3

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8.3.1.4 Other Designated Sites

Nature Reserves

No nature reserves are present within 15km of the proposed development. The closest Nature Reserve is Caher (Murphy), c. 25km north of the proposed wind farm.

RAMSAR Sites

No RAMSAR sites are present within 15km of the proposed development. The closest RAMSAR site is Ballyallia Lough, c. 30km northwest of the proposed development.

8.3.1.5 Other Sites of Interest

The national survey of native woodlands (NSNW) dataset obtained from the NPWS indicates the presence of Ballymoloney Woods, a woodland overlapping the northern part of the site. This is not an Annex I habitat (see Section 8.2.5.1). Approximately 2km to the northeast of the site is an oak-ash-hazel woodland Ballygarreen. Designated habitat within this site is alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Pandion, Alnion incanae, Salicon albae)* [91E0]. Additionally, c. 3km southwest of the site, this dataset identifies Glenomra Wood, which is also designated as a pNHA and SAC for its Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0]. Additional woodlands identified in the NSNW within the ZoI are Bealkelly Woods, Carownakilly, Aughinish Wood, Garrynatineel, Ballymacdonnell, Violethill, Ballykelly Woods, Doonass Demsne, Cappanahanaagh, and Clare Glen.

8.3.2 Rare and Protected Flora

The results of botanical and habitat surveys carried out are described in section 8.3.4. The Fahy Beg Wind Farm site is located within Ordnance Survey National 10 km Grid Squares R67 and R66.

These 10 km grid squares were searched for records of plant species through the National Biodiversity Data Centre (NBDC) website (most recent search 19th December 2022).

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 wind farm site was obtained from NPWS (received 15/03/2022 and 25/03/2022); this encompassed grid squares R57, R67, R77, R76, and R56. The 1 km grid squares overlapping the proposed grid route (R5861, R5862, R5962, R5963, R5964, R5965, R6065, R6165, R6166, R6167, R6267, R6268) were also searched for records of rare or protected flora.

Table 8-25 presents details of the rare and protected plant species found within the 10km squares R57, R67, R77, R76, and R56. Information on habitats was completed using; Streeter et al*. 'Collins Wildflower Guide'* 2nd edition, 2018 and the British Bryological society's '*Mosses and Liverworts of Britain and Ireland a field guide*' 2010.

Records for eight species are within the 10km grid squares (R66 and R67) which overlap the proposed wind farm site, listed in Table 8-25

Within the study area, habitats broadly suitable for all identified species are present, with the exception of large white-moss (*Leucobryum glaucum*) and scissors pincerwort (*Cephalozia loitlesbergeri*). No rare or protected flora were found within the wind farm site, the GCR or the TDR during surveys.

The NPWS FPO Bryophyte Sites map viewer was also consulted. There are no FPO Bryophyte Sites at or near the proposed wind farm site (closest is Scarriff, Co. Clare, c. 15 km north) or along the GCR and TDR.

Table 8-25: Historic Records of rare and protected flora within the 10km Grid Squares R67 and R66 (NBDC data) and data supplied by NPWS for grid squares within 10km of the Fahy Beg site (R57, R67, R66, R77, R76, R56).

Species	Grid Square	Location of Records	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Fahy Beg
Annual Knawel (*Scleranthus annuus)*	R66	Castleconnell	1902	NPWS Rare/Threatened Plants Database; Herbarium and Literature Database 19/02/2013; Miscellaneous Rare Plant Records Sept 2013	Flora (Protection) Order, 2022; Vulnerable	Open vegetation on sandy, dry and slightly acidic soils e.g., quarries, sandpits and disturbed wastelands	Not observed
Smooth Brome (*Bromus racemosus)*	R66	Lacka, North of Castleconnell; Ballycummin; South of Castleconnell	2010	Herbarium and Literature Database 19/02/2013; Rare Vascilar Plants: Additional Records on Survey Cards 2011, Miscellaneous Rare Plant Records 2013; Co. Limerick 2006 Rare Plant Survey	Near Threatened	Alkaline meadows and wastelands	Not observed
Heath Cudweed (*Gnaphalium sylvaticum*)	R67	Glennagalliagh Mountain	1896	NPWS Rare/Threatened Plants Database	Flora (Protection) Order, 2022; Endangered	Damp or dry sandy/gravelly acidic soils. In full light or semi-shade.	Not observed
Small Cudweed (*Filago minima*)	R66	Gooig Gravel/Sand Pit, Co. Limerick	2020	NPWS Rare/Threatened Plants Database	Near Threatened	Open, dry, sandy/gravelly infertile soils.	Not observed
Opposite-leaved Pondweed (*Groenlandia densa)*	R67, R77	Killaloe	2011	Herbarium and Literature Database 19/02/2013; Miscellaneous Records A (2012); Rare Vascular Plants: Additional Records on Survey Cards 2011	Flora (Protection) Order, 2022; Near Threatened	Base-rich lakes.	Not observed

Species	Grid Square	Location of Records	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Fahy Beg
Meadow Brome (*Bromus commutatus*)	R66	World's End, North of Castleconnell	1999	Herbarium and Literature Database 19/02/2013	Near Threatened	Unimproved damp meadows, road verges, field borders.	Not observed
Small Cow-wheat (*Melampyrum sylvaticum*)	R67	No Data	2008	Vascular plants: Online Atlas of Vascular Plants 2012 Onwards	Endangered	Shallow, infertile acidic soil.	Not observed
Large White-moss (*Leucobryum glaucum*)	R67	No Data	2004	Bryophytes of Ireland	EU Habitats Directive Annex IV	Acidic woodland, wet heath and mires, raised bogs and fens.	Not observed
Scissors Pincerwort (*Cephalozia loitlesbergeri*)	R57	Derrymore House	2004	NPWS Rare/Threatened Plants Database	Vulnerable	Bogs	Not observed
Heath Threadwort (*Cephaloziella stellulifera*)	R76	Lackamore	2008	NPWS Rare/Threatened Plants Database	Near Threatened	Damp, neutral or acidic habitats	Not observed
Cladonia portentosa	R56, R57, R77	Woodcock Hill Bog NHA; Tountinna, Arra Mountains; Gortacullin Bog NHA, Seefin; Laghter Mountain	2009	NPWS Lichen Surveys; LichenIreland, North Tipperary Heathland Survey 1986	EU Habitats Directive Annex V	Heaths, dunes, peaty moorland	Not observed

Species	Grid Square	Location of Records	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys for Fahy Beg
Wood Club-rush (*Scirpus sylvaticus*)	R56	Parteen	1903	NPWS Scare Plants Spreadsheet (Historic Records)	Near Threatened	Wet woodland, stream banks	Not observed
Northern Dead-nettle (*Lamium confertum*)	R66	Donass, Co. Limerick	1901	Miscellaneous Rare Plant Records Sept. 2013	Near Threatened	Agricultural fields and waste ground	Not observed

8.3.3 Invasive Non-Native Flora

The invasive species listed in Table 8-26 have been recorded within the 10km grid squares (R66, R67) overlapping the wind farm site. A total of 12 invasive plant species have been recorded in these 10km grid squares, of which nine 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 two invasive species were found in the 2km grid squares overlapping the proposed wind farm, of which one is a Schedule III, High Impact species (Japanese knotweed). Sycamore was the other invasive species within the 2km grid squares and is classified as a "Medium Risk" species[3].

Invasive species of flora recorded within 1km grid squares that overlap the grid connection route are also detailed in Table 8-26.

Table 8-26: Invasive Species within 10km and 2km grid squares overlapping Fahy Beg Wind Farm and 1km squares overlapping the Grid Connection Route.

Species	1km (GCR)	2km	10km	Invasive Impact[3]	Legal Status	Recorded in Study Area
Canadian Waterweed (*Elodea canadensis*)	-	-	R66, R67	High Risk	Schedule III	
Curly Waterweed (*Lagarosiphon major*)	-	-	R67	High Risk	Schedule III	
Giant Hogweed (*Heracleum mantegazzianum*)	R5962	-	R66	High Risk	Schedule III	
Himalayan Honeysuckle (*Leycesteria formosa*)	-	-	R66, R67	Medium Risk	None	
Himalayan Knotweed (*Persicaria wallichii*)	-	-	R66, R67	Medium Risk	Schedule III	Yes
Indian/Himalayan Balsam (*Impatiens glandulifera*)	-	-	R66, R67	High Risk	Schedule III	
Japanese Knotweed (*Fallopia japonica*)	R5861	R67F	R66, R67	High Risk	Schedule III	Yes
Nuttall's Waterweed (*Elodea nuttallii*)	-	-	R66, R67	High Risk	Schedule III	
Rhododendron ponticum	-	-	R66	High Risk	Schedule III	
Sycamore (*Acer pseudoplatanus*)	R5965, R6167	R67F	R66, R67	Medium Risk	None	
Three-cornered Garlic (*Allium triquetrum*)	-	-	R66	Medium Risk	Schedule III	
Traveller's-joy (*Clematis vitalba*)	-	-	R66	Medium Risk	None	

---

[3] NBDC Invasiveness Risk. Accessed for individual species via NBDC non-native species catalogue https://species.biodiversityireland.ie/?keyword=Catalogue%20of%20Irelands%20Non-native%20Species

8.3.3.1 Invasive Species Recorded within the Study Area

Wind Farm Site

Stands of Japanese knotweed (*Fallopia japonica*) are present at the derelict farm in the northern part of the site (ITM 0564345 0670541 and 564421 670562). These are multi-stemmed stands measuring 3-4m height. One stand is c. 10 x 17m while the other is c. 3 x 12m in area. These stands (inclusive of 7m buffer) are outside the proposed infrastructure footprint (closest proposed infrastructure is an access track c. 50m north-west).

Fuchsia (*Fuchsia magellanica*) and cherry laurel (*Prunus lauroceracus*) are also present in this area. Neither of these species is within the proposed development footprint (closest proposed infrastructure is an access track c. 30m away).

A large stand of Himalayan knotweed (*Persicaria wallichii*) is present c. 50m north of the proposed access track running through the quarry in the south-west of the site. This stand is irregular in shape, measuring c. 12m across at it's widest part but tapering to c. 1.5m. It is c. 60m in length.

Sycamore is present in an area of young mixed broadleaved woodland on the boundary of the quarry, at the western boundary of the proposed wind farm site.

Other non-native species present in the area of the derelict farm include Wilson's honeysuckle, Lawson cypress and New Zealand holly. These also located outside the proposed development footprint.

See Figure 8-11 for the locations of invasive species at the proposed wind farm site.

Table 8-27: Invasive & non-native species at the wind farm site

Species	Invasive Impact	Location
Japanese knotweed *Fallopia japonica*	Schedule III Risk of High Impact	Derelict farm between T6 & T7
Himalayan knotweed *Persicaria wallichii*	Schedule III Risk of Medium Impact	Western part of quarry
Cherry laurel *Prunus lauroceracus*	Risk of High Impact	Derelict farm between T6 & T7
Sycamore *Acer pseudoplatanus*	Risk of Medium Impact	Western boundary of site (quarry boundary woodland)
Fuchsia *Fuchsia magellanica*	Not Assessed[4]	Derelict farm between T6 & T7
Wilson's honeysuckle *Lonicera nitida*	Not Assessed	Derelict farm between T6 & T7
Lawson cypress *Chamaecyparis lawsoniana*	Not Assessed	Derelict farm between T6 & T7

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[4] The National Biodiversity Data Centre has not carried out an assessment of the risk to native flora associated with these species to date

Species	Invasive Impact	Location
New Zealand holly *Olearia macrodonta*	Not Assessed	Derelict farm between T6 & T7

The Grid Connection

A total of 14 non-native species with varying levels of invasiveness were recorded along the proposed GCR. These are present within the road verges and along property boundaries/within properties set back from the roads along the GCR.

These included two Schedule III-listed species, Japanese knotweed and giant hogweed. The Japanese knotweed growth is in a field set back c. 9m from the R465 running through Ardnacrusha (ITM 559225, 662661).

A linear growth and one small specimen of giant hogweed are present on opposite sides of an un-named local road along the GCR north-west of Harol's Cross (ITM 561277, 666182 & ITM 561291, 666202). The road at this location is narrow (c. 2.5m width), with both occurrences of giant hogweed located immediately adjacent in the verges.

Cherry laurel is present in association with private garden boundaries fronting roads. A high number of non-native species are present in association with private gardens in Ardnacrusha, and at other locations along the GCR. The most frequently recorded species was snowberry, which occurs along all sections of the route. This species occurs in hedgerows bounding roads, with linear growths over 500m in length recorded.

The potentially invasive species recorded along the GCR are listed below in Table 8-28 and shown on

.

Table 8-28: Invasive & non-native species recorded along the GCR

Species	Invasive Impact	Location
Butterfly bush *Buddleja davidii*	Risk of Medium Impact	Ardnacrusha
Cherry laurel *Prunus lauroceracus*	Risk of High Impact	Ardnacrusha R465 R471
Fuchsia *Fuchsia magellanica*	Not Assessed	Ardnacrusha Un-named local road off Harol's Cross Un-named local road joining R466
Giant hogweed *Heracleum mantegazzianum*	Schedule III Risk of High Impact	Un-named local road Ballyboucher
Himalayan honeysuckle *Leycesteria formosa*	Risk of Medium Impact	R465
Japanese knotweed *Fallopia japonica*	Schedule III Risk of High Impact	Ardnacrusha

Species	Invasive Impact	Location
Montbretia *Crocosmia x crocosmiiflora*	Low risk of Impact	Ardnacrusha R465 R471 Un-named local road off Harol's Cross Un-named local road Ballyboucher
Red osier dogwood *Cornus sericea*	Low risk of Impact	Ardnacrusha
Snowberry *Symphoricarpos albus*	Low risk of Impact	Ardnacrusha R465 R471 Un-named local road off Harol's Cross Un-named local road Ballyboucher Un-named local road joining R466 R466
Sycamore *Acer pseudoplatanus*	Risk of Medium Impact	Dispersed throughout GCR
Traveller's joy *Clematis vitalba*	Risk of Medium Impact	Un-named local road off Harol's Cross
Wall cotoneaster *Cotoneaster horizontalis*	Risk of Medium Impact	Ardnacrusha Un-named local road joining R466
Wilson's honeysuckle *Lonicera nitida*	Not Assessed	Ardnacrusha
Winter heliotrope *Petasites fragrans*	Low risk of Impact	Ardnacrusha R465

Turbine Delivery Route

This section details the occurrence of invasive species at points of interest (TDR Nodes) along the TDR which are relevant in terms of ecological impacts (any Node where works are proposed falls into this category).

Botanical / Habitat surveys along the TDR was undertaken between 20th – 22nd July 2022. Survey effort during the walkover of the TDR focussed on nodes where vegetation trimming/clearance or enabling works are proposed to accommodate the TDR.

A total of 12 invasive species were recorded across 12 locations along the TDR. Of these 12 invasive species none are classified as High Risk, four are Medium Risk, four are Low Risk and four are not assessed (NBDC, 2022). See Table 8-29 for more information.

It is noted that Spanish bluebell (*Hyacinthoides hispanica*) was recorded during previous surveys at Clarina Roundabout c. 10m from the proposed load bearing footprint (Fehily Timoney, 2021). This is assumed to still be present at the same location. Spanish bluebell is a Third Schedule listed species, although classified as having a wow risk of Impact (NBDC, 2022).

Table 8-29: Invasive & non-native species recorded at TDR points of interest (areas requiring accommodation works)

Species	Invasive Impact	Location
Node 3 - Foynes Port Access Road / N69		
Red osier dogwood *Cornus sericea*	Low risk of Impact	Ornamental planting bounding oversail area footprint – northern verge.
Traveller's joy *Clematis vitalba*	Risk of Medium Impact	In & adjacent oversail area footprint – northern verge.
Butterfly bush *Buddleja davidii*	Risk of Medium Impact	Immediately adjacent to oversail areas – north & south verges
Node 6 – N69 Tree Canopy		
No invasive species		
Node 8 - Clarina Roundabout		
Butterfly bush *Buddleja davidii*	Risk of Medium Impact	Immediately adjacent to oversail areas – north & south verges
Norway maple *Acer platanoides*	Low risk of Impact	Ornamental planting adjacent to load bearing footprint
Traveller's joy *Clematis vitalba*	Risk of Medium Impact	C. 8m south of load bearing footprint
Japanese rose *Rosa rugosa*	Risk of Medium Impact	C. 14m north-west of load bearing footprint
Winter heliotrope *Petasites fragrans*	Low risk of Impact	C. 16m west of load bearing footprint
Node 9 – Dock Road West Roundabout		
Norway maple *Acer platanoides*	Low risk of Impact	Ornamental planting adjacent to load bearing footprint
Small-leaved lime *Tilia cordata*	Not assessed	Ornamental planting adjacent to load bearing footprint
Node 10 – Dock Road East Roundabout		
Norway maple *Acer platanoides*	Low risk of Impact	Ornamental planting c. 14m north of oversail footprint
Small-leaved lime *Tilia cordata*	Not assessed	Ornamental planting c. 14m north of oversail footprint
Node 11 – M7 Junction 27		
No invasive species		
Node 12 – R494 Birdhill Roundabout		
No invasive species		
Node 18 – R494 Roundabout Templehollow		
No invasive species		
Node 19 – R463 Roundabout north-east of Cloverfield		

Species	Invasive Impact	Location
Winter heliotrope *Petasites fragrans*	Low risk of Impact	In/adjacent to consented Killaloe bypass roundabout footprint.
Butterfly bush *Buddleja davidii*	Risk of Medium Impact	In/adjacent to consented Killaloe bypass roundabout footprint.
Node 20 – R463 Bends south of Cloverfield		
No invasive species		
Node 21 – R463 Bends south-west of Bellisle		
Snowberry *Symphoricarpos albus*	Low risk of Impact	In vegetation trimming (oversail) footprint
Node 23 – R463 Ardcloony Bridge		
Giant butterbur *Petasites japonicus*	Not assessed	Adjacent to oversail footprint.
Node 25/26 – R463 Bends south of Knockadrohid		
Sycamore *Acer pseudoplatanus*	Risk of Medium Impact	In vegetation trimming (oversail) footprint
Wilson's honeysuckle *Lonicera nitida*	Not Assessed	In vegetation trimming (oversail) footprint
Traveller's joy *Clematis vitalba*	Risk of Medium Impact	Outside oversail footprint (opposite verge).
Fuchsia *Fuchsia magellanica*	Not Assessed	Outside oversail footprint (opposite verge).
Node 27 – R463/R466 Junction		
Winter heliotrope *Petasites fragrans*	Low risk of Impact	In load bearing/oversail/vegetation clearance footprint
Traveller's joy *Clematis vitalba*	Risk of Medium Impact	On north-western road verge. Not adjacent to any proposed works.
Nodes 28-30 – R466 Bends Northwest of O'Briensbridge Cross		
Winter heliotrope *Petasites fragrans*	Low risk of Impact	In oversail/vegetation clearance footprint
Snowberry *Symphoricarpos albus*	Low risk of Impact	In oversail/vegetation clearance footprint
Node 31 – R466 Bends Southeast of Bridgetown		
Winter heliotrope *Petasites fragrans*	Low risk of Impact	In load bearing footprint (southern verge)
Snowberry *Symphoricarpos albus*	Low risk of Impact	In oversail footprint (northern verge)
Node 32 – R466 Left Bend at Bridgetown		
Sycamore *Acer pseudoplatanus*	Risk of Medium Impact	In load bearing/vegetation clearance footprint (northern verge)

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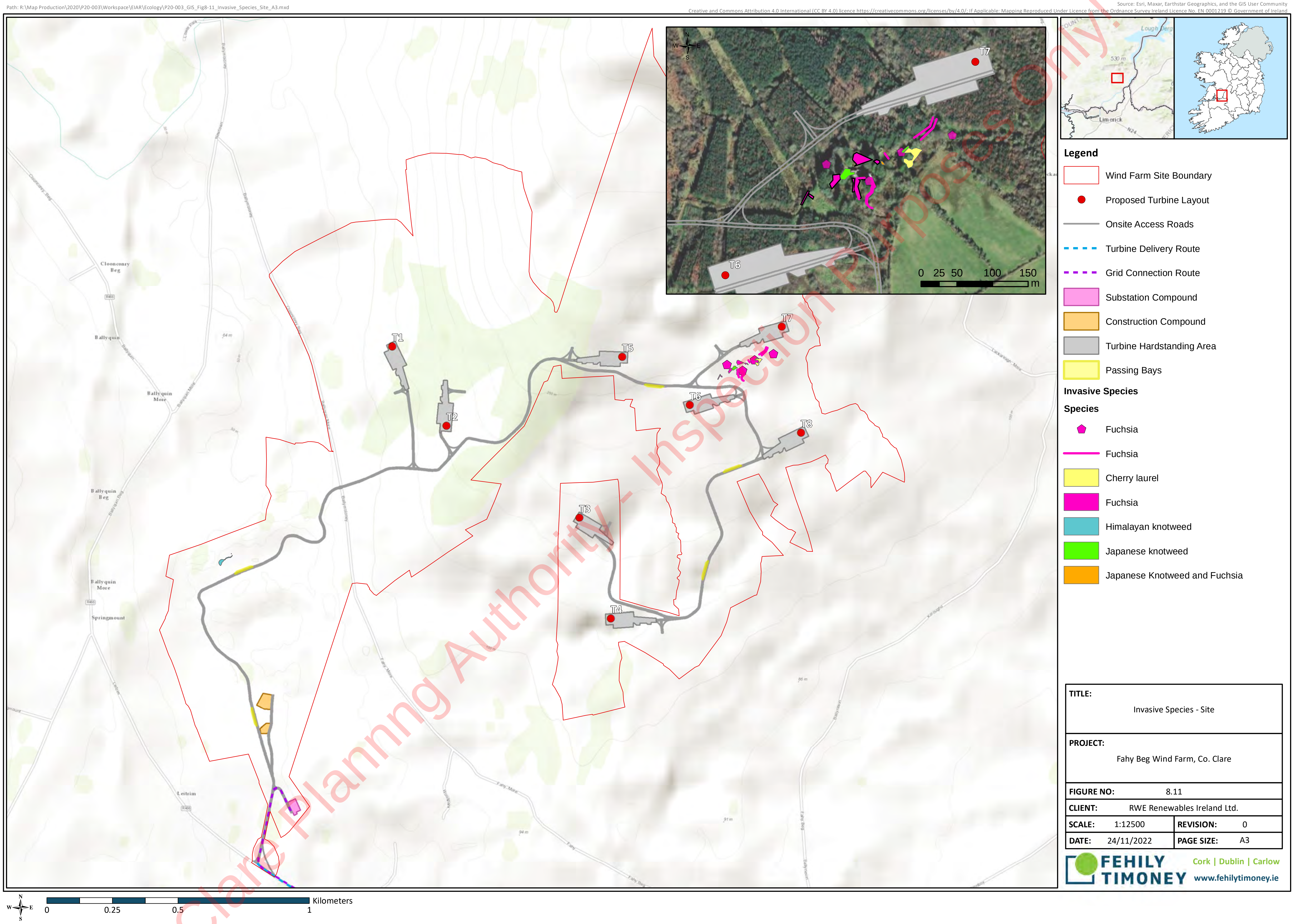

Legend

- ▭ Wind Farm Site Boundary
- ● Proposed Turbine Layout
- — Onsite Access Roads
- - - Turbine Delivery Route
- - - Grid Connection Route
- ▨ Substation Compound
- ▨ Construction Compound
- ▨ Turbine Hardstanding Area
- ▨ Passing Bays

Invasive Species

Species

- ⬟ Fuchsia
- — Fuchsia
- 🟨 Cherry laurel
- ▨ Fuchsia
- ▨ Himalayan knotweed
- 🟩 Japanese knotweed
- 🟧 Japanese Knotweed and Fuchsia

TITLE:	Invasive Species - Site		
PROJECT:	Fahy Beg Wind Farm, Co. Clare		
FIGURE NO:	8.11		
CLIENT:	RWE Renewables Ireland Ltd.		
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Legend

🟥 Wind Farm Site Boundary
— Onsite Access Roads
- - - Turbine Delivery Route
- - - Grid Connection Route
🟪 Substation Compound
— Snowberry

TITLE: Invasive Species - Grid Connection Route
Page 1 of 8

PROJECT: Fahy Beg Wind Farm, Co. Clare

FIGURE NO: 8.12
CLIENT: RWE Renewables Ireland Ltd.
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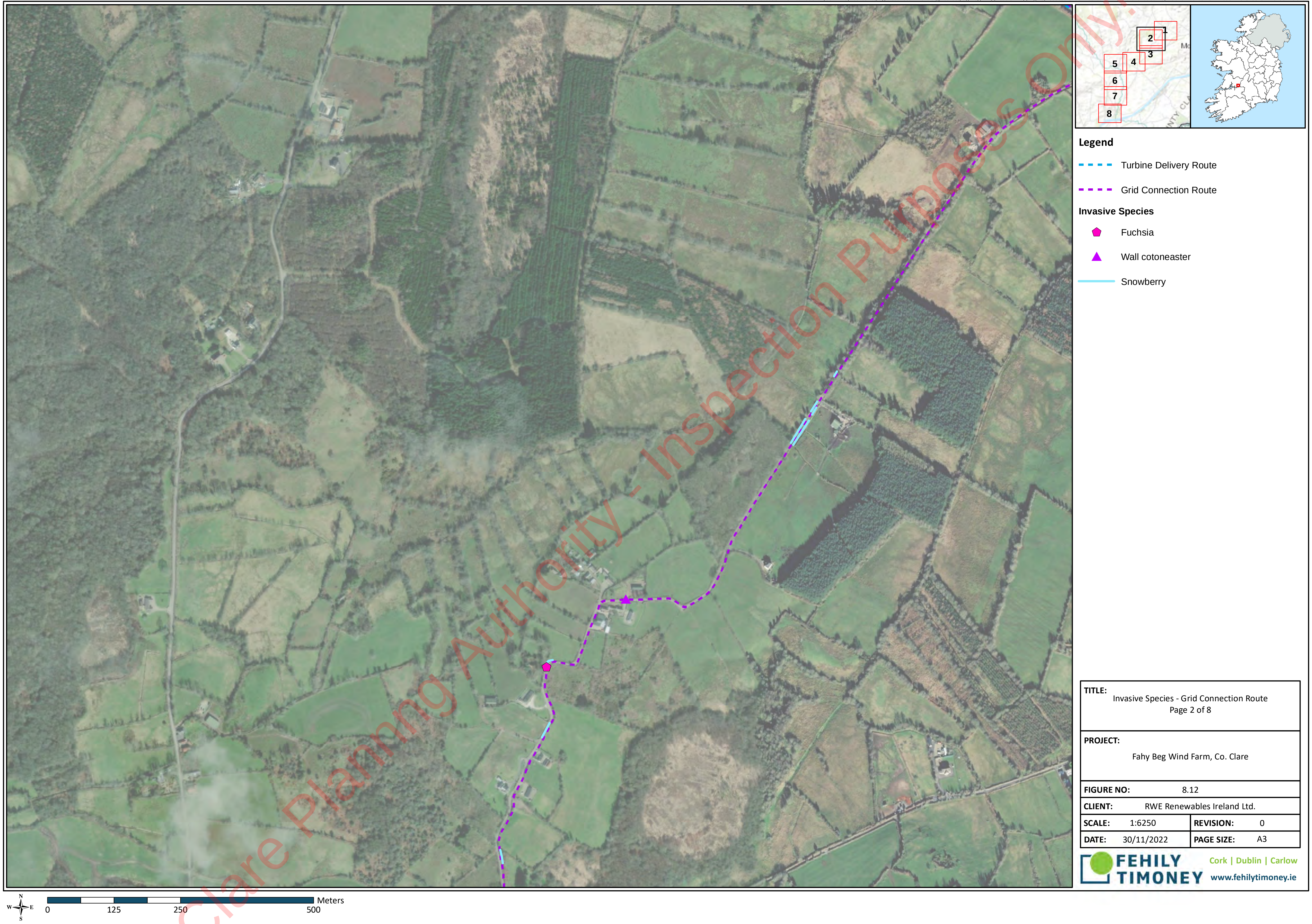

Legend

- - - Turbine Delivery Route
- - - Grid Connection Route

Invasive Species

⬟ Fuchsia
▲ Wall cotoneaster
— Snowberry

TITLE: Invasive Species - Grid Connection Route
Page 2 of 8

PROJECT: Fahy Beg Wind Farm, Co. Clare

FIGURE NO: 8.12

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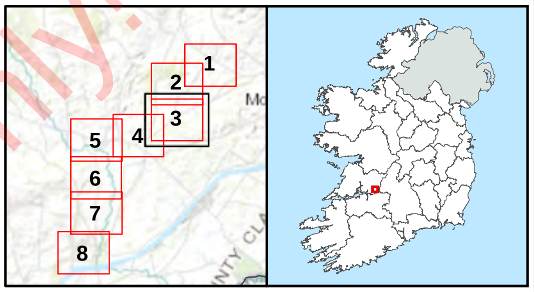

Legend

- - - Grid Connection Route

Invasive Species

- ⬟ Giant hogweed
- ⬟ Cherry laurel
- ⬟ Fuchsia
- ▲ Montbretia
- ▲ Snowberry
- ━ Giant hogweed
- ━ Cherry laurel & Traveller's joy
- ━ Montbretia
- ━ Snowberry
- ━ Snowberry & Traveller's joy

TITLE:
Invasive Species - Grid Connection Route
Page 3 of 8

PROJECT:
Fahy Beg Wind Farm, Co. Clare

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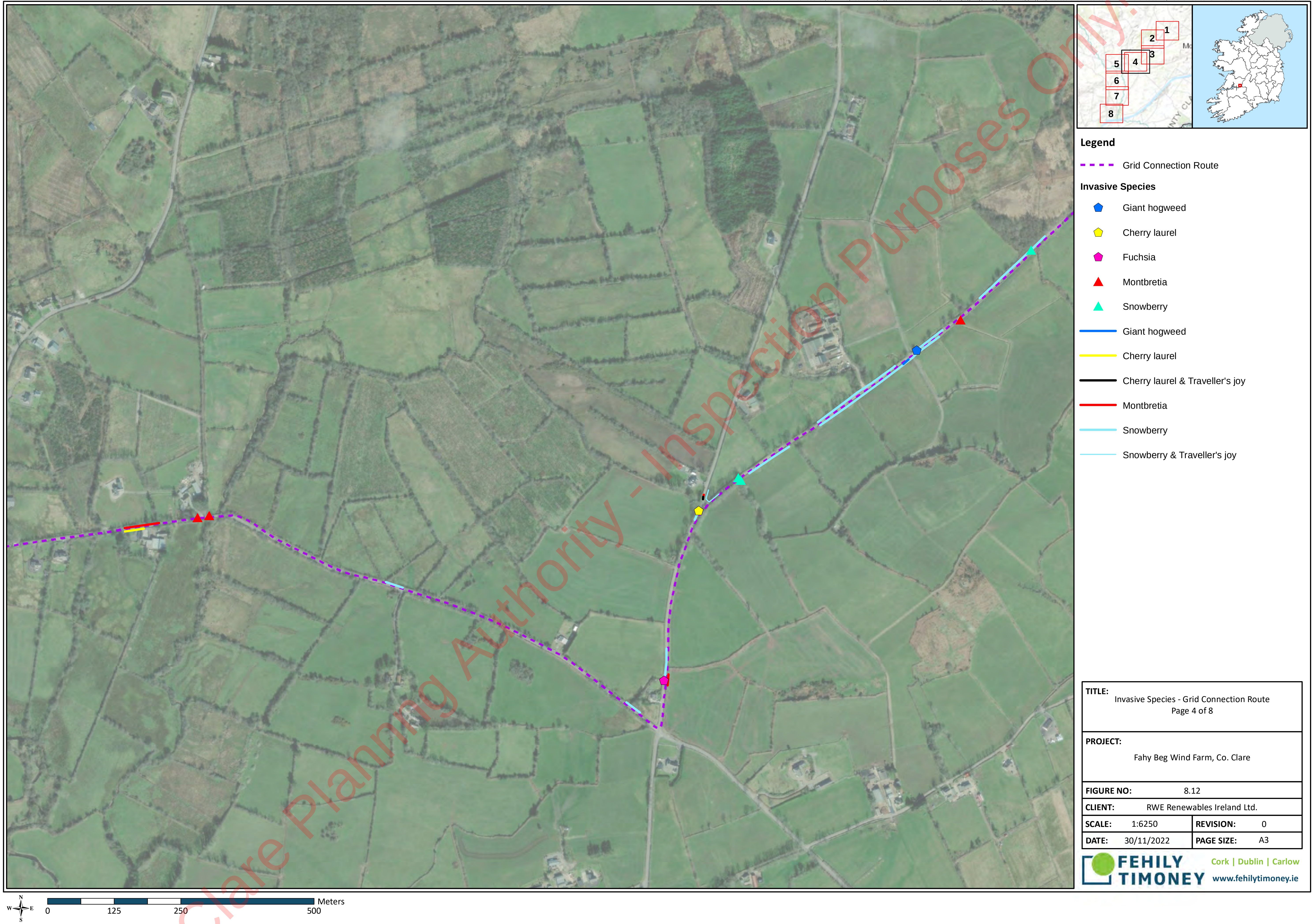

Legend

- - - Grid Connection Route

Invasive Species

⬟ Giant hogweed
⬟ Cherry laurel
⬟ Fuchsia
▲ Montbretia
▲ Snowberry
— Giant hogweed
— Cherry laurel
— Cherry laurel & Traveller's joy
— Montbretia
— Snowberry
— Snowberry & Traveller's joy

TITLE:
Invasive Species - Grid Connection Route
Page 4 of 8

PROJECT:
Fahy Beg Wind Farm, Co. Clare

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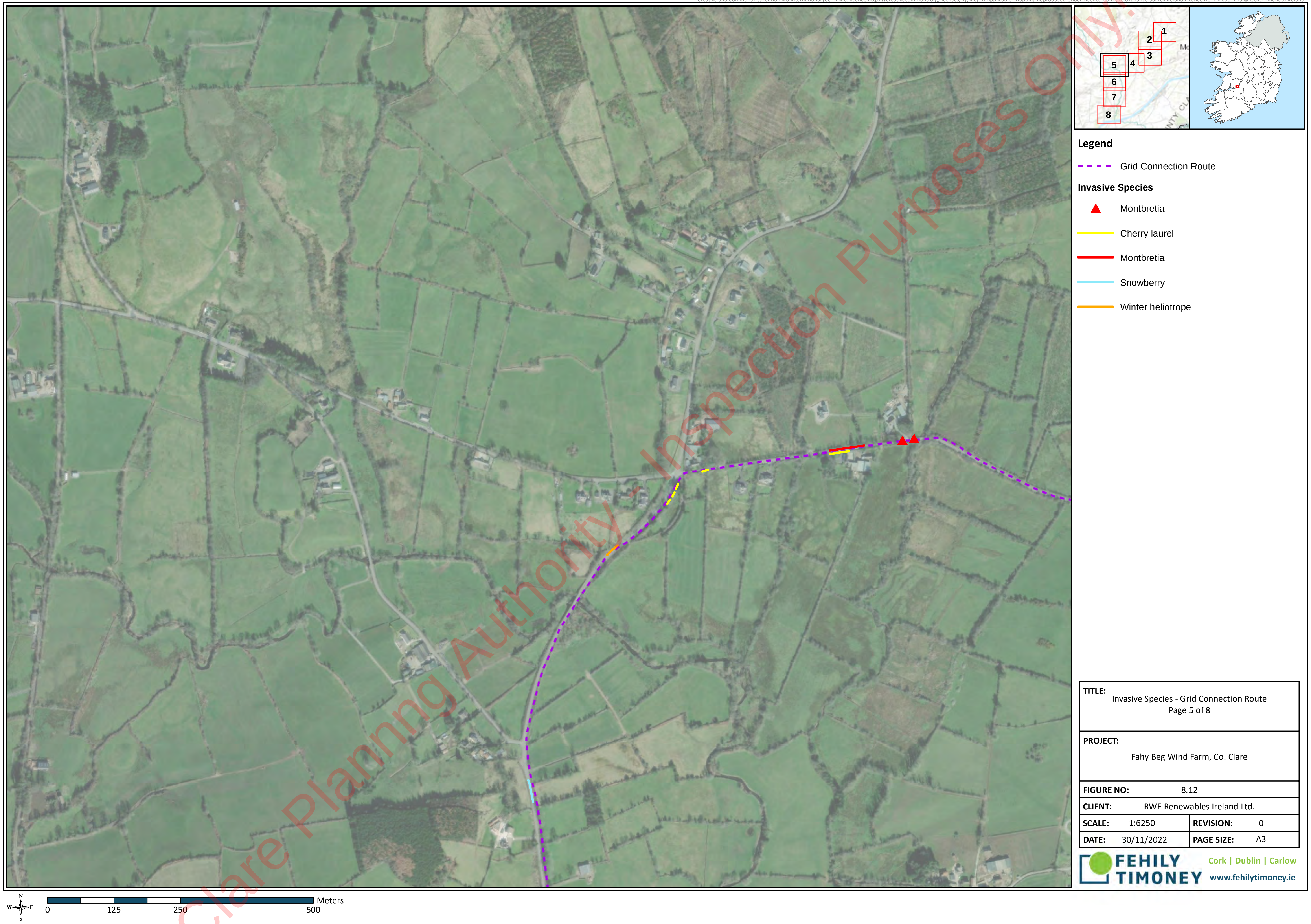

Legend

- - - Grid Connection Route

Invasive Species

▲ Montbretia

— Cherry laurel

— Montbretia

— Snowberry

— Winter heliotrope

TITLE:	Invasive Species - Grid Connection Route Page 5 of 8
PROJECT:	Fahy Beg Wind Farm, Co. Clare
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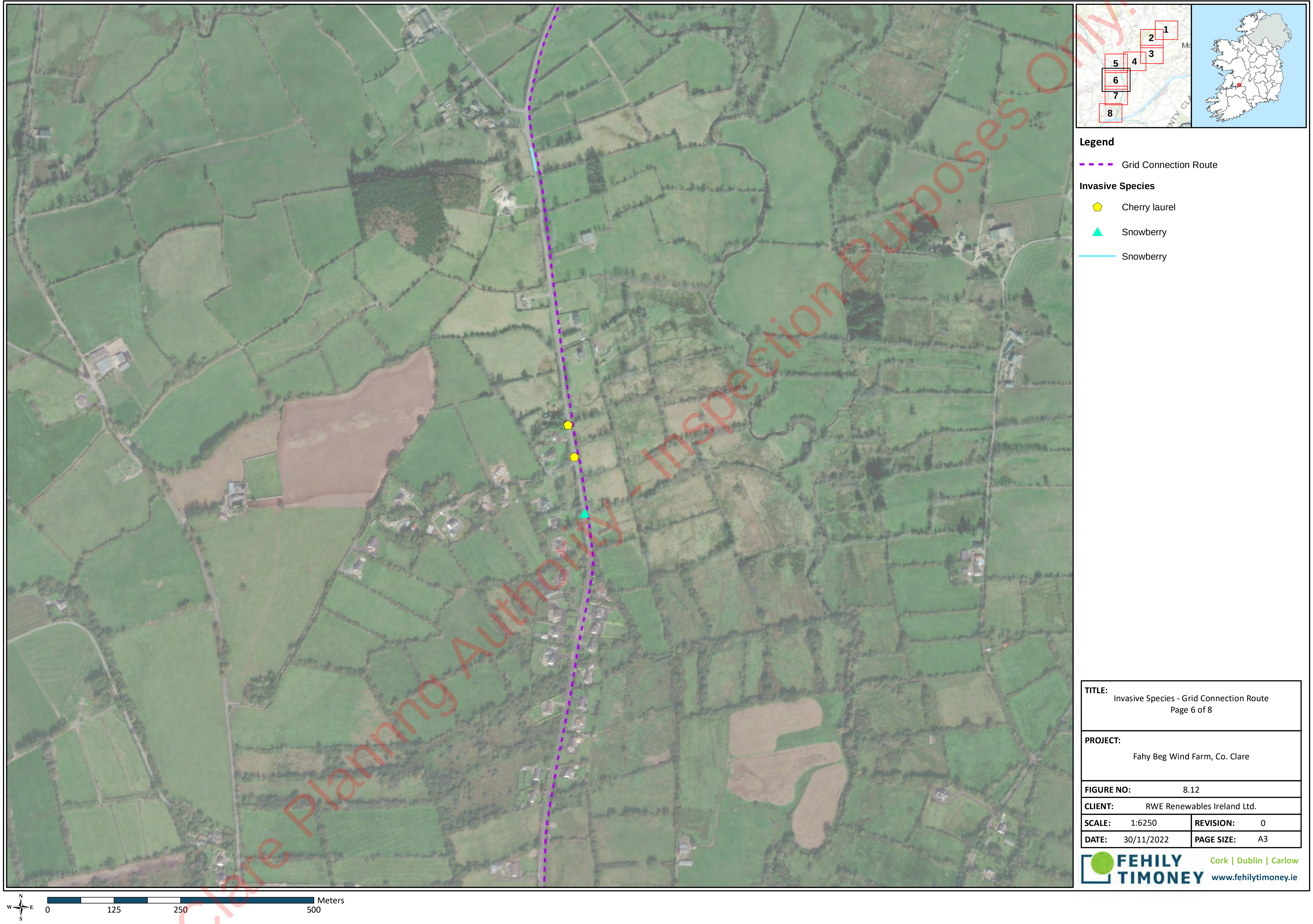

Legend

- - - Grid Connection Route

Invasive Species

⬠ Cherry laurel

▲ Snowberry

— Snowberry

TITLE:	Invasive Species - Grid Connection Route Page 6 of 8
PROJECT:	Fahy Beg Wind Farm, Co. Clare
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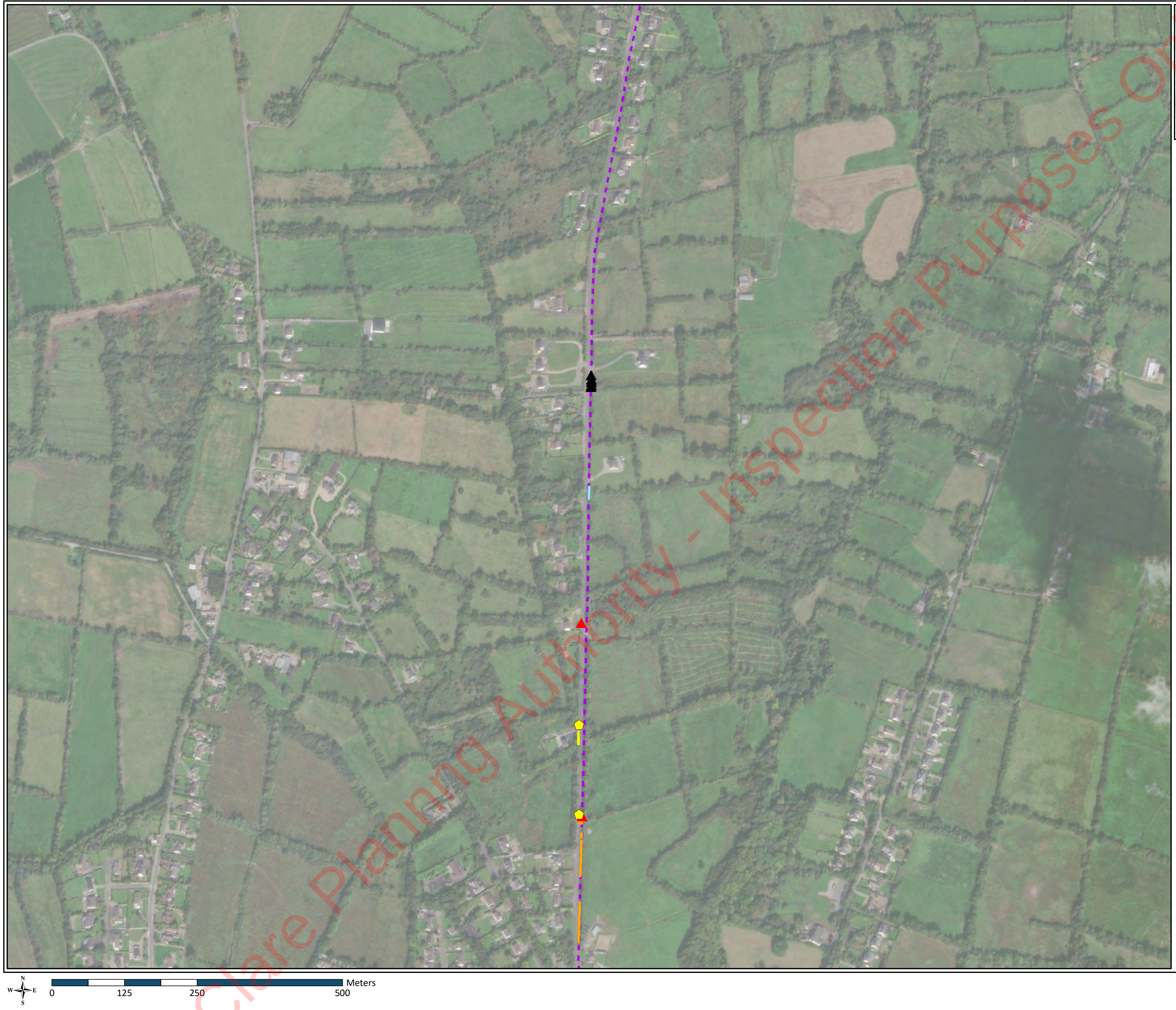

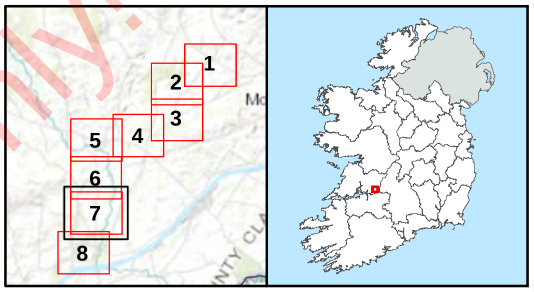

Legend

- - - Grid Connection Route

Invasive Species

⬠ Cherry laurel

▲ Himalayan honeysuckle

▲ Montbretia

— Cherry laurel

— Snowberry

— Winter heliotrope

TITLE:
Invasive Species - Grid Connection Route
Page 7 of 8

PROJECT:
Fahy Beg Wind Farm, Co. Clare

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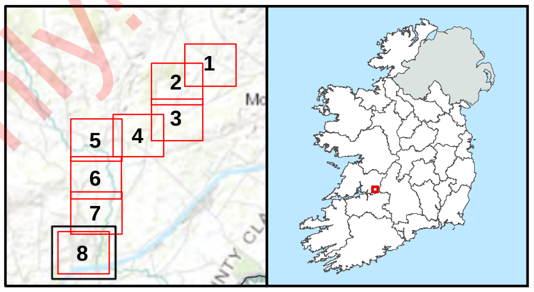

Legend

- - - Grid Connection Route

Invasive Species

⬟ Buddleia
⬟ Cherry laurel
▲ Japanese Knotweed and Fuschia
▲ Montbretia
▲ Red osier dogwood
▲ Snowberry
▲ Wall cotoneaster
▲ Winter heliotrope
— Cherry laurel
— Fuchsia
— Montbretia
— Red osier dogwood
— Snowberry
— Snowberry & Montbretia
— Wilson's honeysuckle
— Winter heliotrope
— Winter heliotrope & Montbretia
— Winter heliotrope. Occ. Snowberry
— Winter heliotrpe & Wilson's Honeysuck

TITLE:
Invasive Species - Grid Connection Route
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PROJECT:
Fahy Beg Wind Farm, Co. Clare

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8.3.4 Description of Existing Habitats

8.3.4.1 Wind Farm Site

No flora listed on the FPO or as threatened, vulnerable or endangered on the Irish Red List were recorded during site walkovers. A notable observation of bee orchid (*Ophrys apifera*) was recorded during surveys, with one plant observed growing beside an existing quarry track outside the proposed development footprint. This plant was recorded in the track verge bordering Mixed broadleaved woodland. Bee orchid is not protected under the FPO (2022) and is categorised as Least Concern on the Irish Vascular Plant Red List (Wyse Jackson et al., 2016); however, it has a relatively restricted distribution due to it's preference for low-nutrient calcareous soils, and was previously categorised as Near Threatened in the Irish Red Data Book (Curtis and McGough, 1988). As such it is still treated as being of higher conservation concern than more common species.

The habitat survey study area supports extensive areas of conifer woodland (WD4) and improved agricultural grassland (GA1). The proposed wind farm will be accessed via the western boundary of a disused quarry site, the footprint of which supports scrub (WS1), young broadleaved woodland (WD1), other artificial lakes and ponds (FL8) and areas of recolonising bare ground and spoil and bare ground (ED2). The proposed access road turns east, crossing a local road and then entering the footprint of the proposed wind farm. Immediately east of the local access road, the lands comprise of low-lying improved agricultural grassland (GA1) bound by treelines (WL2) and hedgerows (WL1), with localised areas of rush dominant wet grassland (GS4). Continuing east, the topography of the study area continues to increase rapidly toward an extensive area of beech dominated mixed broadleaved woodland (WD1), which is bound to the north and east by conifer woodland (WD4). The southernmost areas of the study area support improved (GA1) and semi-improved agricultural grassland habitats, in addition to localised areas of wet grassland (GS4) habitats. The distribution and occurrence of these habitats are influenced by recent and ongoing maintenance, particularly drainage maintenance. The eastern and southernmost sections of the study area are drained by tributaries of the Bridgetown (Clare)_010 river while the western half of the study area is drained by the Broadford_010 river.

Descriptions of habitats within the habitat study survey area site are provided below and mapped in Figure 8-13. Habitat evaluations are provided in Table 8-57.

Improved Agricultural Grassland (GA1)

The western and southernmost sections of the habitat survey study area form extensive areas of improved agricultural grassland which primarily supports grazing cattle. These habitats are typically species poor and include perennial rye grass (*Lolium perenne*), Yorkshire fog (*Holcus lanatus*), common bent (*Agrostis capillaris*), creeping bent (*Agrostis stolonifera*), creeping buttercup (*Ranunculus repens*), white clover (*Trifolium repens*), creeping thistle (*Cirsium palustre*) and ragwort (*Jacobaea vulgaris*). Near the southern boundary of the study area, the improved agricultural grassland habitats have developed through ongoing improvement of poor draining lands. Such lands support localised occurrences of common rush (*Juncus effusus*), due to poor drainage or localised changes in topography.

This habitat type is *Lower value, Local importance.*

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

Plate 8-1: Improved Agricultural Grassland GA1

Dry Meadows and Grassy Verge Grassland (GS2)

Discrete and localised sections of this habitat occur to the east of the quarry entrance and near the eastern boundary of the study area. In both cases, this habitat has developed where ongoing management, such as grazing or mowing, of improved agricultural grassland or semi-improved grassland has ceased. This has led to the development of dense tussocky grasses and tall thick sward height.

Dry meadows and grassy verge grassland located east of the quarry entrance are characterised by dense grasses including cock's-foot (*Dactylis glomerata*), Yorkshire fog, common bent and false oat grass (*Arrhenatherum elatius*). Accompanying grasses and herbs include creeping buttercup, yarrow (*Achillea millefolium*), ragwort, broadleaved dock (*Rumex obtusifolius*), lesser stitchwort (*Stellaria graminea*), tormentil (*Potentilla erecta*) and greater bird's foot trefoil (*Lotus pedunculatus*). Gorse (*Ulex europaeus*) scrub is beginning to encroach on these GS2 fields from the field margins.

This habitat also occurs near the eastern boundary of the study area, where it has also developed from the lack of recent or ongoing management, leading to the development of a dense grass sward and the spread and expansion of bracken (*Pteridium aquilinum*) scrub.

This habitat type is *Higher value, Local importance.*

The proposed substation and associated access track are located in dry meadows and grassy verge grassland/ improved agricultural grassland (GS2/GA1) Mosaic.

Plate 8-2: Dry Meadows and Grassy Verge Grassland GS2

Dry Humid Acid Grassland (GS3)

Dry humid acid grassland is located near the northern and eastern boundary of the study area. These habitats are typically located on unimproved or semi-improved grassland on sloping terrain, that has received very little ongoing management over the short term. Plant species composition within these grassland areas near the study area's eastern boundary include sweet vernal grass (*Anthoxanthum odoratum*), common bent, yarrow, common knapweed (*Centaurea nigra*), jointed rush (*Juncus articulatus*), ribwort plantain (*Plantago lanceolata*), common sorrel (*Rumex acetosa*), cat's ear (*Hypochaeris radicata*), occasional devil's bit scabious (*Succisa pratensis*) and lesser stitchwort (*Stellaria graminea*). These habitats are being actively encroached by dense bracken scrub (HD1).

The areas of this habitat located near the northern boundary of the study area are again located on unmanaged sloping ground that is being encroached by spreading gorse (*Ulex europaeus*) and bramble scrub. These areas are defined from nearby areas of wet grassland due to reductions in jointed rush cover and the occurrence of frequent common bent, creeping bent, ribwort plantain, Yorkshire fog, cat's ear and occasional devil's bit scabious, tormentil and lousewort (*Pedicularis sylvatica*).

This habitat type is *Higher value, Local importance.*

No proposed infrastructure overlaps this habitat type or any mosaics containing dry-humid acid grassland.

Plate 8-3: Dry Humid Acid Grassland GS3

Wet Grassland (GS4)

Wet grassland occurs is localised areas throughout the study area, typically in mosaic with improved agricultural grassland and less typically with gorse scrub, where the grassland has not been managed through ongoing grazing or cutting.

Where it occurs with improved grassland, it is typically associated with localised, low-lying areas that are poor draining or that receive and collect local surface water flows from areas of higher terrain.

Wet grassland within the study area is typically rush dominated, mostly common rush. Flushed areas support jointed rush and sharp flowered rush. Associated grass species include Yorkshire fog, creeping bent, common bent and sweet vernal grass. Forb species include marsh thistle, greater bird's foot trefoil, meadowsweet (*Filipendula ulmaria*), marsh bedstraw (*Galium palustre*), ragwort, creeping bent, marsh ragwort (*Senecio aquatilis*), lesser spearwort (*Ranunculus flammula*), water mint (*Mentha aquatica*) and the moss *Calliergonella cuspidata*. Near the southern boundary of the study area, this habitat occurs in mosaics in localised pockets amongst expansive areas of improved grassland.

A rideline area within a conifer plantation located near the northern boundary of the study area supports wet grassland exhibiting extensive rush growth with spreading bramble (*Rubus fruticosus* agg.) and occasional grey willow (*Salix cinerea* subsp. *oelifolia*).

Two pockets of more diverse wet grassland are located near the northern boundary of the study area, within an opening of otherwise afforested land that has not been actively managed in recent years. These lands are moderate to steep sloping which influences a flushed and diverse wet grassland habitat that also exhibits some calcareous affinities. Plant species composition includes abundant jointed rush and frequent devil's bit scabious. Other accompanying species in the understorey of the tall rush growth includes common marsh bedstraw, greater bird's foot trefoil, water mint, meadow buttercup (*Ranunculus acris*), tormentil, hairy sedge (*Carex hirta*), self heal (*Prunella vulgaris*), crested dog's tail (*Cynosurus cristatus*), marsh violet (*Viola palustris*), eyebright (*Euphrasia* agg.), glaucous sedge (*Carex flacca*), autumn hawkbit (*Scorzoneroides autumnalis*) and lesser stitchwort. The southernmost polygon of this habitat type supports localised reductions of rush growth and greater occurrences of marsh thistle (*Cirsium dissectum*) and purple moor grass (*Molinia caerulea*). These areas of grassland are considerably diverse when considered in the context of the study area and the surrounding hinterland. The diversity of this grassland and its plant species composition supports affinities with and corresponds to the Annex I grassland habitat *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) (6410). Willow and gorse scrub are actively spreading from the east and south-eastern corner of this habitat.

The diverse Annex I -linked fields described above are *Higher Value, County Importance*. These are outside the proposed footprint.

The remainder of this habitat type is *Higher value, Local importance.* This habitat type/grade is overlapped by proposed access tracks and hard standings.

Plate 8-4: Wet Grassland GS4

Dense Bracken (HD1)

Dense bracken scrub is typified by the presence of abundant bracken (*Pteridium aquilinum*) with occasional occurrences of bramble and gorse. Discrete sections of this habitat occur near the site's eastern boundary, where it has established upon unmanaged agricultural grassland habitats.

This habitat type is *Lower value, Local importance.*

No proposed infrastructure overlaps this habitat type.

Plate 8-5: Dense Bracken HD1

Scrub (WS1)

Extensive areas of scrub are located near the western boundary of the study area, associated with the margin of the quarry footprint, supports an extensive area of mixed scrub. Species composition includes hawthorn (*Crataegus monogyna*), blackthorn (*Prunus spinosa*), elder (*Sambucus nigra*), goat willow (*Salix caprea*), grey willow, gorse and broom (*Cytisus scoparius*).

Willow, hawthorn and gorse scrub occurs near the north-eastern boundary of the study area, primarily along the margins and within the internal firebreaks running through the extensive areas of conifer plantation.

Gorse, bramble and willow scrub also occurs in mosaic with small areas of wet grassland near the western boundary of the study area.

This habitat type is *Higher value, Local importance.*

This habitat type (including mosaics containing scrub) is overlapped by proposed access tracks and turbine hard standings.

Plate 8-6: Scrub WS1

Mixed Broadleaved Woodland (WD1)

A large area of mature mixed broadleaved woodland is located near the centre of the study area. The woodland is characterised by abundant beech (*Fagus sylvatica*) in the canopy layer, localised and occasional pubescent birch (*Betula pubescens*) and locally frequent occurrences of mature pedunculate oak (*Quercus robur*). The beech trees are long established, many of which are structurally robust and provide suitable habitat and refuge for birds and mammals. This broadleaved woodland is long established and is identified in 1st edition OS mapping at Ballymoloney Wood.

Much of the woodland's understorey structure is open, with large areas supporting little or no shrub species cover. Bramble occurs in localised abundances within the understory but is not extensive. Ground layer species in higher drier areas include rough meadow grass (*Poa trivialis*), wood dock (*Rumex sanguineus*), wood avens (*Geum urbanum*), enchanter's nightshade (*Circaea lutetiana*), Atlantic ivy (*Hedera hibernica*), hedge woundwort (*Stachys sylvatica*), germander speedwell (*Veronica chaemedrys*), tufted hair grass (*Deschampsia cespitosa*), *Viola* sp. and bluebell (*Hyacinthoides non-scripta*). Localised low-lying habitats support locally frequent remote sedge (*Carex remota*) with wood sorrel (*Oxalis acetosella*), opposite leaved golden saxifrage (*Chrysosplenium oppositifolium*), broad buckler fern (D*ryopteris dilatata*) and the mosses *Polytrichum commune*, *Rhytidiadelphus triquetrus* and *Climacium dendroides*.

The southern and westernmost fringes of this woodland are more low lying and change from a canopy layer dominated by beech to a mixed canopy supporting sycamore, pubescent birch and grey willow, in addition to frequent to locally abundant beech.

The mixed broadleaved woodland making up Ballymoloney Wood is of *County Importance.*

A section of proposed access track (linking T2 & T5) traverses Ballymoloney Woods. The southern part of this section follows an existing track. The northern part traverses the woodland along a route minimising overlap with mature trees.

Young mixed broadleaved woodland is also located near the western boundary of the study area, established on the boundary of the quarry site, most likely for screening purposes. This woodland supports young broadleaved trees including grey willow, sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*) and downy birch. This mixed broadleaved woodland is *Higher value, Local importance.*

This habitat sub-type is traversed by proposed access tracks.

Areas of young ash plantation woodland located in the northern part of the study area also correspond to this woodland category. This mixed broadleaved woodland is *Lower value, Local importance.*

This habitat sub-type is traversed by a section of proposed access track.

Plate 8-7: Mixed Broadleaved Woodland WD1

Conifer Woodland (WD4)

This habitat relates to the extensive areas of conifer woodland located on areas of higher terrain in the northern part of the study area. The main tree species associated with this habitat includes Sitka spruce (*Picea sitchensis*), lodgepole pine (*Pinus contorta*) with localised areas of larch (*Larix* sp.).

This habitat type is *Lower value, Local importance.*

Proposed access tracks and turbine hard standings overlap conifer plantation.

Plate 8-8: Conifer Woodland

Oak-Birch-Holly Woodland (WN1)

This habitat includes a small pocket of downy birch dominated woodland near the western boundary of the study area. The woodland supports abundant downy birch in the canopy layer with occasional pedunculate oak and occasional hawthorn. The understorey supports abundant bramble, rough meadow-grass, enchanter's nightshade, wood avens and polypody fern (*Polypodium* sp.).

This habitat type is *Higher value, Local importance.*

No proposed infrastructure overlaps this habitat type.

Plate 8-9: Oak-Birch-Holly Woodland WN1

Oak-Ash-Hazel Woodland (WN2)

A tributary of the Bridgetown (Clare)_010 watercourse flows near the centre of the study area, flowing in a north to south direction. Near the southern boundary of the study area, the river channel and associated margins deepen and support oak-ash-hazel woodland. This woodland is narrow (c. 35m wide) and is located on very steep margins with a c. 20m drop between the valley margins and the riverbed. The woodland is characterised by hazel (*Corylus avellana*) in the canopy layer, which forms individual multi-stemmed stands. The ground layer species assemblage within the woodland is relatively well developed and supports bluebell, greater wood rush (*Luzula sylvatica*), ivy, wood sedge (*Carex sylvatica*), herb-robert (*Geranium robertianum*), wood sorrel, wood avens, broad buckler fern, greater stitchwort (*Stellaria holostea*), spindle (*Euonymous europaeus*), sanicle, hard fern (*Blechnum spicant*) and *Viola* sp. The watercourse flowing through this woodland is narrow and sinuous and due to shading from the adjoining woodland, supports no instream macrophytes.

This habitat type is *Higher value, Local importance.*

This habitat is traversed by a section of proposed access track and clear span bridge which crosses the Bridgetown (Clare)_010 en route to T4.

Plate 8-10: Oak-Ash-Hazel Woodland WN2

Wet Willow-Alder-Ash Woodland (WN6)

This area of wet willow-alder-ash woodland is located immediately west of the large mixed broadleaved woodland block characterised by abundant beech growth. This woodland area supports a noted reduction in beech cover in the canopy, replaced by downy birch with occasional grey willow and ash. This is a young woodland habitat, and the ground layer is undeveloped comprising abundant bramble scrub and young grey willow trees.

This habitat type is *Higher value, Local importance.*

No proposed infrastructure overlaps this habitat type.

Plate 8-11: Wet Willow-Alder-Ash Woodland WN6

Spoil and Bare Ground (ED2)

This habitat is associated with the western boundary of the study area and includes the access roads and open areas of ground associated with past quarrying practices and ongoing maintenance and access operations. This is a species poor habitat but may include localised occurrences of the species listed for the recolonising bare ground (ED3) habitat described below.

This habitat type is *Lower value, Local importance*

Sections of proposed access track overlap this habitat type.

Plate 8-12: Spoil and Bare Ground ED2 (foreground)

Recolonising Bare Ground (ED3)

Areas of recolonising bare ground are associated with the western boundary of the study area and includes the access roads and open areas of ground associated with past quarrying practices and ongoing maintenance and access operations. Ruderal plant species and early colonising grasses have established along the margins of access roads or where quarrying or excavation practices have ceased. Plant species assemblage is varied and reasonably diverse and includes bird's foot trefoil (*Lotus corniculatus*), Yorkshire fog, sweet vernal grass, yellow-wort (*Blackstonia perfoliata*), ox eye daisy (*Leucanthemum vulgare*), coltsfoot (*Tussilago farfara*), purple loosestrife (*Lythrum salicaria*), common knapweed, selfheal, jointed rush, perforate St. John's wort (*Hypericum* *perforatum*), common bent, false oat grass, common centaury (*Centaurium erythraea*), ragwort, mouse-ear hawkweed (*Pilosella officinarum*), cat's-ear, foxglove (*Digitalis purpurea*), wall lettuce (*Mycelis muralis*), hoary willowherb (*Epilobium parvifolium*), autumn hawkbit, greater plantain (*Plantago major*), and seedling downy birch. This habitat occurs in mosaic with mixed scrub near the northernmost sections of the quarry, occurring in openings of the willow, gorse, broom and birch scrub.

This habitat type is *Higher value, Local importance*

One of the proposed site compounds and sections of access track overlap this habitat type.

Plate 8-13: Recolonising Bare Ground ED3

Other Artificial Lakes and Ponds (FL8)

The western and south-western margins of the study area support a series of unused artificial ponds and lakes. These artificial waterbodies were used to attenuate water during the quarry's operational phase. These are primarily deep open waterbodies and plant species growth comprises abundant broadleaved pondweed (*Potamogeton natans*). These waterbodies are fringed by areas of scrub and young mixed broadleaved woodland.

This habitat type is *Higher value, Local importance.*

No proposed infrastructure overlaps this habitat type.

Plate 8-14: Other Artificial Lakes and Ponds FL8

Reed and Large Sedge Swamp (FS1)

This habitat occurs at the southern boundary of the quarry site and is associated with low lying lands which supports water moving south from higher areas of the quarry located to the north. It is also associated with the margins artificial pond areas that have become overgrown or are encroaching with emergent aquatic vegetation. These habitats where they occur on site and are dominated by common reed (*Phragmites australis*) with encroaching willow and gorse scrub growing along the drier margins.

This habitat type is *Higher value, Local importance.*

No proposed infrastructure overlaps this habitat type.

Plate 8-15: Reed and Large Sedge Swamp FL8

Drainage Channels (FW4)

Drainage channels are located on the margins of steeply sloped improved agricultural grassland and wet grassland habitats and fringing the access road serving the quarry site. These are generally fringed by earth banks and / or hedgerow habitats. Waterflow within these channels are seasonal and the channel morphology is narrow with stony substrates.

This habitat type is *Higher value, Local importance.*

This habitat is intersected by proposed access tracks and overlapped by the proposed T4 hard standing.

Plate 8-16: Drainage Channels FW4

Eroding Upland River (FW1)

The southern and eastern sections of the study area are drained by upper tributaries of the Bridgetown (Clare)_010 river waterbody. The western boundary of the study area is drained by an upper tributary of the Broadford_010 waterbody. These tributaries are narrow sinuous channels located on steep sloping terrain and support varying levels of water within the channel. Where these channels occur on site, they are located along field margins and are fringed by treelines, hedgerows, scrub and semi-natural woodland. Due to the eroding and ephemeral nature these watercourses support little or no instream aquatic plant species.

This habitat type is *Higher value, Local importance.*

This habitat type is intersected by proposed access tracks and crossing structures at three locations, and a section of unmapped ephemeral stream is overlapped by the proposed T7 hard standing.

Plate 8-17: Eroding Upland River FW1

Hedgerows (WL1)

Hedgerow habitats occur along the margins of the improved grassland and other pastoral grassland habitats. These hedgerows support varying levels of management and consequent structural condition. In the better draining areas of the study area, hedgerows support hawthorn, blackthorn (*Prunus spinosa*), elder and honeysuckle with overtopping ash. Poorer draining areas of the site support more grey willow cover, in addition to common birch. Near the southern boundary of the study area, some hedgerows comprise abundant gorse growing on an earth embankment.

This habitat type is *Higher value, Local importance.*

This habitat type is intersected by proposed access tracks and overlapped by a number of turbine hard standings.

Plate 8-18: Hedgerows WL1

Treelines (WL2)

Treelines occur consistently with hedgerows along the boundaries of pastoral habitats. In some instances, such as those treelines located near the study area’s western and southern boundaries, the treeline habitat has formed from an unmanaged or an overgrown hedgerow. These treelines typically support tall thin and semi-mature ash trees and occasional pedunculate oak, downy birch and mountain ash overtopping hawthorn, blackthorn and gorse. Wetter sections of the site support more willow cover, in addition to mountain ash and pubescent birch.

This habitat type is *Higher value, Local importance.*

This habitat type is intersected by proposed access tracks and overlapped by a number of turbine hard standings.

Plate 8-19: Treelines WL2

Buildings and Artificial Surfaces (BL3)

This habitat includes a ruined dwelling located in the northern part of the study area. The margins of this building supports spreading bramble and fuchsia (*Fuschia magellanica*) scrub in addition to an established stand of Japanese knotweed (*Fallopia japonica*). The Japanese knotweed is a multi-stemmed stand and is 3-4 metres high and 10 metres wide.

Existing roads and hard standings within the quarry also correspond to this habitat type.

One of the proposed site compounds and a section of proposed access track overlap this habitat type.

Plate 8-20: Buildings and Artificial Surfaces BL3

Path: R:\Map Production\2020\P20-003\Workspace\EIAR\Ecology\P20-003_GIS_Fig8-13_Habitats_Site_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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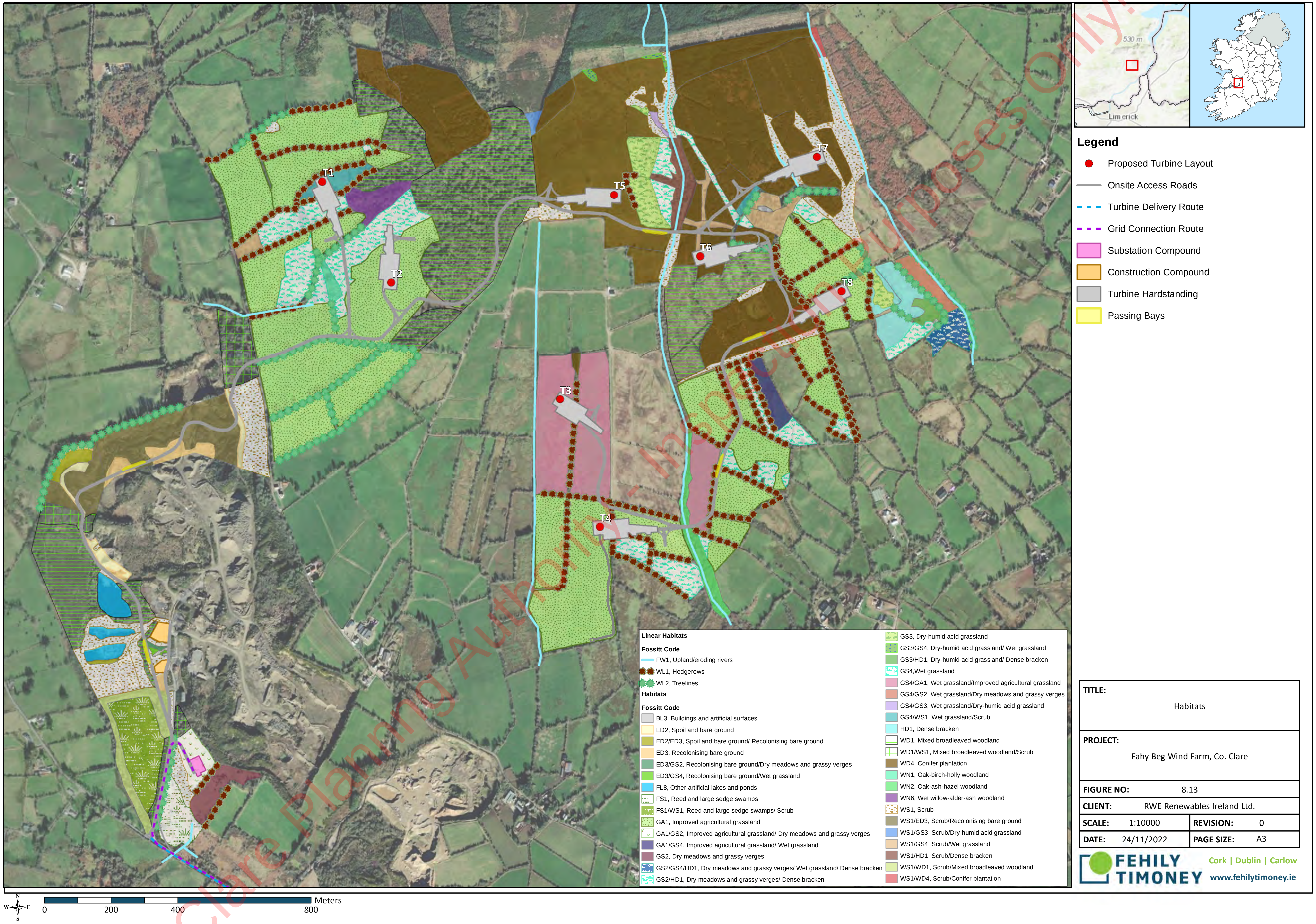

Legend

- ● Proposed Turbine Layout
- Onsite Access Roads
- Turbine Delivery Route
- Grid Connection Route
- Substation Compound
- Construction Compound
- Turbine Hardstanding
- Passing Bays

Linear Habitats

Fossitt Code

- FW1, Upland/eroding rivers
- WL1, Hedgerows
- WL2, Treelines

Habitats

Fossitt Code

- BL3, Buildings and artificial surfaces
- ED2, Spoil and bare ground
- ED2/ED3, Spoil and bare ground/ Recolonising bare ground
- ED3, Recolonising bare ground
- ED3/GS2, Recolonising bare ground/Dry meadows and grassy verges
- ED3/GS4, Recolonising bare ground/Wet grassland
- FL8, Other artificial lakes and ponds
- FS1, Reed and large sedge swamps
- FS1/WS1, Reed and large sedge swamps/ Scrub
- GA1, Improved agricultural grassland
- GA1/GS2, Improved agricultural grassland/ Dry meadows and grassy verges
- GA1/GS4, Improved agricultural grassland/ Wet grassland
- GS2, Dry meadows and grassy verges
- GS2/GS4/HD1, Dry meadows and grassy verges/ Wet grassland/ Dense bracken
- GS2/HD1, Dry meadows and grassy verges/ Dense bracken
- GS3, Dry-humid acid grassland
- GS3/GS4, Dry-humid acid grassland/ Wet grassland
- GS3/HD1, Dry-humid acid grassland/ Dense bracken
- GS4,Wet grassland
- GS4/GA1, Wet grassland/Improved agricultural grassland
- GS4/GS2, Wet grassland/Dry meadows and grassy verges
- GS4/GS3, Wet grassland/Dry-humid acid grassland
- GS4/WS1, Wet grassland/Scrub
- HD1, Dense bracken
- WD1, Mixed broadleaved woodland
- WD1/WS1, Mixed broadleaved woodland/Scrub
- WD4, Conifer plantation
- WN1, Oak-birch-holly woodland
- WN2, Oak-ash-hazel woodland
- WN6, Wet willow-alder-ash woodland
- WS1, Scrub
- WS1/ED3, Scrub/Recolonising bare ground
- WS1/GS3, Scrub/Dry-humid acid grassland
- WS1/GS4, Scrub/Wet grassland
- WS1/HD1, Scrub/Dense bracken
- WS1/WD1, Scrub/Mixed broadleaved woodland
- WS1/WD4, Scrub/Conifer plantation

TITLE:
Habitats

PROJECT:
Fahy Beg Wind Farm, Co. Clare

FIGURE NO: 8.13
CLIENT: RWE Renewables Ireland Ltd.
SCALE: 1:10000
REVISION: 0
DATE: 24/11/2022
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8.3.4.2 Grid Connection

The proposed grid connection will connect the onsite substation to the existing Ardacrusha 110kV substation. From Ardnacrusha, the route follows the L3056 eastwards to Barry's Cross where it joins the R465 heading north. The GCR continues along the R465 until Carmody's Cross where it turns east to join the R471 until Harol's Cross. From Harol's Cross, the GCR follows local roads northward until the R466. On meeting the R466 the GCR continues north-west until the existing quarry entrance/proposed development site entrance. The route then travels along the existing quarry access road northwards before turning back south-east to enter the agricultural field where the proposed onsite substation is located.

Surveys along the GCR were conducted on 14th and 19th July 2022. No flora listed on the FPO or as threatened on the Irish Red list for vascular plants were recorded during this survey.

The dominant habitats along the GCR are buildings and artificial surfaces (BL3), dry meadows & grassy verges (GS2), hedgerows (WL1), treelines (WL2), improved agricultural grassland (GA1) and wet grassland (GS4). Amenity grassland (GA2) is present in built-up areas. Isolated stands of wet willow-alder-ash woodland (WN6), mixed broadleaved woodland (WD1) and conifer plantation (WD4) are also present abutting the GCR. Lowland/depositing rivers (FW2) are intersected by the GCR at a total of five locations (four EPA-mapped channels and one unmapped stream). Drainage ditches (FW4) in the form of roadside and field drains are present along the GCR.

Buildings and artificial surfaces (BL3)

The grid connection follows existing roads and paved access tracks. These are paved and have no biodiversity value. Adjacent to the existing roads lie residential properties, agricultural buildings, surrounding grounds, and other structures which also represent this habitat type. Older buildings may present some nesting habitat for birds and roosting habitat for bats. Residential buildings have the potential to support bat roosts whilst agricultural and residential buildings have the potential to support roosting birds such as swallow *Hirundo rustica* and may be Local Importance (Higher Value). These are outside the proposed grid connection footprint, however. The existing roads are of no value to wildlife.

Plate 8-21: Buildings and artificial surfaces BL3

Dry Meadows & Grassy Verges (GS2)

This habitat is present along road verges bordering the grid connection. Species present include false oat-grass (*Arrhenatherum elatius*), cocksfoot grass (*Dactylis glomerata*), herb-robert (*Geranium robertianum*), marsh woundwort (*Stachys palustris*), common figwort (*Scrophularia nodosa*), tufted vetch (*Vicia cracca*), wavy St. John's-wort (*Hypericum undulatum*), selfheal (*Prunella vulgaris*), fleabane (*Pulicaria dysenterica*), creeping buttercup (*Rannunculus repens*), daisy (*Bellis perennis*), spear thistle (*Cirsium vulgare*), meadowsweet (*Fillipendula ulmaria*) and white clover (*Trifolium repens*).

Non-native invasive species such as montbretia and winter heliotrope are also present in the verges on some sections of the route (see Figure 8-12).

Although the grid connection will be located primarily within existing roads, it may also enter sections of dry meadows & grassy verges habitat.

Due to its semi-natural character this habitat is ***Local Importance , Higher value.***
This habitat does not have links with the corresponding Annex 1 habitat '*Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [6510]'.*

Plate 8-22: Dry Meadows & Grassy Verges GS2

Hedgerows (WL1)

The hedgerows bordering the grid connection vary in character and quality, ranging from thick mature hawthorn and ash hedges to domestic property boundaries delineated by non-native species such as cherry laurel and Wilson's honeysuckle.

In addition to hawthorn and ash, hedgerows along the GCR also contained ivy, sycamore, beech, whych elm, goat willow, pedunculate oak, guelder rose, bramble and dog-rose. Individual specimens of crab apple (*Malus sylvestris*) and yew (*Taxus baccata*) are present along the local road running east from Ardnacrusha substation.

In addition to cherry laurel and Wilson's honeysuckle, other non-native species forming hedgerows along the route included New Zealand broadleaf (*Griselinia littoralis*), redclaws (*Escalonia* Sp.), red robin (*Photinia* x *fraseri*), sitka spruce (*Picea sitchensis*) and Leyland cypress (*Cupressus × leylandii*). The species noted above were associated with contemporary dwellings in built-up areas. Outside built-up areas, the non-native species snowberry was recorded frequently in roadside hedges.

This habitat is ***Local Importance, Higher value*****.**

No hedgerows bounding the grid connection along public roads are within the proposed footprint; however, limited trimming of tree branches may be required for safe machinery access.

Plate 8-23: Hedgerow WL1

Treelines (WL2)

Ash is the most frequent species in treelines along the route, however a suite of other species including beech, pedunculate oak and sycamore are also present. Treelines also occur in mosaic with hedgerows.

This habitat is ***Local Importance , Higher value.***

No treelines bounding the grid connection along public roads are within the proposed footprint; however, limited trimming of tree branches may be required for safe machinery access.

Plate 8-24: Treelines WL2

Improved agricultural grassland (GA1)

This highly artificial habitat is common throughout the rural areas traversed by the route. Species-poor swards dominated by perennial ryegrass (*Lolium perenne*) are the most common form of this habitat present. This habitat is species poor and common in the area and is assessed as being ***locally important, lower value*****.**

This habitat type is not within the proposed GCR footprint.

Plate 8-25: Improved agricultural grassland GA1

Wet grassland (GS4)

This semi-natural habitat is also common in rural areas abutting the GCR. The dominant species typically recorded were Yorkshire fog and soft rush. Meadow buttercup and greater birds-foot trefoil were locally abundant, while march thistle was frequent. This habitat is assessed as being ***Local Importance, Higher value.***

Wet grassland also occurs in mosaics with Improved agricultural grassland.

This habitat type is not within the proposed GCR footprint.

Plate 8-26: Wet grassland GS4

Amenity grassland (GA2)

This highly artificial habitat is common in built-up areas along the GCR. It is species-poor, dominated by close cropped grass, with occasional common forbs such as daisy, creeping buttercup and white clover punctuating the sward. This habitat is species poor and common in the area and is assessed as being ***Local Importance, Higher value.***

Limited areas of this habitat could be affected by the GCR where the habitat is present abutting existing roads.

Plate 8-27: Amenity grassland GA2

Wet willow-alder-ash woodland (WN6)

This habitat is present in pockets bounding the GCR at Ardnacrusha and approaching the quarry/proposed site entrance. The dominant tree species is grey willow. Alder is also present, and pendulous sedge (*Carex pendula*) is frequent. This habitat is assessed as being ***Local Importance, Higher value.***

This habitat type is not within the proposed GCR footprint.

Plate 8-28: Wet willow-alder-ash woodland WN6

Mixed broadleaved woodland (WD1)

This habitat is present adjacent to the GCR along local roads north of Harol’s Cross. Woodland composed of birch (*Betula* Sp.) and willow (*Salix* Sp.) abuts the GCR in one location, while a mature ash plantation is present at another. This habitat is assessed as being ***Local Importance, Higher value.***

It is not within the proposed GCR footprint.

Plate 8-29: Mixed broadleaved woodland WD1

Conifer plantation (WD4)

This habitat is present adjacent to the GCR along a local road approaching the R466. It is dominated by sitka spruce, with ash planted around the edges. This habitat is assessed as being ***Local Importance, Higher value.***

It is not within the proposed GCR footprint.

Lowland/depositing rivers (FW2)

This habitat is present where the GCR intersects natural watercourses. These range from small streams to wide rivers.

The smallest watercourse is the Bridgetown (Clare) which intersects the GCR near the proposed site access. This stream has wet width and depth of c. 40cm and 3-5cm respectively. It is densely shaded by hawthorn and grey willow. Its banks are densely vegetated, with ivy, bramble, hart's tongue fern and soft shield fern (*Polystichum setiferum*) being the dominant species in the ground and shrub later. No emergent or submerged vegetation is present. The existing crossing structure is a square stone culvert.

The River Bridgetown (Clare) also runs parallel to the GCR for c. 330m after the crossing point, at distances ranging from 35 -15m from the GCR. This channel runs through and drains a reed swamp. The wet width of this section is c. 1m. The gradient is low and siltation is high. There were eroding banks present. There have recently been extensive river works at this site. The flow is sluggish and there are high levels of fringing instream vegetation.

An un-named watercourse draining towards the Shannon intersects the GCR via an existing culvert crossing just east of Ardnacrusha; this channel is densely shaded by ash, *Griselinia* and cherry laurel. It's banks are densely carpeted with ivy; soft shield fern, hart's tongue fern and pendulous sedge are also present. Wet width and depth are c. 50cm and 5cm respectively, and there is no emergent or instream vegetation. The existing crossing structure is a concrete culvert.

Two of the watercourses crossed (Glenlon South and Glenomra Wood Stream) are small-medium in size, with wet widths and depths of c. 1.5-2.5m and 10-30cm respectively. Both contain densely shaded and less shaded sections. Riparian vegetation includes ash, hawthorn, cherry laurel, sycamore, grey willow, bramble, nettles and hemlock water-dropwort. The latter occurs as an emergent plant in the Glenomra Wood Stream, and water moss *Fontinalis* Sp. is present as both submerged and emergent vegetation in the same location.

The existing crossing structure over the Glenlon South is a single stone arch. The existing crossing structure over the Glenomra Wood Stream is formed by two stone arches.

The Blackwater (Clare) is the largest watercourse crossed. The channel at the crossing point has a wet width ranging from c. 4-12m and wet depth of c. 30-50cm. The existing crossing structure is a tall, wide single stone arch.

Areas of wet grassland, improved agricultural grassland, dense bramble, nettles and riparian woodland fringe the Blackwater. Hemlock water-dropwort and *Fontinalis* Sp. are present in the main channel; growths of duckweed (*Lemna* Sp.) and water pepper (*Persicaria hydropiper*) are present in shallow stagnant pools in marginal areas at the bridge.

Although the two smaller streams are of limited fisheries and general ecological value, this habitat is assessed as being ***Local Importance, Higher value*** overall**.**

Plate 8-30: Lowland/depositing rivers FW2

Drainage ditches (FW4)

This habitat is present in the form of roadside and field drains at intermittent locations along the GCR and is intersected by the GCR where it crosses culverted drains.

The drains observed were small and muddy, with negligible biodiversity value. This habitat is ***Local Importance, Lower value.***

8.3.4.3 Turbine Delivery Route

A walkover of the TDR was undertaken at the TDR Nodes (points of interest along the route where accommodation works may be required) during 20th-22nd July 2022. Additional works are required at the locations (identified by TDR Node numbers) in Table 8-29. No flora listed on the FPO or listed as threatened on the Irish Red list were recorded during surveys of the TDR.

Node 2 – Foynes Port Access Road/N69

This area includes buildings and artificial surfaces BL3 (roads and modern stone wall), improved agricultural grassland GA1, ornamental/non-native shrub WS3, hedgerows WL1, mixed broadleaved woodland WD1 and recolonising bare ground ED3. It is noted that accommodation works have been carried out for an unrelated project, with a section of ornamental/non-native shrub and mixed broadleaved woodland along the northern verge having been cleared and replaced with an aggregate surface. This new surface is being recolonised by vegetation including the invasive species red osier dogwood and traveller's joy. Ornamental/non-native shrub has been cut back on the southern verge but is re-growing.

The oversail footprint overlaps recolonising bare ground and ornamental/non-native shrub. Ornamental/non-native shrub within the oversail footprint is comprised of red osier dogwood and buddleja and domesticated cultivars of the genera *Philadelphus, Potentilla, Hypericum* and *Rosa*.

The strip of mixed broadleaved woodland of recent origin adjacent to the oversail footprint is comprised of birch, black pine (*Pinus nigra*), hazel, alder and Atlantic cedar (*Cedrus atlantica*).

The hedgerow, recolonising bare ground and area of mixed broadleaved woodland are ***Local Importance, Higher value***, while the other habitats are ***Local Importance, Lower value.***

Plate 8-31: TDR Node 3

Node 6 – N69 Tree Canopy

Mature treelines and hedgerows are present at dispersed locations along this route. The most frequent species in semi-natural treelines are ash and sycamore.

Dense mature treelines are present along the N69 bypassing Askeaton. These treelines originated as roadside landscaping and contain Norway maple, lime and ash.

There is a potential requirement for trimming of tree limbs overhanging the N69 to provide 5m vertical clearance.

No potential bat roosting features were observed in mature trees along the N69.

This habitat is ***Local Importance, Higher value*** based on the occurrence mature native trees.

Node 8 –Clarina Roundabout

This node comprises buildings and artificial surface BL3, spoil and bare ground ED2, amenity grassland GA2 and mixed broadleaved woodland WD1 of recent origin comprised of the invasive non-native tree Norway maple (low risk of impact). Accommodation works have been carried out for an unrelated project, with a track through the roundabout having been cleared. The cleared area comprises compacted earth with a hard plastic mesh driven into the ground. A section of the mixed broadleaved woodland has been removed to accommodate the existing track.

One tree on the southern side of the roundabout (outside the proposed footprint) has a split trunk, potentially providing bat roosting opportunities. The urban setting, lack of surrounding vegetation and connectivity with the surrounding landscape reduces the likelihood the area would be used by bats however.

A specimen of bristly oxtongue (*Helminthotheca echioides*) was observed under the trees to the south of the proposed oversail footprint. This species is noted as being an archeophyte (non-native introduced pre-1500) in Streeter et. al (2016). It is not listed on the FPO (2022) and is classified as Least Concern on the Vascular Plants Red List (Wyse-Jackson et al. 2016) but has a relatively restricted distribution with most records occurring in the south-east.

The mixed broadleaved woodland is ***Local Importance, Higher value*** due to being of some use to foraging birds and possibly bats, however the wooded area itself is not of high value in it's own right, being recently planted and comprised of non-native (low-risk) invasive species.

Plate 8-32: TDR Node 8

Node 9 – Dock Road West Roundabout

This roundabout supports spoil and bare ground ED2, amenity grassland GA2 and immature woodland WS2. Mowed amenity grassland is present in open areas. The immature woodland in the centre of the roundabout is comprised of Norway maple and a smaller amount of small-leaved lime.

Similar to previous nodes, accommodation works for another project have been carried out here. These comprise an aggregate track through the north-western side of the roundabout and an area of compacted earth with a hard plastic mesh on the western edge.

The areas of spoil and bare ground and amenity grassland are within the load bearing footprint. These are ***Local Importance, Lower value.***

The immature woodland is ***Local Importance, Higher value*** . This habitat is immediately adjacent to the load bearing/oversail footprint.

Plate 8-33: TDR Node 9

Node 10– Dock Road East Roundabout

This roundabout is very similar to Node 9, supporting amenity grassland GA2 and immature woodland WS2. The immature woodland in the centre of the roundabout has the same species composition and age as Node 5. No accommodation works have been carried out on the roundabout island; however, a load bearing surface (spoil and bare ground ED2) has been installed to replace a grassy verge along the road south of the roundabout.

Mixed broadleaved woodland WD1 comprised of alder, pedunculate oak, crack willow (*Salix × fragilis*), birch, aspen (*Populus tremula*), goat willow (*Salix caprea*), and hazel is present adjacent to the oversail footprint. This habitat originated as roadside landscaping.

The immature woodland and mixed broadleaved woodland habitats are ***Local Importance, Higher value*** . Only amenity grassland and spoil and bare ground (***Local Importance, Lower value***) are within the load bearing and oversail footprints.

Plate 8-34: TDR Node 10

Node 11 – M7 Junction 27

This Node which extends over the Junction 27 northbound off-ramp and roundabout includes buildings and artificial surface BL3, amenity grassland GA2 and dry meadows and grassy verges GS2. Amenity grassland is present on the road verges and roundabout. Dry meadows and grassy verges is present along a grassy bank beyond the verge on the south-eastern side. Species recorded in this semi-natural habitat included cocksfoot, false oat grass, bent-grass, cat's ear, ragwort, red clover, dandelion, white clover, knapweed, greater bird's foot trefoil and tufted vetch.

The load bearing footprint overlaps amenity grassland (***Local Importance, Lower value***). The oversail footprint also overlaps dry meadows and grassy verges (***Local Importance, Higher value***).

Node 12– R494 Birdhill Roundabout

This Node includes buildings and artificial surface BL3 and amenity grassland GA2. Installation of a load bearing surface on the roundabout is proposed. Buildings and artificial surface and amenity grassland will be oversailed.

Amenity grassland is ***Local Importance, Lower value*** .

Plate 8-35: TDR Node 12

Node 18 – R494 Roundabout Templehollow

This Node relates to load bearing and oversail footprints required to accommodate turbine deliveries through the consented Killaloe Bypass roundabout at this location. As such the habitats currently present will have been altered by the time turbine deliveries take place.

The current hedgerow WL1 section consisting of grey willow, ash, hawthorn and ivy will no longer exist within the proposed load bearing and oversail footprints when deliveries occur. It is considered that agricultural grassland GA1 will be within the oversail footprint. This will not be impacted by oversail, however.

Node 19 – R463 Roundabout north-east of Cloverfield

This Node relates to load bearing and oversail footprints required to accommodate turbine deliveries through the consented Killaloe Bypass roundabout at this location. As such the habitats currently present will have been altered by the time turbine deliveries take place.

The current hedgerow WL1 section consisting of grey willow, ash, and osier, and dry meadows and grassy verges GS2 verge containing false oat-grass, meadowsweet, great willowherb, wild angelica, spear thistle, winter heliotrope and purple loosestrife will no longer exist within the proposed load bearing and oversail footprints when deliveries occur. It is considered that the oversail footprint will cover buildings and artificial surfaces, and potentially amenity grassland or a similar landscaped habitat. These will not be impacted by oversail, however.

Node 20 – R463 Bends south of Cloverfield

Mature trees have been recently felled along this section. As such the remaining vegetation is primarily comprised of Dry meadows and grassy verges GS2. False oat-grass, cow parsley, bramble, rosebay willowherb, docks and ragwort are present in the verges. An individual mature beech tree partly overhangs the road where the route crosses the Ballyteige 25 river is at this point a depositing/lowland river FW2. This beech forms part of the mixed broadleaved woodland WD1 bordering the river at this location.

There is a potential requirement to trim this beech tree to provide 5m vertical clearance. No potential bat roosting features were observed in this tree.

Mixed broadleaved woodland WD1 is ***Local Importance, Higher value.***

Plate 8-36: TDR Node 20

Node 21 – R463 Bends south-west of Bellisle

Hedgerows WL1 are present on both road verges at this node. Species include ash, sycamore, Leyland cypress, blackthorn, meadowsweet, cocksfoot, hogweed and hart's tongue fern. The invasive species snowberry is present in the hedgerow south of the road fork.

The hedgerow within the proposed oversail footprint north of the road fork has been trimmed to c. head height except where trees around a telegraph pole have been allowed to grow. The hedgerow within the proposed oversail footprint south of the road fork contains full-sized trees.

Trimming of hedgerows and tree canopy trimming are proposed at this location.

Hedgerows WL1 are ***Local Importance, Higher value.***

Plate 8-37: TDR Node 21

Node 23 – R463 Ardcloony Bridge

Mature treelines WL2 are present in this area. These are comprised of hazel, pedunculate oak, beech and sycamore. The TDR crosses the Ardcloony river which is at this point a depositing/lowland river FW2. Mixed broadleaved woodland WD1 is present bordering the river at this location.

Grassy verge habitat (GS2) dominated by false oat-grass is also present on the approach to the bridge. The proposed load bearing footprint overlaps this verge, while the oversail/clearance footprint will require trimming of overhanging tree branches on the approach to the bridge and at the bridge.

No potential bat roosting features were observed in the mature trees at this location.

Dry meadows and grassy verges, treelines and mixed broadleaved woodland are ***Local Importance, Higher value.***

Plate 8-38: TDR Node 23

Node 25/26 – R463 Bends south of Knockadrohid

Hedgerows WL1 are present along this section. A number of domestic dwellings are present along the road. Species present in the hedgerows include elder, hawthorn, blackthorn, ash, crab apple, beech and sycamore. Species present in the understory and hedgerow fringes include bracken, false oat-grass, bramble, nettle and the garden escapee sweet rocket (*Hesperis matronalis*). Invasive species including wilson's honeysuckle, fuchsia and traveller's joy are present in parts.

Amenity grassland GA2 will be oversailed. Trimming of hedgerows and trees is required for oversail.

Hedgerows WL1 are ***Local Importance, Higher value.***

Plate 8-39: TDR Node 25-26

Node 27 – R463/R466 Junction

Buildings and artificial surfaces BL3, hedgerows WL1, drainage ditches FW4, recolonising bare ground ED3 and wet grassland GS4 are present at this location. Hedgerows comprised of grey willow, bramble and sycamore border the roadside. Great willowherb, nettles and hedge bindweed are present in association with hedgerows. A stagnant drain with no visible outflow is present behind the hedgerow fringing the northern side of the crossroads.

An open area at the eastern side of the crossroads has been recently cleared and is being recolonised by wet grassland. False oatgrass, marsh woundwort, hedge bindweed, prickly sow thistle, bramble, crack willow, tufted vetch, field horsetail (*Equisetum* Sp.) and meadowsweet are present in this area.

It is proposed to oversail the recolonising wet grassland area. Cutting back of willow will be required in the event this continues to grow until turbine deliveries take place.

A small mesotrophic lake FL4 (Mac Namara's Lake) is present behind a hedgerow to the west of Node 27. No wetland birds were observed here during the TDR survey; however, this water feature is likely to be used by species such as mute swan, mallard and grey heron. Mute swan has previously been recorded within the 1 km grid square overlapping this lake.

Hedgerows, drainage ditches, mesotrophic lakes and wet grassland are ***Local Importance, Higher value.***

Plate 8-40: TDR Node 27

Nodes 28-30 – R466 Bends Northwest of O'Briensbridge Cross

Hedgerows WL1 and treelines WL2 are present along this section. Mature ash trees are present in treelines and hedgerows, and hedgerows also contain grey willow, blackthorn, hawthorn and sycamore. Other species occurring in association with these habitats include bramble, ivy, hedge bindweed and privet (*Ligustrum vulgare*).

No potential bat roosting features were observed in the mature trees at this location.

The proposed oversail footprint requires trimming of trees and vegetation in the south-eastern sections (Nodes 28-29). The oversail footprint would require felling of ash and hawthorn trees along the southern verge in the north-western section (south of farm buildings) (Node 30). These trees are semi-mature. No potential bat roosting features were observed in the trees at this location.

Hedgerows and treelines are ***Local Importance, Higher value.***

Node 31 – R466 Bends Southeast of Bridgetown

Hedgerows WL1 and treelines WL2 are present along this section. A young/semi-mature hedgerow comprised of ash and sycamore is present along the northern verge. A mature treeline containing ash, sycamore, pedunculate oak and hawthorn is present along the southern verge. Ivy and bramble are also present along the verges.

The proposed oversail and load bearing footprints require the removal of trees on both verges, with the majority (c. 50m length of treeline) being in the southern verge comprised of mature and semi-mature trees. These include a mature pedunculate oak, and two mature ash trees with dense ivy cladding. These two ash trees have low potential to host bat roosting features.

Hedgerows and treelines are ***Local Importance, Higher value .***

Plate 8-41: TDR Node 31

Node 32 – R466 Left Bend at Bridgetown

Treelines WL2 and amenity grassland GA2 are present at this node. A treeline comprised of birch and ash which originated as a village landscaping feature is present on the southern verge; this is outside the load bearing and oversail footprint. A semi-natural treeline comprised of ash, birch, beech, sycamore and ivy is present on the northern verge within the load bearing and oversail footprint. Two mature ash trees at the eastern end of this section were observed to be severely affected by ash dieback.

A semi-mature ash is present near the birch treeline on the southern verge. This tree has dense ivy cladding and has low potential to host bat roosting features.

Treelines are ***Local Importance, Higher value.***

8.3.5 Terrestrial Mammals

8.3.5.1 Desktop Study Rare and Protected Mammals

The mammal species listed in Table 8-30, below have been recorded within the 10 km grid squares (R66 and R67) in which the wind farm site is located. Both NBDC records (accessed 24/03/2022) and NPWS records obtained by request (received 15/03/2022 and 25/03/2022) were consulted as part of the desktop study.

A total of nine protected mammal species have been recorded within the 10km grid squares (R66 & R67) overlapping the wind farm site, namely badger (*Meles meles*), pygmy shrew (*Sorex minutus*), red squirrel (*Sciurus vulgaris*), otter (*Lutra lutra*), pine marten (*Martes martes*), hedgehog (*Erinaceus europaeus*), red deer (*Cervus elaphus*), Irish hare (*Lepus timidus subsp. Hibernicus*) and Irish stoat (*Mustela erminea subsp. Hibernica*).

Two further native mammal species which are not protected under conservation legislation, red fox (*Vupes vulpes*), and wood mouse (*Apodemus sylvaticus*) were also recorded in grid square R66.

Of the species noted, only badger has been recorded within a 1km grid square overlapping the wind farm site. The closest historical otter record is represented by a spraint observed approx. 1km southeast of the site. However, this record is from 1980. Additionally, there is a record of pine marten 200m north of the northern site boundary.

8.3.5.2 Desktop Study Invasive Mammal Species

The mammal species listed in Table 8-31 below have been recorded within the 10 km grid squares (R66 and R67) in which the wind farm site is located. Both NBDC records (accessed 24/03/2022) and NPWS records obtained by request (received 15/03/2022 and 25/03/2022) were consulted as part of the desktop study.

A total of seven invasive mammal species have been recorded within the 10km grid squares (R66 & R67) overlapping the wind farm site, namely American mink (*Mustela vison*), bank vole (*Myodes glareolus*), brown rat (*Rattus norvegicus*), European rabbit (*Oryctolagus cuniculus*), greater white-toothed shrew (*Crocidura russula*), wild boar (*Sus scrofa*) and fallow deer (*Dama dama*).

Table 8-30: Historical Mammal Records of Mammal Species within 10km of the Wind Farm Site and GCR (Excluding Bats)

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
Eurasian Badger (*Meles meles*)	R66, R67	2018	Mammals of Ireland 2016-2025; Badger Setts of Ireland Database	Wildlife Acts	Closest records are 1km resolution records from 2005 and 2006 from grid square R6369 and R6469, which overlap the wind farm site. Other 1km records are present to the east and west of these squares. Also recorded in 1 km grid squares overlapping the proposed GCR – R5861, R5962, R5964 & R6166.
Eurasian Pygmy Shrew (*Sorex minutus*)	R66, R67	2017	Mammals of Ireland 2016-2025; Atlas of Animals Ireland 2010-2015	Wildlife Acts	There are no records of Eurasian pygmy shrew within the wind farm site. A record of a live animal from 2012 exists within a 1km grid square overlapping the grid connection. This record has a precision of 100m, and is c. 600m from the GCR. The next closest record is over 3km northeast of the wind farm site in R676715. This record is of two live animals. Also recorded in 1 km grid squares overlapping the proposed GCR – R5861, R5862 & R5963.
Eurasian Red Squirrel (*Sciurus vulgaris*)	R66, R67	2016	Mammals of Ireland 2016-2025; Irish Squirrel Survey 2012	Wildlife Acts	No records of red squirrel exist within the wind farm site. However, a record with 100m accuracy from 2012 is c. 200m north of the site. Additionally, in 2012, a record with 100m accuracy exists c. 800m northwest of the grid connection.
European Otter (*Lutra lutra*)	R66, R67	2012	Road Kill Survey; Atlas of Animals Ireland 2010-2015	Annex II Annex IV Wildlife Acts	No records for otter exist within the wind farm site. The nearest record is approx. 1km southeast of the site. This record, with 100m accuracy, is of droppings in 1980, within the R647689 square. Otter droppings were recorded in 1980 in Grid Square R594655. This record (100m accuracy) overlaps the grid connection route.

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
Irish Hare (*Lepus timidus* subsp. *hibernicus*)	R66, R67	2015	Atlas of Mammals in Ireland 2010-2015	Not Protected	No records for Irish hare exist within the wind farm site. The closest record is in the R6070 grid square from 1991. This record has an accuracy of 1km and is c. 2km east of the wind farm site. No records for Irish hare exist along the grid connection route.
Pine Marten (*Martes martes*)	R66, R67	2018	Atlas of Mammals in Ireland 2010-2015; Mammals of Ireland 2016-2025	Wildlife Acts Annex V	No records for pine marten exist within the wind farm site, but there is a record 200m north of the northern boundary. This record is 100m resolution and occurred in 2012 (R643708). No records for pine marten exist within the grid connection. The nearest record (100m accuracy) is c. 800m north of the grid connection in grid square R585629. This record is of a live animal in 2021.
Irish Stoat (*Mustela erminea* subsp. *hibernica*)	R67	2018	Mammals of Ireland 2016-2025	Not Protected	No records for Irish stoat exist within the wind farm site. The nearest record is c. 5km east in grid square R7072. The next closest record to the wind farm site is approx. 8km north of the site boundary. This record (Grid Square R633788) is of a live animal in 2018. The closest record of Irish stoat to the GCR is over 6km west. This record, in grid square R517610, is a sighting of a live animal in 2015.
Red Deer (*Cervus elaphus*)	R67	2014	Atlas of Mammals in Ireland 2010-2015	Wildlife Acts	No records for red deer exist within the wind farm site. The nearest record is c. 3km north of the site boundary. This 100m resolution record dates to 2010 and is a sighting of a live animal in Grid Square R636737. The next closest record is c. 5km north east of the site boundary (Grid Square R670748). This record is also a sighting of a live animal from 2010. No records of red deer exist in the vicinity of the GCR.
Red Fox (*Vulpes vulpes*)	R66	2018	Atlas of Mammals in Ireland 2010-2015;	Not Protected	No records for red fox exist within the wind farm site. The nearest record is 2.5km east of the site boundary. This 1km resolution record dates to 1981.

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
			Mammals of Ireland 2016-2025		The next closest record is >3km southeast of the site. This record from 2011 was at grid square R668666 (100m accuracy).
West European Hedgehog (*Erinaceus europaeus*)	R66	2021	Hedgehogs of Ireland	Wildlife Acts	No records for European hedgehog exist within the wind farm site. The nearest record is c. 1km north of the site boundary. This 100m resolution record (R642725) dates to 2016 (road kill). Records of live animals exist within the vicinity of the GCR. Sightings at R584615 and R587621 in 2007 were approx. 200m south of the GCR.
Wood Mouse (*Apodemus sylvaticus*)	R66	2012	Atlas of Mammals in Ireland 2010-2015	Not Protected	No records for wood mouse exist within the wind farm site. The closest record is c. 2km southeast of the wind farm, in grid square R611673. This live animal was observed in 2012. The next closest record 7km southeast of the windfarm and c. 1.5km east of the GCR. This record at R6162 is of two live animals in 1970.

Table 8-31: Historical Mammal Records of Invasive Mammal Species within 10km of the Wind Farm Site and GCR

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
American Mink (*Mustela vison*)	R66, R67	2010	Atlas of Mammals in Ireland 2010-2015	High Impact Schedule III	Closest record is 100m resolution record from 2010 from grid square R69571, c. 5km east of the wind farm site. Less than 500m from the GCR, a 100m resolution record from 2010 exists from grid square R596620.
Bank Vole (*Myodes glareolus*)	R66, R67	2012	Atlas of Mammals in Ireland 2010-2015	Medium Impact	No records for bank vole exist within the wind farm site. The closest record is c. 4km east of the wind farm, in grid square R6870. The next closest record is c. 4km northwest of the wind farm, in grid square R6172 These records both date to 1977. A record exists 700m west of the GCR in square R611673. This record is of a live animal in 2012.
Brown Rat (*Rattus norvegicus*)	R66	2012	Atlas of Mammals in Ireland 2010-2015	High Impact Schedule III	No records for brown rat exist within the wind farm site. The closest record is > 8km southeast of the wind farm, in grid square R666615. This record of a road kill is from 2012. This record is also over 8km from the GCR. The next closest record is c. 12km south of the wind farm, in grid square R654589. This record of a dead animal dates to 2013.
European Rabbit (*Oryctolagus cuniculus*)	R67	2013	Badger and Habitats Survey of Ireland; Atlas of Mammals in Ireland 2010-2015	Medium Risk	No records for rabbit exist within the wind farm site. The closest record is c. 3km west of the wind farm, in grid square R6070. This record originated in 1991. The next closest record is c. 5km northeast of the wind farm site. This record (grid square R663758) is of a live animal in 2013.
Greater White-toothed Shrew (*Crocidura russula*)	R66	2014	Atlas of Mammals in Ireland 2010-2015	Medium Risk	No records for greater white-toothed shrew exist within the wind farm site. The closest record is c. 5km west of the wind farm, in grid square R708704. This record originated in 2010 and it was a live animal.

Species	Grid Squares covering Wind Farm site	Year of Last Record	Survey/Dataset	Protection	NBDC and NPWS records within the study area
					Another record exists 3km west of the GCR and c. 6km southeast of the wind farm site. This record was from 2014 in Grid Square R626638.
Wild Boar (*Sus scrofa*)	R67	2011	National Invasive Species Database	High Impact	No records for wild boar exist within the wind farm site. The closest record is c. 5km north of the main site. This was a sighting of a live animal in 2010 (Grid Square R625756). The next closest record of wild boar is over 8km north east of the wind farm site. This record (Grid Square R738720) was of a live animal in 2016. No records of wild boar exist in the vicinity of the GCR.
Fallow Deer (*Dama dama*)	R66, R67	2008	Deer of Ireland Database	High Impact	Fallow deer are recorded covering all relevant grid squares for the wind farm site and GCR, at a resolution of 10km. Data from the NPWS identified fallow deer approx. 1km north of the site boundary. This record dates to 2004 in the R6472 grid square.

8.3.5.3 Terrestrial Mammals Survey Results

A total of seven mammal species were recorded during surveys at the proposed wind farm site. No mammals or mammal signs were observed during GCR and TDR surveys.

See Table 8-32 for more information. Figure 8-14 shows the location of mammal field signs, image captures and direct observations of live mammals.

Badger setts are omitted as this information cannot be disclosed publicly due to the persistence of badger baiting; public disclosure of sett locations poses a risk of animal cruelty. Detailed information on badgers is therefore provided within the confidential Appendix: Badger Report.

This data was obtained during the mammal survey walkover and from trail cameras located in the wind farm site as well as incidental records gathered during other ecological surveys. Six of these species are considered to be of 'Least Concern', namely badger, rabbit, fox, fallow deer, Irish hare and pine marten. The remaining species, namely greater white-toothed shrew was recently introduced and is therefore not provided a conservation status. As discussed in section 8.3.5.2, greater white-toothed shrew is a Medium Risk invasive species.

Other mammal species previously recorded in the area (see section 8.3.5.1) of the study area but not observed during surveys may also occur; red squirrel, otter, red deer, Irish stoat, pygmy shrew, wood mouse and hedgehog. The woodlands, treelines, as well as the edge of woodland and scrub habitats, and adjacent field edges are suitable for Irish stoat, utilising habitat edges to hunt. Hedgehog if present is likely to use the same habitats. Red squirrel could potentially forage and/or breed within the woodlands in the study area and use hedgerows to commute between dispersed blocks of woodland. Trees at TDR Nodes are located beside public roads subject to disturbance which makes them sub-optimal for red squirrel dreys. Red deer could potentially use all habitats within the study area. Wood mouse could occur in woodland, hedgerows and grassland habitats in the study area.

Otter are unlikely to use the small spate streams draining the hillsides in the proposed site; these do not support fish or invertebrate populations required for foraging otter. There is low potential for otter to use these streams to navigate to secluded natal holts, however the absence of convenient foraging grounds reduces the suitability of these streams for that purpose.

Pygmy shrew could occur where sufficient vegetated ground cover is available. It is noted the presence of greater white-toothed shrew would put pressure on pygmy shrew through competitive superiority in catching insect prey.

There is potential for otter to hunt in the Bridgetown (Clare) along the canalised section south-east of the proposed site entrance; the aquatic assessment considered that brown trout and brook lamprey are likely to occur in this channel.

There is potential for otter to occur at TDR Nodes 20 and 23 which intersect the Ballyteige 25 and Ardcloony rivers. No otter signs or holts were recorded at these locations or within 150m up or downstream. Otter prints were observed downstream of Node 22 along the Ballyteige 25 River. Proposed works at these locations are limited to vegetation trimming within the road corridor.

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 8-32: 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) (Marnell et. al 2019)
Eurasian Badger (*Meles meles*)	Least Concern
European Rabbit (*Oryctolagus cuniculus*)	Least Concern
Fallow Deer (*Dama dama*)	Least Concern
Greater White-toothed Shrew (*Crocidura russula*)	Not included in red list (post 1500 introductions are excluded)
Irish Hare (*Lepus timidus* subsp. *hibernicus*)	Least Concern
Pine Marten (*Martes martes*)	Least Concern
Red Fox (*Vulpes vulpes*)	Least Concern

Badger

Badgers are present at the proposed wind farm site. Activity was distributed across the Site, with six setts recorded. One main sett showed signs of recent activity during surveys. Active latrines were recorded in an area in the northern central part of the site, indicating a territorial boundary, with two different family groups occupying the eastern and western parts of the site.

Badger scat was distributed widely throughout the site, and latrines were also recorded at an additional location in the eastern part of the site. A live adult badger was also observed foraging during daylight (seen snuffling in grassland) and adult badgers were recorded on trail cameras at multiple locations onsite.

No setts are located within the proposed infrastructure footprint. A total of three setts are located in areas which may be impacted indirectly by the proposed development. Details on the location and status of badger setts are included in the confidential Appendix [Badger Report].

No evidence of badgers was observed along the GCR or at TDR Nodes.

Rabbit

This species is present at the proposed wind farm site, as indicated by the presence of burrows distributed across the Site. These are located in the quarry, along field boundaries and within wooded areas. No burrows are located within the proposed infrastructure footprint.

Fallow Deer

Deer tracks and droppings were abundant throughout the proposed wind farm site, particularly in wooded areas. The presence of fallow deer was confirmed by recordings of this species on trail cameras in the quarry, Ballymoloney Woods and near conifer plantation on the hilltop in the north of the site.

Greater White-toothed Shrew

A cadaver of this species was observed in a field adjacent to Ballymoloney Woods. Greater white-toothed shrew is a Medium Risk invasive species. It is a threat to the native pygmy shrew due to competition and displacement. It has also been noted as potentially having a positive impact by increasing prey abundance for birds of prey such as barn owl and kestrel.

Irish Hare

A live hare was observed at the proposed wind farm site; droppings were recorded at locations dispersed throughout the Site, and hares were recorded on trail cameras in Ballymoloney Woods.

Pine Marten

This species was recorded on a trail camera placed in woodland within the quarry, and pine marten scat was observed throughout the proposed wind farm site. No pine marten dens were observed. The complex mosaic of habitats, hedgerow connectivity and good cover of woodland means the Site offers suitable conditions for pine marten.

Fox

Live foxes were observed three times during surveys, fox was recorded on a trail camera in Ballymoloney Woods, and fox scat was observed.

Otter (GCR Crossings)

The un-named stream (Athlunkard headwaters) east of Ardnacrusha (see Bridge 1 in Appendix 8.3) was assessed as having no Otter potential. This stream / drain was visibly polluted and is too small to contain fish or provide any habitat for Otters. The Glenlon south watercourse (see Bridge 2 in Appendix 8.3) is also too small to contain fish / be of interest to Otters. No signs of Otter activity were recorded. The River Blackwater at Bridge 3 (see Appendix 8.3) is an important salmonid watercourse and has optimum Otter habitat present. Otter signs we recorded upstream of the bridge with footprints present on sand on the left bank of the river c.50m upstream of the bridge. There were also Otter footprints in an exposed sand /silt deposit under the bridge. A suspected Otter slide/couch was recorded c.100m downstream of the bridge. Otters appeared to enter the water here sliding though vegetation. However, it was not very active. No spraints were recorded. No holts were present, but Otters are using this site.

Otter activity was also recorded on the Glenmora wood stream (see Bridge 4 in Appendix 8.3). Suspected Otter footprints were recorded at the bridge and c. 50m downstream of the bridge. There are no holts, but Otters are active at this site.

The Bridgetown (Clare) (see Bridge 5 in Appendix 8.3) does not provide habitat for fish and it is very unlikely that Otters would use this site. There is a large wetland area upstream of the bridge. There are no Otter holts or important Otter features near this bridge. It is highly unlikely that Otters would use this site. area.

Path: R:\Map Production\2020\P20-003\Workspace\EIAR\Ecology\P20-003_GIS_Fig8-14_Mammal_Signs_and_Sightings_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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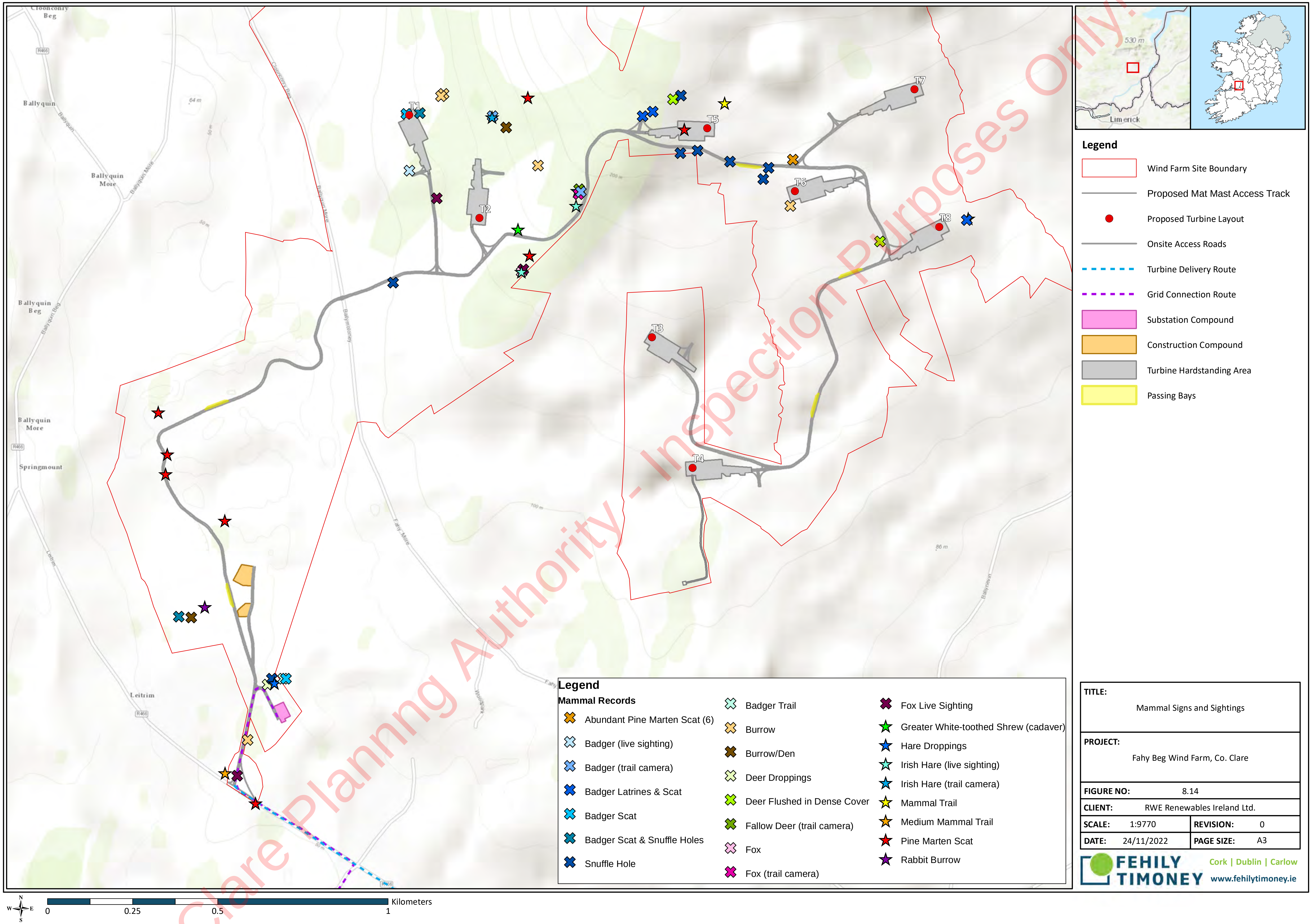

Legend

□	Wind Farm Site Boundary
—	Proposed Mat Mast Access Track
●	Proposed Turbine Layout
—	Onsite Access Roads
- - -	Turbine Delivery Route
- - -	Grid Connection Route
▨	Substation Compound
▨	Construction Compound
▨	Turbine Hardstanding Area
▨	Passing Bays

Legend

Mammal Records

✖	Abundant Pine Marten Scat (6)	✖	Badger Trail	✖	Fox Live Sighting
✖	Badger (live sighting)	✖	Burrow	★	Greater White-toothed Shrew (cadaver)
✖	Badger (trail camera)	✖	Burrow/Den	★	Hare Droppings
✖	Badger Latrines & Scat	✖	Deer Droppings	★	Irish Hare (live sighting)
✖	Badger Scat	✖	Deer Flushed in Dense Cover	★	Irish Hare (trail camera)
✖	Badger Scat & Snuffle Holes	✖	Fallow Deer (trail camera)	★	Mammal Trail
✖	Snuffle Hole	✖	Fox	★	Medium Mammal Trail
		✖	Fox (trail camera)	★	Pine Marten Scat
				★	Rabbit Burrow

TITLE:
Mammal Signs and Sightings

PROJECT:
Fahy Beg Wind Farm, Co. Clare

FIGURE NO:	8.14		
CLIENT:	RWE Renewables Ireland Ltd.		
SCALE:	1:9770	**REVISION:**	0
DATE:	24/11/2022	**PAGE SIZE:**	A3

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8.3.6 Bats

8.3.6.1 Desk Study

A data request was submitted to BCI for known roost records within 10km of the Site. A total of 41 bat records were provided of which 16 were bat roosts. The closest roost to the site is within 1km (this was surveyed by Woodrow and originally highlighted through a BCI data request). With the exception of this roost, all BCI roost records are approximately ≥5km from the Site. The BCI data shown in Table 8-33 shows bat data recorded in transect and ad hoc surveys with distances from site provided, and that indicates eight species have been recorded in the environs, including:

- Common pipistrelle *Pipistrellus pipistrellus*
- Soprano pipistrelle *Pipistrellus pygmaeus*
- Leisler's bat *Nyctalus leisleri*
- Brown long-eared bat *Plecotus auratus*
- Daubenton's bat *Myotis daubentonii*
- Natterer's bat *Myotis nattereri*
- Whiskered bat *Myotis mystacinus*
- Lesser horseshoe bat *Rhinolophus hipposideros*

The closest pNHA for lesser horseshoe bats (*Rhinolophus hipposideros*) is Danes Hole, Poulnalecka Cave (000030) (also an SAC) of which the eastern most point lies *c.* 8.5km of the western most point of the site. The foraging range (core sustenance zone) for lesser horseshoe bats from maternity roosts is approximately 2.5km and seasonal movements between summer and winter roosts reported as 5 to 10km (Collins *et al.* 2016). This places the proposed development site within the potential zone of influence of lesser horseshow bat populations ecologically linked to Danes Hole, Poulnalecka Cave pNHA.

Table 8-33: BCI Roost and Survey Data within 10km of the Site

Name	Distance from Site	Species Observed
Roosts		
Private	C. 5.7km	*Pipistrellus pipistrellus; Pipistrellus pygmaeus; Pipistrellus* spp.
Private	c. 5km	*Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus; Plecotus auritus*
Private	c. 5km	*Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus; Pipistrellus* spp.
Private	c. 4.8km	*Pipistrellus pipistrellus; Pipistrellus pygmaeus; Pipistrellus* spp.
Private	c. 7km	*Nyctalus leisleri*
Private	c. 5.5km	*Plecotus auritus*
Private	c. 8.5km	*Rhinolophus hipposideros*
Private	c. 8.3km	Unidentified bat

Name	Distance from Site	Species Observed	
Private	c. 5.7km	*Myotis mystacinus/brandtii; Myotis natterreri; Nyctalus leisleri; Pipistrellus pygmaeus; Pipistrellus* spp.*; Plecotus auritus*	
Private	c. 9.5km	Species data not provided	
Private	c. 9.6km	*Pipistrellus pygmaeus; Plecotus auritus*	
Private	< 1km	*Plecotus auritus*	
Private	c. 5km	*Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus;* Unidentified bat	
Private	c. 10km	*Myotis* spp.; *Plecotus auritus; Rhinolophus hipposideros*	
Private	c. 5.7km	*Myotis daubentonii*	
Tree Roost; R494 Ballina – Birdhill	c. 6km	*Pipistrellus pipistrellus; Pipistrellus pygmaeus*	
Transects Survey Data			
Errina Bridge	c. 5km	*Myotis daubentonii;* Unidentified bat	
Killaloe Town Centre Transect	c. 5.7km	*Myotis daubentonii;* Unidentified bat	
O'Briensbridge Transect	c. 4km	*Myotis daubentonii;* Unidentified bat	
Rockvale Bridge Transect	c. 10km	*Myotis daubentonii*	
Ad-hoc Observations			
BATLAS 2010	c. 9km	*Myotis daubentonii; Pipistrellus pipistrellus*	10/09/2009
BATLAS 2010	c. 5km	*Pipistrellus pygmaeus*	10/09/2009
BATLAS 2010	c. 3.7km	*Pipistrellus pygmaeus*	28/07/2008
BATLAS 2010	c. 9.5km	*Myotis daubentonii; Pipistrellus pipistrellus*	10/09/2009
BATLAS 2010	c. 6.7km	*Myotis mystacinus/brandtii; Nyctalus leisleri*	10/09/2009
BATLAS 2010	c. 8.6km	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pygmaeus*	10/09/2009
BATLAS 2010	c. 6.5km	*Myotis daubentonii; Nyctalus leisleri*	10/09/2009
BATLAS 2010	c. 2.6km	*Myotis* spp.; *Pipistrellus pipistrellus; Plecotus auritus*	28/07/2008
BATLAS 2010	c. 6.9km	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pygmaeus*	10/09/2009
BATLAS 2010	c. 3.1km	*Myotis daubentonii; Nyctalus leisleri*	28/07/2008
BATLAS 2010	c. 11.7km	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus;* Unidentified bat	09/10/2009

Name	Distance from Site	Species Observed	
BATLAS 2010	c. 4.3km	*Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus*	15/07/2009
EIS Survey	c. 11km	*Pipistrellus pipistrellus; Pipistrellus pygmaeus*	19/09/2005
EIS Survey	c. 10.1km	*Pipistrellus pipistrellus; Pipistrellus pygmaeus*	19/04/2007
EIS Survey	c. 6.3km	*Pipistrellus pygmaeus*	13/04/2000
EIS Survey	c. 3.8km	*Pipistrellus pygmaeus*	17/07/2005
EIS Survey	c. 7km	*Myotis daubentonii; Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus*	16/06/2009
EIS Survey	c. 7km	*Myotis daubentonii; Pipistrellus pygmaeus*	08/05/2007
EIS Survey	c. 7km	*Nyctalus leisleri; Pipistrellus pygmaeus*	03/05/2012
EIS Survey	c. 7km	*Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus; Plecotus auritus*	02/05/2012
EIS Survey	c. 6.5km	*Myotis spp.; Nyctalus leisleri; Pipistrellus pipistrellus; Pipistrellus pygmaeus*	24/05/2011

8.3.6.2 Bat Habitat and Roost Suitability Assessment

Based on Lundy *et al*., (2011) habitat suitability index, the overall suitability for the two 5x5 km squares which the wind farm site is spread between have been scored as holding moderate/high suitability for all bat species combined. For individual species it was ranked as having moderate/high suitability for common pipistrelle, brown long-eared bats, natterer's bat, Leisler's bat, soprano pipistrelle and Daubenton's bat. Whiskered bats scored moderate/low on the index. Suitability for Nathusius' pipistrelle and lesser horseshoe bats was ranked as low for both species.

The habitat within the wind farm site is comprised of improved grassland, conifer plantation, and long-established beech woodland. The detector locations D.01 and D.02 are in the western side of the site on edge. D.01 is situated on a treeline connected to the western side of the mature beech woodland while D.02 is situated in a field of improved grassland with the beech woodland to its north and west. D.05, D.06, and D.08 are situated in or adjacent to conifer plantation to cover proposed turbines within the plantation.

Preliminary surveys of potential roost features found several structures of moderate or higher potential roost within the site, some of which lie within the 300m turbine Zone of Influence for bats. Figure 7 in the accompanying bat report (Appendix 8-4) shows the following roost features classed as moderate and higher within the site:

- Structures at the abandoned farmstead were determined to vary from low (ruins with no rooves, overgrown and relatively exposed) to high roost potential (**Derelict Cottage** and **Cow shed** with many entry points and crevices features). Some mature beech trees surrounding these ruins have butt rot roost features [52.784, -8.528]
- The **Farmhouse** currently in use within a kilometre to the south of the site contained a known roost in the BCI database. [52.776, -8.522]

- The **Long-established beech woodland** on the west side of the site contained many trees which were of moderate and in some cases high roost potential, however, the survey of this area was not exhaustive as each individual tree could not be surveyed. For this reason, the area has been classified as "Moderate*" [area can be seen in Figure 5]
- **Mature hawthorn treeline** with dense ivy, rot holes, and tree unions. This treeline is connected to the long-established beech woodland [52.7836, -8.5515 to 52.7859, -8.5462].
- A **Tree with severe butt rot** considered to be of high roost potential was found in the most north-western point of the beech woodland. [52.787, -8.546]
- A **Mature ash tree** with knot holes, cankers, and transverse snaps, classed as having moderate roost potential in a clearing within conifer plantation in the north of the site. [52.785, -8.535]

Table 8-34: Summary of bat habitat and roost suitability based on the 2021 detector locations

Detector Location	Foraging features and assessment of vegetation removal required for turbine buffer (c. 100m)	Roost potential within c. 300m of turbines of moderate of higher suitability
D.01	In an open field of improved grassland which contains treelines, providing good foraging features. Within 100m of the long-established beech woodland. The edge of this habitat provides a strong linear feature for foraging bats.	The long-established beech woodland lies within *c.* 90m to the east of this detector location. The high roost potential tree with butt rot lies within *c.* 250m to the north east of this location.
D.02	In an open field of improved grassland. The long-established beech woodland is *c.* 90m to the east & northeast of this turbine location. The interface of woodland to improved grassland provides a strong linear foraging feature.	The long-established woodland is within 300m of D.02. The closest point is *c.* 110m to the northeast of the detector location.
D.03	In a field of improved grassland. The detector location is directly adjacent to a hedgerow which has foraging potential for bats. There are also treelines/hedgerows bordering fields of semi-improved grassland farmland to the north and improved grassland west of the turbine *c.* 100m distance from both.	There are no potential roost features classed as moderate or higher within 300m of the proposed location for turbine associated with this detector.
D.04	In a field of improved grassland. There are treelines to the north (*c.* 50m), west (*c.* 40m), and east (*c.* 90m) which hold foraging potential for bats.	There are no potential roost features classed as moderate or higher within 300m of the proposed location associated with this detector.
D.05	In a conifer plantation with the plantation edge *c.* 20m to its east. With a treeline *c.* 15m to the east bordering open fields with patches of gorse. The edge of this plantation provides a linear feature along which bats can forage. The clearing with the old ash tree *c.* 80m to the west of the turbine location also provides a linear feature for foraging bats.	This detector was within 300m of the mature ash tree classed as having moderate roost potential within conifer plantation.
D.06	In conifer plantation bordered by broadleaf treelines, which are adjacent to more conifer plantation to the east *c.* 30m, and open fields to the south *c.* 50m to turbine location.	There are no potential roost features classed as moderate or higher within 300m of the proposed turbine location associated with D.06.

Detector Location	Foraging features and assessment of vegetation removal required for turbine buffer (c. 100m)	Roost potential within c. 300m of turbines of moderate of higher suitability
D.07	In a field of improved grassland with a treeline *c.* 70m to the north and south, with hedgerows *c.* 20m to the east and *c.* 55m to the west. These linear features are likely used by commuting and foraging bats	There are no potential roost features classed as moderate or higher within 300m of the proposed location for the turbine associated with D.07.
D.08	In a clearing between two conifer plantations. There are several broadleaf treelines within this plantation.	The derelict buildings of the abandoned farmstead classed as having high bat roost potential are located *c.* 250m to the southwest of this detector location

8.3.6.3 Roost surveys

The locations of moderate or high roost potential can be seen in Figure 7 in the accompanying bat report (Appendix 8-4). Roost feature locations for which emergence and re-entry surveys were conducted are shown in Figure 8 (Appendix 8-4), while sample pictures of these locations can be found in Appendix 1: Roost survey locations 8 (Appendix 8-4). Please note, *Derelict cottage* refers to the same location throughout.

Roost surveys 2020

Emergence survey 1:

Date: 11-Jun-2020 *Sunset:* 21:55 *Start:* 21:25 *End:* 23:25

Derelict cottage: Frequent soprano pipistrelle calls were recorded from 22:07 to 22:17 potentially from the same individual. Though not heard by the surveyor the detector recorded lesser horseshoe calls on two occasions, first at 22:38 then at 22:45. Given that the surveyor was unaware of its presence it is not possible to ascertain if it emerged from the cottage. During a fifteen-minute window between 23:06 and 23:21 multiple common and soprano pipistrelles were recorded but it is noted that they were commuting in the vicinity of the cottage rather than emerging from it.

Result: **No emergence recorded**

Emergence survey 2:

Date: 31-Jul-2020 *Sunset:* 21:26 *Start*: 20:44 *End*: 22:41

Derelict cottage: Despite wet conditions common pipistrelle calls were recorded between 21:51 and 22:24 taking shelter from light rain in the shed adjacent to the cottage. *Myotis* spp. were recorded at 22:28 and again at 22:36. These bats may also have emerged from the cottage given the later emergence times of *Myotis* spp.

Result: **No emergence recorded**

Emergence survey 3:

Date: 18-Aug-2020 *Sunset*: 20:55 *Start*: 20:25 *End*: 22:05

Derelict cottage: The first recorded bat was a soprano pipistrelle which passed at 21:13 but was not visible to the surveyor, emergence from the suspected roost could not be determined. At 21:30 and 21:37 two common pipistrelles were recorded commuting through the area. Soprano and common pipistrelles were noted to be commuting through and foraging in this area in low numbers (2 – 5).

Farmhouse c.720m from site boundary: This survey took place on the east facing side of the farmhouse. From the first recorded bat until recording at the house ceased there was a near constant social cacophony being produced from this roost, much of which was audible without detectors. These social calls matched those recorded at large soprano pipistrelle roosts. The first emergence recorded was a soprano pipistrelle at 21:13 emerging from the right gable of the house. Between this time and the end of the roost watch the surveyor recorded 54 emerging soprano pipistrelles and multiple foraging individuals. The majority of these emergences came from the right gable of the house; however, several individuals were noted to have emerged from the tiling on the left side of the roof. The detector used recorded 140 soprano calls (including social) during this time period There were also several passes of Leisler's and brown long-eared bats noted to be foraging in the area.

Results: **Confirmed soprano pipistrelle roost at farmhouse;**
No emergence recorded at derelict cottage

Emergence survey 4:

Date: 01-Sep-2020 *Sunset*: 20:24 *Start*: 20:20 End*:* 21:00

Farmhouse c. 720m from site boundary: The first soprano pipistrelle emergence from the farmhouse occurred at 20:41. As with the previous survey at this location there was an almost constant social cacophony between 18 and 30kHz some of which was audible without the use of a detector. 40 soprano pipistrelles emerged between the start and end time of the roost survey.

Results: **Confirmed soprano pipistrelle roost in farmhouse**

Roost surveys 2020

Emergence survey 5:

Date: 13-May-2021 *Sunset:* 21:21 *Start:* 21:11 *End:* 22:50

Mature beech tree with mushroom butt rot on the southern edge of beech woodland: The first bat recorded was a Soprano pipistrelle at 21:33. Common pipistrelles, Soprano pipistrelles and Leisler's bats were recorded throughout the survey. No bats were seen emerging from the feature. Common pipistrelles were noted foraging north and south of the roost. Leisler's bats were recorded at 22:00 unseen but in the open with long intervals between calls. They were noted again at 22:08, commuting from west to east through the woodland.

Result: No emergence recorded

Emergence survey 6:

Date: 23-Jun-2021 *Sunset:* 22:00 *Start:* 21:45 *End:* 23:30

Derelict cottage: There were several commuting common and soprano pipistrelles and a single commuting Liesler's bat recorded commuting nearby the house within the first hour after sunset. An individual common pipistrelle was recorded emerging from the first-floor window beside the ruined section of the derelict cottage. Two lesser horseshoe bat passes were recorded and noted at 23:17 and 23:23 but the bats responsible were not seen. Between 23:23 and 23:27 common pipistrelles a soprano pipistrelle and a Leisler's bat were recorded foraging in the vicinity of the cottage.

Cow shed ruin: No bats were recorded emerging from the cow shed ruin during this survey. Both common and soprano pipistrelles were recorded foraging adjacent to the building for the duration of the survey.

Results: Confirmed common pipistrelle roost in derelict cottage;
No emergence recorded from cow shed

Re-entry survey 1:

Date: 24-Jun-2021 *Sunrise:* 05:11 *Start:* 03:44 *End:* 05:26

Derelict cottage: Two unseen Leisler's bat passes were recorded at 03:51 and 04:22 and a single unseen Soprano pipistrelle pass was recorded at 04:38. A confirmed common pipistrelle re-entry into a crevice in the roof tiling of the derelict cottage was recorded at 04:42.

Result: Confirmed common pipistrelle roost in derelict cottage

Emergence survey 7:

Date: 12-Jul-2021 *Sunset:* 21:57 *Start:* 22:00 *End:* 23:36

Ash tree: During this survey only 7 common pipistrelle passes were recorded, all of which were unseen or attributed to distant individuals foraging near the plantation edge. No emerging bats were detected.

Result: No emergence recorded

Emergence survey 8:

Date: 11-Aug-2021 *Sunset:* 21:10 *Start:* 20:55 *End:* 22:25

Derelict house: No bats were recorded emerging during this survey. However, between 21:40 and 21:58 four common pipistrelles and one Soprano pipistrelle were recorded commuting with all of them travelling in a westerly or north westerly direction. During the duration of the survey from the first pass at 22:50, onwards, there was constant foraging behaviour of both common and Soprano pipistrelle. It was noted by surveyors that these calls were produced by between two or three individual pipistrelles.

Two mature beech trees in NE of beech woodland: Though this survey recorded a very high level of pipistrelle foraging activity within the woodland no bats were recorded emerging from the moderate roost potential beech trees. Each surveyor also separately recorded lesser horseshoe bat passes, one at 22:01 and the other at 22:05. Due to dense canopy cover ascertaining exact numbers of foraging bats proved difficult though multiple recordings feature a minimum of three separate bats calling at once.

Result: **No emergence recorded**

Re-entry survey 2:

*Date:*12-Aug-2021 *Sunrise:* 06:10 *Start:* 04:40 *End:* 6:25

Ash tree in plantation: Only two Leisler's bat passes were recorded during the re-entry survey at the ash tree clearing in the conifer plantation. The first, recorded by both surveyors at 05:42 was noted as being distant. The second, only recorded by one surveyor was recorded at 05:45 and was noted as being a lone foraging bat above plantation to the north of the ash tree.

Mature beech with mushroom butt rot along the southern edge of beech woodland: A lesser horseshoe bat was recorded and noted but not observed at 04:59. Though the focus of this survey was the roost feature foraging pipistrelles were recorded frequently in the beech woodland between 04:39 and 05:25. No bats were recorded entering the tree with butt rot.

Result: No re-entry recorded

Re-entry survey 3:

Date: 28-Sep-2021 *Sunrise:* 06:32 *Start:* 04:30 *End:* 06:50

Derelict cottage: Intermittent drizzle at the beginning of the survey may have resulted in no recorded activity but when the rain stopped multiple bats were recorded shortly after. Both surveyors recorded a soprano pipistrelle foraging at the back of the house. A lesser horseshoe was recorded and seen directly above the chimney of the house and then seen re-entering the building at 07:13 on the open 1st floor wall, confirming it as a lesser horseshoe roost.

Result: Confirmed lesser horseshoe bat roost in derelict cottage.

Roost inspection:

Date: 13-May-2021

Tree with severe butt rot west of site: A precautionary endoscope inspection under licence was carried out on the tree in the west of the site to determine its potential use as a roost in the absence of emergence surveys. This inspection found no bats or evidence of roosting bats.

Result: No confirmed roost

8.3.6.4 Winter Roost inspection surveys

Beech tree with severe butt rot: [52.784621, -8.528125]

The tree with severe butt rot in the west of the site was examined for hibernation roosts. While not conclusive, some faecal samples were collected and there was evidence of bats feeding (moth wings on the ground), there was a layer detritus covering much of this evidence. There were only two faecal samples present. This suggests it was not in current use as a hibernation roost. However, the presence of this evidence suggests its use as a night roost during the active bat season.

Derelict cottage and surrounding buildings: [52.784621, -8.528125]

Several faecal samples were collected from the ruined stable and the derelict cottage. The majority of samples collected did not appear to be recent. Some samples collected in the fireplace of the derelict cottage could be recent. The cottage has multiple entry points to the second floor and large spaces with entry points between floors. Even though the presence of a hibernation roost could not be confirmed there is a reasonable likelihood of one being present in this structure.

Genetic analysis results of faecal samples collected during winter inspection were inconclusive for the beech tree with severe butt rot and the cow shed ruin. Results for samples collected from the derelict cottage fireplace indicated a 99.5% match of lesser horseshoe bat.

8.3.6.5 Transect surveys

The following section summarises the transect results recorded in both 2020 and 2021. The distribution of bats recorded along transects are displayed in Figures 9 -17 in the appended bat report (Appendix 8-4). The total pass results, obtained using Elekon Batlogger M bat detectors, are presented in Table 8-35 and Table 8-36.

Transect 1

Date: 12-Jun-2020 *Sunset*: 21:55 *Start*: 21:55 *End*: 00:21

During the first transect the central fields of the site were surveyed to begin with. At 22:38 several soprano pipistrelles passes were recorded along the ash treeline perimeter of this field. However, despite being recorded they could not be seen so it is not known if they were foraging or commuting. Multiple foraging common pipistrelles were recorded along the entry lane to this field while the surveyors departed this field at approximately 23:38. The second half of this transect covered the track on the eastern side of the site between the farmhouse and the derelict cottage. Common and soprano pipistrelles were detected at the farmhouse. Common pipistrelles and *Myotis* spp. were detected at the derelict cottage noted to be foraging in the area around the cottage at 00:11. The transect continued to track up to the centre north of the site only recording a single soprano pipistrelle along the route at 00:25 and did not record any further activity along this track or at the ash tree in a clearing of conifer at the end of the route. During this transect common pipistrelles were the most frequently recorded bat (77 passes) with only small numbers of soprano pipistrelles (7 passes) and *Myotis* spp. (5 passes) being recorded.

Transect 2

Date: 31-Jul-2020 *Sunset*: 21:26 *Start*: 22:42 *End*: 23:51

The first walked section of this transect covered the track between the derelict cottage and the farmhouse on eastern side of the site. Along this track no bats were recorded but this was likely impacted by a light rain at this time which eased off as the survey progressed. The first driven section of the transect was conducted from the farmhouse along the main road to the south of the site and then tracking west, along this driven route common pipistrelles and soprano pipistrelles were recorded. A second walked transect was conducted in a field on the western edge of the site. During this transect, primarily foraging common pipistrelles were recorded along the treeline of the field though activity decreased higher up the hill of the field. An individual brown long-eared bat was recorded on the treeline on the southern end of the field. Common pipistrelles were the most active during this transect (133 passes). Soprano pipistrelles were less active (26 passes) while only a single brown-long-eared bat pass was recorded.

Transect 3

Date: 18-Aug-2020 *Sunset*: 20:55 *Start*: 22:05 *End*: 23:35

The first walked section of this transect covered the track from the farmhouse to the derelict cottage and back. Along this route, multiple common and soprano pipistrelles were recorded foraging above the track. There were also two Myotis spp. bats recorded which were likely foraging along the small drainage stream adjacent to the track. The driven transect from the farmhouse to the field south of the site recorded soprano and common pipistrelles along its route along with a single Leisler's bat. The walked transect recorded common and soprano pipistrelles foraging along the treelines adjacent to the track leading towards the southern end of the site while three Leisler's bat passes were recorded in the centre of a field at this location. The final driven part of the transect recorded multiple common pipistrelles, soprano pipistrelles and a single Leisler's bat foraging along the treeline adjacent to the road for all of its length. A spot count was taken at the edge of the field on the western side of the site at which 23 common pipistrelle passes, 19 soprano pipistrelle passes, and a single Leisler's bat was recorded. These bats were noted to be foraging between the field gate and the trees on the opposite side of the road. During this transect common pipistrelles were the most active species (124 passes), followed by soprano pipistrelles (67 passes) with only a small number of Leisler's bats (15 passes) and Myotis spp. (3 passes) being recorded.

Transect 4

Date: 01-Sep-2020 *Sunset*: 20:27 *Start*: 20:30 *End*: 22:00

This short walked transect went from the farmhouse to the derelict cottage and back. It recorded high levels of bat along the track and its adjacent stream and treelines which surveyors noted as commuting bats. The Leisler's bat calls recorded on this transect were heard but not seen by surveyors so the distinction between foraging and commuting through this habitat could not be made. Soprano pipistrelles were the most active species (30 passes). Common pipistrelles were less active than on any of the previous transects (17 passes), while only a single *Myotis* spp. pass was recorded.

Transect 5

Date: 13-May-2021 *Sunset:* 21:20 *Start:* 22:50 *End:* 00:20

A driven section of this transect was carried out along the southern edge of the beech woodland while a walked transect was simultaneously carried out down the eastern edge of the improved grassland field. Both surveyors recorded common and soprano pipistrelles foraging along the treelines. Both surveyors also recorded unseen Leisler's at different times. A driven transect conducted on the road recorded multiple common and soprano pipistrelles foraging along the treelines adjacent to the road. A final short, walked section of transect was conducted in the field on the western edge of the site. The north-western treeline edge of this field had multiple common pipistrelles foraging along its length and passes of Myotis spp. and brown long-eared bats were also recorded.

Transect 6

Date: 23-Jun-2021 *Sunset:* 22:02 *Start:* 23:31 *End:* 00:53

The first section of this survey was a walked transect from 23:31 until 00:15 along the track to the abandoned farmstead in the east of the site. There were multiple calls of unseen bats recorded, several common and soprano pipistrelles were seen and recorded foraging along the treelines either side of the track. A driven transect was completed then from 00:15 until 00:27. Much like the previous transect common and soprano pipistrelles were recorded foraging along the treelines by the road. A walked transect was recommenced south of the centre of the site, tracking northwards until the end of the survey at 00:53. Soprano and common pipistrelles were recorded while adjacent to treelines but not in the improved grassland along this track.

Transect 7

Date: 12-Jul-2021 *Sunset:* 21:57 *Start:* 23:23 *End:* 01:20

This transect contained two walked sections. The first covered the northern centre section of the site and tracked eastward to the abandoned farmstead. Only a small number of individual common pipistrelles were recorded foraging along gaps in the plantation forestry (3 individuals producing several passes at different points in the plantation). Both common and soprano pipistrelles were once again recorded foraging along the track in the east of the site. A section of transect covered the improved grassland field in the eastern section of the site and recorded no bats in the field or along the hawthorn hedgerow in its centre. A second walked section of transect covered an area in the southern centre of the site. There were between 2 and 3 common and soprano pipistrelles foraging at the farmyard and the path out on the farmyard through which was walked for access to the south of the site. Another common pipistrelle and soprano pipistrelle were recorded foraging along a treeline in the south of the site occasionally going over the improved grassland.

Transect 8

Date: 11-Aug-2021 *Sunset:* 21:10 *Start:* 22:40 *End:* 23:30

This transect was a walked transect carried out by four surveyors. Two surveyors covered a track from the abandoned farmstead to the western edge of the conifer plantation within the site while the other two surveyors covered a transect through the beech woodland in the north west of the site. Visibility was poor on this night and it was noted to be particularly dark. Within the beech woodland there was constant foraging of common and soprano pipistrelles beneath the canopy between the trees. An exact number was difficult to ascertain as many of the bats could not be seen but based on the review of call data it was likely multiple individuals of both species contributing to the constant foraging. It was noted on the southern edge of the woodland a minimum of three common pipistrelles were foraging simultaneously. A single Leisler’s bat was recorded during this section of the transect.

The second group of surveyors recorded continuous common pipistrelle foraging in the woodland adjacent to the abandoned farmstead. However, the section through the plantation forestry in the north of the site recorded only occasionally foraging individual common and soprano pipistrelles and a single *Myotis* species bat. Several Leisler’s bat calls were recorded at the ash tree within plantation; however, these calls were identified using call data and were not heard by surveyors during the transect. A 15-minute point count at the western edge of the conifer recorded only a single common pipistrelle and a single soprano pipistrelle.

Transect 9

Date: 24-Aug-2021 *Sunset:* 20:43 *Start:* 20:22 *End:* 23:03

This transect covered the quarry in the south of the site. Common pipistrelles were recorded foraging along the disused track allowing access into the north of the quarry. Leisler’s bats were recorded flying between 15m and 30m height in open areas such as above sand mounds. One *Myotis* spp. bat was recorded at the northern end of the quarry with two more passes recorded at the southern end. Common pipistrelles were noted to be flying inside a large shed on the quarry site.

Table 8-35: Number of bat passes recorded during 2020 transect surveys

Species	Transect Survey Date			
	12-Jun 2020	31-Jul 2020	01-Aug 2020	09-Sep 2020
Myotis sp.	5	0	3	1
Nyctalus leisleri	0	0	15	30
Pipistrellus pipistrellus	77	133	124	17
Pipistrellus pygmaeus	7	26	67	90
Plecotus auritus	0	1	0	0
Total	**89**	**160**	**209**	**138**

Table 8-36: Number of bat passes recorded during 2021 transect surveys

Species	Transect Survey Date					
	13-May-2021	23-Jun-2021	12-Jul-2021	11-Aug-2021 Beech woodland	11-Aug-2021 Conifer plantation	24-Aug-2021
Myotis sp.	2	6	1	0	1	4
Nyctalus leisleri	9	1	0	23	0	18
Pipistrellus pipistrellus	249	94	97	139	122	83
Pipistrellus pygmaeus	26	66	28	40	15	79
Pipistrellus Spp.	0	0	0	0	0	2
Plecotus auritus	0	0	0	1	1	1
Total	**286**	**167**	**126**	**203**	**139**	**187**

8.3.6.6 Static Detector Surveys

In compliance with SNH (2021) guidelines, static bat detectors were deployed three times per season over the 2020 and 2021 active seasons at or in areas adjacent to the eight proposed turbines and two context locations at Fahy Beg Wind Farm – see Figures 4 & 5 in Appendix 8-4, Figure 8-4,
Table 8-6 and Table 8-7. Weather conditions during the three deployment periods were proven to be compliant with SNH (2021) requirements, that is, 10 nights above thresholds for minimum dusk temperature (8°C), wind speeds below 5m/s at ground level, and below thresholds for overnight for rainfall.

Geographical and temporal context for activity levels was examined through the analysis of the data with Ecobat. The percentiles generated by Ecobat for specific nights of bat activity allow for the objective classification of bat activity as 'Low', 'Moderate' or 'High'. As Ecobat uses median percentile data it is less influenced by large variance in the data. Table 8-37 shows the levels of bat activity categories by Ecobat percentile scores, which is suggested by SNH *et al.* (2021) for use in the assessment of risk to local bat population from wind farm developments.

Table 8-37: Bat Activity Levels Categorised by Percentile Scores

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

The following sections detail the results from static monitoring surveys for each of the three seasonal deployments.

Weather data for the three deployment periods has been extracted and is shown graphically in Appendix 3 of the Bat Report (see Appendix 8-4) for spring, summer and autumn deployments respectively.

This initial analysis examines the data for the site as a whole examining all values taken across all the detectors over the duration of all three deployments to provide site-wide median activity levels for bats in the wind farm site. The median activity levels on a site-wide basis, as analysed and categorised by Ecobat, showed common and soprano pipistrelles to have a high level of activity, Leisler's bats have a moderate/high level of activity, and *Myotis* spp. have moderate median activity levels. The remaining species; lesser horseshoe bat, Nathusius' pipistrelle, and brown long-eared bats had low median levels of activity. The median activity levels for 2021 remained the same with two exceptions; soprano pipistrelle activity dropped to moderate/high levels and Nathusius' pipistrelle levels increased to moderate/low. The overall activity levels for 2020 and 2021 are summarised in Table 8-38 and

Table 8-39 respectively. Figures 18 - 23 in the accompanying bat report (Appendix 8-4) display these results graphically. Detailed results are provided in Table 8-40 and Table 8-41.

Table 8-38: Summary Table Showing Key Metrics for Each Species Recorded 2020

Species	Median Percentile	95% Confidence Intervals	Max Percentile	Nights Recorded	Median Activity Levels
Myotis species	**47**	76.5 - 94	97	267	**Moderate**
Leisler's bat	**63**	82 - 94.5	97	341	**Moderate/High**
Nathusius' pipistrelle	**14**	31 - 69	69	25	**Low**
Common pipistrelle	**90**	94 - 97.5	100	372	**High**

Species	Median Percentile	95% Confidence Intervals	Max Percentile	Nights Recorded	Median Activity Levels
Soprano pipistrelle	**84**	94 - 99.5	100	359	**High**
Brown long-eared bat	**20**	39 - 39	59	130	**Low**
Lesser horseshoe bat	**14**	14 - 14	31	11	**Low**

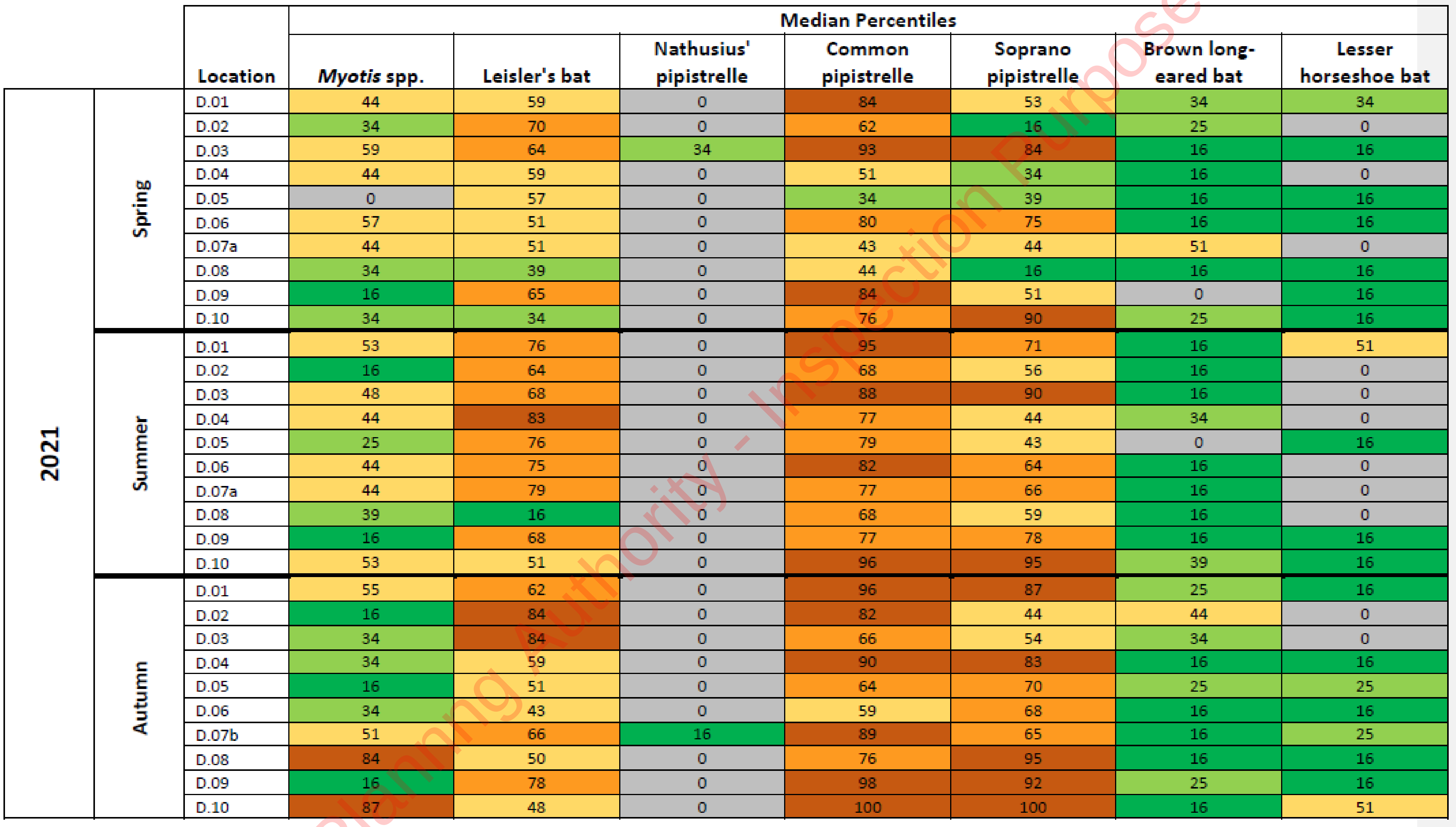
Table 8-39: Summary Table Showing Key Metrics for Each Species Recorded 2021

Species	Median Percentile	95% Confidence Intervals	Max Percentile	Nights Recorded	Median Activity Levels
Myotis species	**44**	75 - 96.5	100	247	**Moderate**
Leisler's bat	**64**	67 - 85.5	94	366	**Moderate/High**
Nathusius' pipistrelle	**25**	16 - 46.5	59	6	**Moderate/Low**
Common pipistrelle	**84**	98.5 - 100	100	366	**High**
Soprano pipistrelle	**70**	99.5 - 100	100	342	**Moderate/High**
Brown long-eared bat	**16**	30 - 56	65	128	**Low**
Lesser horseshoe bat	**16**	34-34	51	31	**Low**

Table 8-40: Median percentiles for each species at each deployment location (2020)

		Location	Median Percentiles						
			Myotis spp.	Leisler's bat	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle	Brown long-eared bat	Lesser horseshoe bat
2020	**Spring**	D.01	47	61	14	96	80	14	14
		D.02	0	0	0	0	0	0	0
		D.03	56	52	23	76	31	14	0
		D.04a	61	39	14	77	50	14	14
		D.05	14	49	0	87	85	0	14
		D.06	54	66	14	87	72	41	0
		D.07a	74	56	56	78	52	0	0
		D.08	36	52	0	77	57	14	14
		D.09	41	52	14	85	41	33	31
		D.10	14	0	0	23	14	0	0
	Summer	D.01	80	71	0	97	86	41	0
		D.02	61	72	0	93	89	31	14
		D.03	65	82	14	95	96	31	0
		D.04b	90	92	14	97	100	14	0
		D.05	23	74	0	93	82	23	0
		D.06	31	54	0	97	89	14	0
		D.07b	36	52	31	89	87	14	0
		D.08	31	59	0	80	68	14	0
		D.09	47	75	0	97	98	14	0
		D.10	31	54	0	97	89	14	0
	Autumn	D.01	20	63	0	91	80	20	0
		D.02	39	86	0	96	88	20	0
		D.03	49	74	0	86	85	20	0
		D.04b	86	92	20	93	99	35	0
		D.05	71	57	0	87	85	39	0
		D.06	0	0	0	0	0	0	0
		D.07b	44	49	0	90	87	20	20
		D.08	54	39	0	82	80	39	0
		D.09	57	65	0	97	95	30	0
		D.10	20	30	0	81	78	0	0

Table 8-41: Median percentiles for each species at each deployment location (2021)



			Median Percentiles						
		Location	***Myotis* spp.**	**Leisler's bat**	**Nathusius' pipistrelle**	**Common pipistrelle**	**Soprano pipistrelle**	**Brown long-eared bat**	**Lesser horseshoe bat**
2021	**Spring**	D.01	44	59	0	84	53	34	34
		D.02	34	70	0	62	16	25	0
		D.03	59	64	34	93	84	16	16
		D.04	44	59	0	51	34	16	0
		D.05	0	57	0	34	39	16	16
		D.06	57	51	0	80	75	16	16
		D.07a	44	51	0	43	44	51	0
		D.08	34	39	0	44	16	16	16
		D.09	16	65	0	84	51	0	16
		D.10	34	34	0	76	90	25	16
	Summer	D.01	53	76	0	95	71	16	51
		D.02	16	64	0	68	56	16	0
		D.03	48	68	0	88	90	16	0
		D.04	44	83	0	77	44	34	0
		D.05	25	76	0	79	43	0	16
		D.06	44	75	0	82	64	16	0
		D.07a	44	79	0	77	66	16	0
		D.08	39	16	0	68	59	16	0
		D.09	16	68	0	77	78	16	16
		D.10	53	51	0	96	95	39	16
	Autumn	D.01	55	62	0	96	87	25	16
		D.02	16	84	0	82	44	44	0
		D.03	34	84	0	66	54	34	0
		D.04	34	59	0	90	83	16	16
		D.05	16	51	0	64	70	25	25
		D.06	34	43	0	59	68	16	16
		D.07b	51	66	16	89	65	16	25
		D.08	84	50	0	76	95	16	16
		D.09	16	78	0	98	92	25	16
		D.10	87	48	0	100	100	16	51

The results of static detector monitoring are discussed in-depth in Sections 3.4.1 – 3.4.6 of the Bat Report (included in Appendix 8-4).

A summary interpretation of the results details of activity for each species is provided here.

8.3.6.7 Summary of static deployment data

Taking an overview of static deployment results there are a number of patterns which can be discerned, notably: in 2020, bat activity overall is considered to be high. This is largely driven by the fact that common and soprano pipistrelle activity was high across the site. Leisler's bat activity was considered moderate/high. It is also worth noting common and soprano pipistrelles experienced a maximum of 100th percentile median activity on one of its nights recording while Leisler's bat and *Myotis* spp. experienced maximum activity nights of 97th percentile median activity (Table 8-38). In both 2020 and 2021, differences in median activity levels were influenced much more by detector location than season.

In 2021 the overall activity summary for the whole years summer recording showed similar activity levels to 2020 with only two species having differing median activity levels across the two years. Soprano pipistrelles decreased from a high activity classification to a moderate/high activity level, while Nathusius' pipistrelles increased from a low activity level to a moderate/low activity level (Table 8-38;

Table 8-39). Once again, the highest median activity levels were produced by common and soprano pipistrelles.

The following are notable points taken from the results of the static deployments:

- During both years of surveying, as a general trend there was an increase in bat activity from spring to summer followed by a decrease in the autumn. However, some open areas recorded higher activity in the autumn.
- Excluding pipistrelles, in 2020 the only other locations with 'High 'activity recorded for individual species was 'High' Leisler's bat activity at D.03 and D.04b in summer and D.02 and D.04b in autumn, and 'High' *Myotis* spp. activity at D.04b in summer and autumn.
- In 2021, excluding pipistrelles, notable high results were recorded for; *Myotis* spp. at D.08 and D.10 in autumn. Activity was also 'High' for Leisler's bat D.02 and D.03 in summer, D.03 and D.03 in autumn.
- The Annex II species, lesser horseshoe bat was recorded on the site, though only as sporadic individual calls across 7 different locations of the site in 2020, with their activity at these locations classed as low in all cases with the exception of moderate/low activity at D.09 in spring. However, over the course of surveys in 2021 lesser horseshoe bats were recorded in small numbers, across multiple locations, more consistently throughout the three deployments. Though only a small number of calls were recorded, they were analysed as having moderate activity at D.01 in summer and D.10 in autumn.
- All detectors in 2020 (with the exception of D.07a) were placed along linear or edge features, which are frequently exploited by foraging pipistrelles.
- The 2021 deployment of static detectors sought to contextualise this data with detectors placed in more open environments. The impact of several detectors in the open and the comparison of data to a more robust Ecobat dataset can be seen when comparing species activity on a site wide basis, but more specifically in terms of pipistrelle activity in locations such as D.02, D.04, and D.07 (Table 8-41).
- The highest activity levels for both years of study were produced by common and soprano pipistrelles at D.10 in the autumn of 2021 and soprano pipistrelles at D.04b in the summer of 2020, all having median percentile activity level of 100.

- An examination of bat species passes relative to weather conditions in 2021 can be seen in Figure 24 of the bat report (see Appendix 8-4). The following holds true across all species; the 95% confidence interval ellipse highlights an area above 6°C and below max ground level wind speeds of approximately 4m/s. While those parameters show the conditions at which 95% of bats were recorded foraging, they do forage in poorer conditions during spring, with all species (with the exception of the data poor Nathusius' pipistrelle), having several passes recorded between 0°C and 4°C. This figure gives a preliminary insight into the specific weather conditions at which bats are active and provides an important guide for mitigation in the form of curtailment.

8.3.6.8 Bat species activity at the proposed wind farm site

During the 2020 and 2021 seasons, bat activity was recorded within the survey area for a minimum of seven species, including common pipistrelle, soprano pipistrelle, Leisler's bat, *Myotis* species, brown long-eared bat, Nathusius' pipistrelle, and lesser horseshoe bats. The majority of bat activity was attributed to soprano and common pipistrelles. Soprano and common pipistrelles were recorded in all months during transect and static surveys and were the most commonly encountered species for static surveys during all of the seasonal deployments.

Pipistrelle species

Common and soprano pipistrelles were recorded throughout the survey area and at all deployments in 2020 and 2021. Common pipistrelles were the most active species within the site.

The Ecobat analysis shows that common pipistrelles were the species most frequently recorded to have high median activity levels (Table 8-40; Table 8-41). Common pipistrelles were recorded as having high median activity for the following:

- 2020
  - D.01, D.05, D.06, D.09 during spring;
  - all locations in summer with the exception of D.08; and,
  - all locations in autumn.
- 2021
  - D.01, D.03, and D.09 during spring;
  - D.01, D.03, D.06, and D.10 during summer; and,
  - D.01, D.02, D.04, D.07b, D09, and D.10 during autumn.

Common pipistrelles were also the most active species recorded for three of the four transect surveys of the site in 2020. The transect survey conducted on the 01-Sep-2020 recorded more soprano pipistrelles (Table 8-35), though this is likely a function of the surveys start location being at the known farmhouse roost to the south of the site. The transect surveys show that the treelines and hedgerows within the improved grassland of the site are in use by bats for foraging and commuting throughout the site. Foraging common and soprano pipistrelles were recorded foraging along the road traversing the site on the surveys conducted on the 31-Jul-2020 and 18-Aug-2020 (Figure 8 in Appendix 8-4).

In 2021 common pipistrelles were the most abundant species on all transects conducted (Table 8-36). Transect results were similar to 2020, showing common pipistrelles foraging and commuting along treelines and forestry edge with no records made in improved grassland more than several metres from features. Figure 13 (Appendix 8-4) displays this exceptionally well. In 2021 the derelict farmhouse was confirmed to be in use by an individual pipistrelle.

In both 2020 and 2021 soprano pipistrelles were less active than common pipistrelles however, both species show the same trend in how their activity levels change between deployments, with lowest activity levels recorded in spring, while highest activity levels were in the summer and then a reduction of activity again in autumn. During autumn they retained activity levels higher than those recorded in spring. A slight difference in trend was recorded in 2021 with more locations showing activity increases from spring to summer and even more still from summer to autumn (Table 8-40**;** Table 8-41). This is likely a result of weather conditions in autumn 2021 having similar temperatures and lower wind speeds than those in summer of the same year (Figure A3.5, Figure A3.6 in Appendix 8-4).

While common pipistrelle bat were active at consistently high levels, soprano pipistrelle bat had comparatively lower levels at three locations relative to the rest in spring and autumn of 2020 (D.03, D.09, and D.10). The median activity levels for soprano pipistrelle at D.09 in spring (41 percentile) does not match common pipistrelle activity levels (high). However, the activity at D.04b in summer is high, more specifically the highest activity recorded on site in 2020 (100 percentile Table 8-40).

Soprano pipistrelle bat matched common pipistrelle in having 100 percentile median activity in D.10 in the autumn of 2021, further demonstrating the use of this area as foraging habitat.

During 2020 Nathusius' pipistrelles were recorded at low activity levels as classed by Ecobat (Table 8-38,). The number of Nathusius' pipistrelle recorded decreases from spring to summer and further still into autumn, with only one call recorded in the autumn deployment. A similar trend was repeated in 2021 differing slightly with a complete absence in summer. This is likely a result of the migratory pattern exhibited by Nathusius' pipistrelle, which involves migration to Western Europe in autumn and winter, with a return migration to Eastern Europe in late spring (Russ, 2001). The deployment timeframes potentially documented the final individuals leaving/passing through on route to Western Europe but ended prior to numbers increasing again for the winter.

Leisler's bat

Leisler's bat were the third most active species, classed as having moderate/high median activity in 2020 (Table 8-38). Areas at which high activity were measured include; D.03 and D.04b in summer, and D.02 and D.04b in autumn (Table 8-40). The location classed as having the highest levels of activity was D.04b in summer and spring. This result was not replicated in 2021. In 2021 activity for Leisler's bat were high on three occasions; at D.04 in summer and at D.02 and D.03 in autumn.

Leisler's bat will frequently fly at heights greater than other species and are also less reliant on the use of linear features generally increasing their risk of turbine collision. This is shown with Leisler's bat have moderate to moderate/high activity for the majority of locations within the site during both years, showing a lesser reliance on habitat features.

Leisler's bat were not recorded during the first two transects conducted on 12-Jun-2020 and on 31-Jul-2020. On the subsequent surveys (18-Aug-2020 and 01-Sep-2020) they were recorded, though in low numbers. The transect survey on 18-Aug-2020 recorded several individual Leisler's bat foraging with three passes recorded on the walked section of the transect into the field south west of D.04. (Figure 11 in Appendix 8-4). A spot count at the end of the survey at the entrance to the fields in the west of the site only recorded a single Leisler's pass. The transect survey on 01-Sep-2020 which covered a relatively small amount of the site but recorded 30 Leisler's passes of bats foraging along the track in the east of the site (Figure 12 in Appendix A8-4).

In 2021 Leisler's bat were recorded on a higher proportion of transects only being absent on one of the six transects (12-Jul-2021; Table 8-36). Transect surveys in May and June in 2021 only recorded several individual passes, while a higher number were recorded 11-Aug-2021 (23) and 24-Aug-2021 (18), which were recorded in the long-established woodland and quarry respectively.

Myotis species

During the 2020 recording period *Myotis* species activity was measured to be at its highest at D.04b, recording high activity in summer and autumn (90 and 86 percentile respectively). In 2021 there were only two instances of high activity; at D.08 and D.10 in autumn (Table 8-40**;** Table 8-41).

In 2020 recordings of *Myotis* spp. during the transect surveys (Table 8-35) are limited to the eastern side of the site, with foraging records being taken for individuals adjacent to derelict farmhouse on 12-Jun-2020 (5 passes; Figure 9 in Appendix 8-4). During the transects on the 18-Aug-20 and 01-Sep-2020 several individuals were recorded foraging along the track leading to the derelict farm house in the east of the site (Figure 11; Figure 12 in Appendix 8-4). During the emergence survey at the derelict farmhouse on 31-Jul-2020 a *Myotis* spp. were recorded on the site several times within its usual emergence time. However, it is unclear if this species emerged from any of the farmhouse buildings. The bat was recorded flying within the shed during poor weather conditions. This is not a confirmed use of this building as a roost as it was not observed resting/roosting within it but warranted further examination in 2021.

No *Myotis* bats were recorded emerging from the farmhouse or surrounding sheds during 2021. During the 2021 transect surveys *Myotis* spp. were recorded in low numbers on all transects with the exception of the transect through the long-established beech woodland in August (Table 8-36). The highest number of passes in a single transect was to the southwest of the site along the access track to the site (6 passes; Figure 14 in Appendix 8-4). Though only recorded in low numbers on transects they were seemingly more widespread across the site as can be seen in Figure 21-23 showing static detector results in Appendix 8-4.

Brown long-eared bat

It is acknowledged that accurately monitoring brown long-eared activity can prove quite difficult as this species is known to make low amplitude calls and frequently forage using their eyes or ears rather than echolocation (Collins, 2016 and Russ, 2012). As a result, brown long-eared bats are frequently underrepresented in surveys which rely on the use of bat detectors.

A single brown long-eared bat was recorded during the 2020 transect surveys in a field in the west of the site (south of D.01). Brown long-eared median activity was classed as low on a site-wide basis (Table 8-37). The slightly higher levels of activity recorded in the west of the site is likely due to the presence of the long-established beech woodland as brown long-eared bats are frequently associated with broadleaf woodland. On two occasions during 2020 brown long-eared were recorded to have moderate median activity levels; D.06 in spring and D.01 in summer. In 2021 brown long-eared bats once again were recorded at moderate activity levels at two locations; D.07 in spring and D.02 in autumn.

Lesser horseshoe bat

Only 13 lesser horseshoe bat passes were recorded by static bat detectors deployed during 2020. The location with the highest number of passes was D.02 which recorded 4 passes in summer. Their highest median activity level was at D.09 at moderate/low in spring. In 2021 they were recorded more widely across the site and at slightly higher median activity levels. They were recorded at moderate/low activity levels on three occasions; D.01 spring, and D.05 and D.07b in autumn. They were also recorded at moderate activity levels at D.01 in summer and D.10 in autumn. It is important to note that each of these moderate percentile classifications references 4 individual call registrations at these locations in their respective season. The low number of registrations leading to elevated percentile classifications for lesser horseshoe bat suggests that the reference data set used by Ecobat for this species is impoverished. The assertion, accounting for the limitations of the Ecobat reference data set, is that overall activity levels are low and the proposed development site is only likely to be utilised by a small numbers of lesser horseshoe bats.

As shown in Figure 8-9, the proposed site lies within approximately 10-15km of three lesser horseshoe SACs (west of the site). The nearest of these being Danes Hole, Poulnalecka Cave SAC (000030), a site which is considered be one of the eastern most points in the Irish distribution of this species (NPWS, 2013). The proposed development site well beyond the core foraging range of lesser horseshoe bats (2.5km). However, it is estimated that lesser horseshoe summer and winter roosts are usually no more than 5 to 10km apart (Collins et al. 2016). This puts the proposed development just within the 10km winter to summer range for lesser horseshoe bats. Therefore, there is potential for bats using the Danes Hole, Poulnalecka Cave SAC as a winter roost to commute to the wind farm site during the summer season.

Only two lesser horseshoe bat passes were recorded during the emergence surveys conducted in 2020. These passes were recorded at the derelict farmhouse and occurred at 43 and 50 minutes after sunset. The median time of emergence for lesser horseshoe bats is approximately 31 minutes after sunset. (Jones & Rydell, 1994). Further surveys of the derelict cottage in 2021 confirmed its use as a roost by at least one lesser horseshoe bat during the maternity season and was classed as a satellite roost, which is a roost used by males and non-breeding females. Occupation by < 5 individuals is considered a small roost and to put the significance of this roost into context, typically the presence of 100 or more LHS bats in summer or the presence of 50 or more in winter has been applied as the criteria for a site to qualify for SAC designation.

8.3.6.9 Habitat availability and roost suitability

The majority of land within the site boundary is comprised of improved grassland, separated by hedgerows, and hawthorn treelines. On the western side of the site there is an area of long-established beech woodland. On the northern edge of the site there is an area of conifer plantation. There is more conifer plantation to the east of the site though there are mixed broadleaf treelines within the plantation. In the eastern side of the site there is a stream running north to south bordered either side by broadleaf treelines, sitting in a hollow, several metres lower than the surrounding area. This area was assessed to be of high foraging potential, with the presence of water, shelter from the wind, and semi-mature broadleaf treelines. However, this was not supported during the static detector survey in 2020, see D.10 for 2020 in Table 8-40.

Areas in which conifer plantation and woodland interface with improved grassland provide foraging opportunities for bats, particularly pipistrelles. This was demonstrated during the static and transect surveys, particularly in the western side of the site in areas such as D.01, D.02, D.09 2020 and D.09 for 2021. (Table 8-41). One area which seemed to be of particular foraging and commuting importance in 2020 was the treeline along which D.04a/b were placed. Across both years and all seasons, the western treeline of D.01, appeared to be of particular foraging and commuting importance for all species detected with the exception of the poorly represented Nathusius' pipistrelle.

Three areas of hawthorn treeline in the west of the site were originally classed as having moderate roost potential. Upon reassessment in 2021 it was found that trees in these tree lines were of low roost potential.
An area of particular foraging importance is the long-established beech and multiple moderate roost potential trees were recorded during a survey sampling the woodland. Within this woodland one specific tree with severe butt rot has been classed as having high bat roost potential. In 2021, seven trees within the woodland were assessed using emergence or re-entry surveys, while several trees with features in reach of surveyors with a

ladder were assessed using an endoscope during the roost suitability surveys. No roosts were confirmed during these surveys; however, the woodland should still be considered of importance to roosting bats given the abundance of suitable potential roost features. If any trees require felling here, it will be necessary to conduct further pre-felling surveys to identify any mitigation and/or compensatory measures that need to be implemented to ensure that bat populations and individual bats are conserved during the works.

In the north of the site a mature ash tree of moderate roost potential exists in the centre of a conifer plantation. The derelict farmhouse and its surrounding buildings varied in suitability from low to high with the main building being of high potential. Figure 7 in Appendix 8-4 illustrates the locations of these areas of roost potential, while Table 8-34 outlines any identified features with roost potential, which were considered to be of moderate or greater potential, and which lie within the 300m zone of influence of turbine locations.

8.3.6.10 Grid Connection

Mature ash trees with dense ivy cladding are present along the GCR at ITM 561708, 666780 and ITM 562667, 666232. These trees have low bat roosting potential but are located outside the proposed GCR footprint.

8.3.6.11 Turbine Delivery Route

Two mature ash trees with dense ivy cladding are present at TDR Node 31. These trees have low bat roosting potential and are within the proposed felling footprint.

8.3.7 Avifauna

8.3.7.1 Desk Study

Wintering waterbirds

The only waterbodies within the 500 m turbine buffer are small 1st or 2nd order streams and drains which are associated with hedgerows, treelines and scrub. These are not capable of supporting significant densities of waterbirds. The closest larger water bodies are c. 2.5 km from the development site and include the River Shannon, the Ardnacrusha Canal and Mc Namara’s Lake, which lies between Bridgetown and O’Briensbridge. The study area is not documented as supporting any nationally or internationally important numbers of wintering waterbirds or sensitive wintering wetland species, especially swans or geese (Crowe, 2005; Boland & Crowe, 2012; Lewis et al., 2019b). The nearest areas containing internationally/nationally important populations of waterbirds are Lough Derg (6.1 km north-east) and the River Shannon Estuary (14.3 km south-west), which are designated as SPAs – see Figure 8-9.

Agricultural fields along the banks of the River Shannon and Ardnacrusha Canal were judged to have the potential to support wintering waterbirds, including whooper swans and migratory grey geese. There are no historical records of swans or geese consistently occurring along the western banks of the Ardnacrusha Canal or between the sluice gate (Parteen Wier) and Killaloe. The closest whooper swan flocks are reported from the Birdhill area and along the River Shannon south of Castleconnell, areas which are *c.* 5 km west and *c.* 7.5 km from the proposed development (500 m turbine buffer), respectively. Only small flocks (< 20 birds) have been recorded and for this species distances > 5 km are considered beyond the zone of influence for proposed developments (SNH, 2016). Similarly, small numbers of greylag geese (< 30 birds) are reported for the area in the winter. These are likely to be part of the feral (resident) population that breed along the River Shannon and on Lough Derg, as opposed to the migratory Icelandic population that are of higher conservation concern (Balmer *et al*., 2013, Boland & Crowe, 2008; Lewis *et al*., 2019b).

In terms of wintering waders, several species can often be found inland away from coastal hotspots, in particular snipe, golden plover and lapwing, as well as curlew, black-tailed godwits and ring plover. The site is relatively distant from the large concentrations of wintering waterbirds attracted to Lough Derg, the River Shannon and its estuary. In addition, based on the limited habitat availability on the upland slopes of the site, where woodland impinges into the heathland, it was considered unlikely the area would consistently support any significant numbers of wintering waders. The occurrence of plantations and long-established broadleaved woodland were judged following the initial desktop study to offer potential habitat for wintering woodcock.

Breeding waders

There are no recent records of curlew, golden plover or lapwing within either of the 10-km squares covering the Site. The agriculturally improved nature of the farmland present in the southern part of the 500 m turbine buffer was judged to be largely unsuitable for supporting breeding waders, although there were some less managed fields dominated by *Juncus* species providing potential cover for nesting curlew and occasional patches of wet ground offering potential habitat for breeding snipe. Open heathland to the north of the 500 m turbine buffer has the potential to support upland breeding waders including golden plover and curlew, as well as snipe. However, the fragmented nature of the open bog, due to commercial forestry, means it is unlikely to support viable breeding wader populations.

The large areas of plantations and long-established broadleaved woodland have the potential to support breeding woodcock. Historically, woodcock have been confirmed breeding within both 10-km squares encompassing the proposed development. However, the most recent Bird Atlas (Balmer *et al*., 2013) did not record breeding in this region, although wintering birds were recorded. A recent reduction in Irish breeding range for woodcock means that the breeding population is red listed (Gilbert *et al*. 2021), although the winter component which see an influx of continental birds remains green listed.

Birds of prey

Habitat availability within the 2 km buffer (see Figure 8-6) was considered potentially suitable for breeding hen harrier, buzzard, sparrowhawk, merlin and kestrel. The area has the potential to support long-eared owls and barn owls.

Hen harrier

The last National Breeding Hen Harrier Survey conducted in 2015 confirmed the presence of breeding hen harrier within one of the 10-km squares encompassing the proposed development (Ruddock *et al*., 2016). The study reported up to four pairs within the northern square [R67] and noted possible breeding within the southern square [R66], although the occurrence of archetypical hen harrier breeding habitat is lacking in the southern square. In terms of habitat suitability, the 2 km buffer (see Figure 8-6) is considered to have some potential to support this ground-nesting species, including heathland and open thicket plantation in the north, which stretches from the southern extent of Glennagalligh Mountain to the summit of Lackareagh Mountain, directly adjacent to the 500 turbine buffer. A factor likely to limit occupation of the upland habitats on Lackareagh Mountain, closer to the proposed development, is the narrow availability of the more open foraging habitat capable of maintaining the densities of upland passerines and red grouse required to support a pair of breeding hen harrier. The larger expanses of open upland habitat and associated forestry located *c*. 2.5 km north of the 500 m turbine buffer, stretching north from Glennagalligh Mountain and onto Slieve Bearnagh, are considered to provide more substantive home range options for breeding hen harriers.

Though traditionally hen harrier prefer to nest within heather, following the decline of this habitat in Ireland pairs are increasingly being recorded utilising young conifer plantations (Wilson *et al.,* 2006). It is therefore important to note that, depending on ongoing forestry operations in the area, habitat suitability is likely to change over the next 5-10 years, leading to areas of clearfell/second rotation becoming occupied prior to or during construction and operation of the proposed wind farm.

Merlin

In terms of other upland raptors, the presence of conifer plantation and older woodland adjacent to open bog provides potential breeding habitat for merlin. Like hen harrier, merlin are traditionally a ground-nesting species, but in Ireland have taken to utilising old tree nests of other species, in particular those of corvids, due to the absence of suitable habitat (Lusby *et al*., 2017). As for hen harriers, the narrow availability of the more open foraging habitat directly north of the proposed development area limits the overall suitability for merlin and this species is likely to favour areas further north on Slieve Bearnagh.

Other raptors

Buzzard, sparrowhawk and kestrel are widespread resident species in Ireland and based on habitat availability are likely to be breeding within the 2 km buffer. While buzzard and sparrowhawk are both green listed, the conservation status for kestrel was upgraded over the course of the baseline study from amber to red (Colhoun & Cummins, 2013 and Gilbert *et al*., 2021). As reported in Lewis *et al*. (2019a) both breeding numbers and distribution of kestrels have declined significantly, which is thought to have been driven by changes in prey availability due to agricultural intensification (Wilson-Parr & O'Brien, 2019), as well as secondary rodenticide poisoning. Flight behaviour means kestrels are a species emerging as notably susceptible to collision with turbines and this is acknowledged within collision risk modelling, which is run with a lowered avoidance rate for kestrel (95% avoidance rate).

In Ireland, cliffs in quarries can provide suitable nesting ledges for breeding peregrines (Moore *et al.,* 1997). The sand and gravel quarries south of the proposed development do not provide suitable cliffs and the 2 km buffer was assessed as providing no suitable nesting habitat for peregrines. The closest obviously suitable habitat was identified at a quarry *c*. 8.5 km southwest from the proposed development area. There are also reports of a breeding site to the northwest of the proposed development site.

Owls

The lower-lying, open agricultural areas with associated scrub and veteran trees in old growth woodland/treelines provide suitable nesting and foraging habitat for barn owl, and there are contemporary records for the species in the wider area. In Ireland, foraging distances from nest sites can extend up to 6 km and even as far as 9 km; however, the core breeding season home range is documented to be 4 to 5 km from the nest (Lusby & Cleary, 2014, TII 2021). This is further than the 1 km search area recommended by the SNH (2017) survey guidelines for breeding barn owls (owls other than short-eared owls). Likewise, the documented extent for breeding season home ranges for Irish barn owls exceeds the *zone of sensitivity* given for barn owls in relation to wind farm developments in Mc Guinness *et al*. (2015), which is 2 km.

Barn owls are reported as successfully breeding at a large wind farm in Scotland, with the number of pairs increasing after the provision of nest boxes, e.g. Crystal Rig Wind Farm 1. It is generally considered that low level flight behaviour of barn owls (typically < 3-4 m) limits collision risk with larger turbines in the UK (and Ireland) where lattice towers are not commonly employed (Barn Owl Trust, 2015).

The woodland habitats within the 500 m buffer are suitable for long-eared owls and it is likely that this green listed species breeds in the area. As for barn owls, impacts from wind farm developments are more likely to be associated with removal of suitable habitats than potential collision risk.

The occurrence of heathland/bog in association with plantations within the 2 km turbine buffer provides potential habitat for breeding short-eared owl. However, this species although more regularly recorded in habitats backing the coast over the winter, is a notably rare and occasional breeder in Ireland (Hutchinson, 1989); and therefore, unlikely to breed in the vicinity of the proposed development. The closest reported sporadic breeding locations are within the SPA encompassing the Mullaghareirk Mountains, Counties Limerick/Cork/Kerry.

Other species of conservation concern

Kingfisher

Kingfishers are known to occur along watercourses downstream of the proposed development. This species is listed on Annex I of the Birds Directive, however there are no SPAs designated for kingfishers within the zone of influence for the proposed development. While there are watercourses within the 500 m turbine buffer (see Figure 8-7), these 1st order streams were considered too small to support any substantial kingfisher foraging or commuting activity. In addition, the banks of the streams were found to be unsuitable for breeding kingfishers and did not provide any of the exposed banks favoured by this species.

Red grouse

Red grouse occur almost exclusively in open bog and heathland. Suitable habitat occurs to the north of the 500 m turbine buffer on Lackareagh Mountain, with more extensive areas stretching over Slieve Bearnagh. Red grouse are known to occur on the hills to the north of the proposed development (Cummins *et al*., 2010). However, the occurrence of woodland and agriculturally improved grassland within the 500 m turbine buffer effectively excludes this species from occurring within the proposed development area. Red grouse populations occurring in the wider area are beyond the 500 m *zone of sensitivity* reported for this species in Mc Guinness *et al*. (2015) and therefore will not be affected by this proposal.

Swift

As for kestrel, the conservation status of swifts was upgraded over the course of the baseline study from amber to red (Colhoun & Cummins, 2013 and Gilbert *et al*., 2021). There is potential for swifts to forage through the proposed development area over the summer months while nesting in the buildings of nearby towns and villages. Depending on weather conditions swifts often forage at heights of 50 to 100 m placing them within the collision risk zone of wind turbines. As swifts are habituated to manmade structures, it is considered unlikely that foraging birds will be displaced by operational turbines. Conversely this species (along with swallows and other hirundines) may be actively drawn towards turbines to glean insects that are attracted to/more active around turbine towers and hardstands (Rydell *et al*., 2012). While the mechanism and potential effects are poorly understood at this stage, it is considered likely that this behaviour leads to heightened collision risk for this species. In Germany 3% of 1,192 reported fatalities due to collisions with wind turbines between 1989 and 2010 were swifts, which when combined with swallow mortality was proportionally higher than would be expected for small, fast-flying and mobile species like swifts and hirundines (Dürr, 2010 in Rydell *et al.*, 2012).

Nightjar

Areas of forestry plantation in upland habitats, specifically drier areas in young plantation and clearfell, as well as associated scrub and bracken have the potential to support another crepuscular/nocturnal breeding species, namely nightjars. This red listed species is a very rare breeder in Ireland with plantations on the Galtees and Knockmealdowns in Counties Tipperary/Waterford supporting the limited number of contemporary breeding records. It is considered very unlikely that nightjars occur in the vicinity of the proposed development.

Rare passerines

As detailed in SNH (2017), it is considered that most passerines are at low risk from collision with wind turbines; as flight behaviour makes them less susceptible to collisions and population dynamics (e.g. high fecundity and rapidly attaining sexual maturity). This means that any fatalities due to collisions are unlikely to impact on passerine communities at the population level. The exception may be rarer breeding passerines, which in an Irish context would include whinchat, ring ouzel, tree sparrow and yellowhammer. There are no documented populations of rare breeding passerines occurring in the vicinity of the proposed development (Balmer *et al.*, 2013).

Table 8-42: NBDC bird records for target species within 10km from 2011-2022

Common Name	Scientific Name	BoCCI Status	Count	Date of last record
Red listed species are those which are of highest conservation concern where the population is rapidly declining in abundance or range, has experienced a historic rapid decline (without recovery) or are globally threatened.				
Barn Owl	*Tyto alba*	Red Br	2	31/10/2019
Common Goldeneye	*Bucephala clangula*	Red Win	4	31/12/2011
Common Kestrel	*Falco tinnunculus*	Red Br	10	31/12/2011
Common Pochard	*Aythya ferina*	Red Br. & Win	2	31/12/2011
Common Redshank	*Tringa totanus*	Red Br. & Win	2	31/12/2011
Common Snipe	*Gallinago gallinago*	Red Br. & Win	6	31/12/2011
Common Swift	*Apus apus*	Red Br	8	06/06/2011
Dunlin*	*Calidris alpina*	Red Br. & Win	2	31/12/2011
European Golden Plover*	*Pluvialis apricaria*	Red Br. & Win	2	31/12/2011
Greater Scaup	*Aythya marila*	Red Win	2	31/12/2011
Grey Wagtail	*Motacilla cinerea*	Red Br	8	31/12/2011
Red Grouse	*Lagopus lagopus*	Red Br	9	25/07/2017

Common Name	Scientific Name	BoCCI Status	Count	Date of last record
Amber listed species are those with unfavourable European status, occur in internationally important numbers or are moderately declining in abundance or range. May also be Amber listed if population occurs in very small numbers.				
Barn Swallow	*Hirundo rustica*	Amber Br	18	31/12/2011
Black-headed Gull	*Larus ridibundus*	Amber Br. & Win	11	31/12/2011
Common Coot	*Fulica atra*	Amber Br. & Win	12	31/12/2011
Common Kingfisher*	*Alcedo atthis*	Amber Br	7	31/12/2011
Common Tern*	*Sterna hirundo*	Amber Br	3	31/12/2011
Eurasian Teal	*Anas crecca*	Amber Br. & Win	4	31/12/2011
Great Cormorant	*Phalacrocorax carbo*	Amber Br. & Win	5	31/12/2011
Great Crested Grebe	*Podiceps cristatus*	Amber Br. & Win	11	31/12/2011
Greylag Goose	*Anser anser*	Amber Win	4	31/12/2011
Hen Harrier*	*Circus cyaneus*	Amber Br	6	31/12/2011
House Martin	*Delichon urbicum*	Amber Br	7	31/12/2011
Lesser Black-backed Gull	*Larus fuscus*	Amber Br. & Win	2	31/12/2011
Mallard	*Anas platyrhynchos*	Amber Br. & Win	12	31/12/2011
Mute Swan	*Cygnus olor*	Amber Br. & Win	12	31/12/2011
Ruff*	*Philomachus pugnax*	Amber Passage	2	31/12/2011
Sand Martin	*Riparia riparia*	Amber Br	7	31/12/2011
Tufted Duck	*Aythya fuligula*	Amber Br. & Win	12	31/12/2011
Whooper Swan*	*Cygnus cygnus*	Amber Br. & Win	2	31/12/2011
Green Listed birds are not considered threatened.				
Common Moorhen	*Gallinula chloropus*	Green	8	31/12/2011
Eurasian Sparrowhawk	*Accipiter nisus*	Green	8	31/12/2011
Grey Heron	*Ardea cinerea*	Green	4	31/12/2011
Little Grebe	*Tachybaptus ruficollis*	Green	7	31/12/2011
Common Gull	*Larus canus*	Green	5	31/12/2011
Peregrine Falcon*	*Falco peregrinus*	Green	2	31/12/2011
Water Rail	*Rallus aquaticus*	Green	2	31/12/2011
White-throated Dipper	*Cinclus cinclus*	Green	5	31/12/2011

*Species listed on Annex I of the EU Birds Directive are indicated with * and the BOCCI column refers to whether conservation concern status applies to wintering (Win) or breeding (Br) populations.*

8.3.7.2 Target Species Observations (Flight Activity Surveys)

Flight times for target species recorded within the 500 m turbine buffer are provided in Table 8-43, which shows data for two years (September 2019 to August 2021) and has been used to generate collision risk models for selected target species. Flight time is split into time in different altitudinal levels (height bands) in order to better understand the extent to which target species fly within the collision risk zone (CRZ). Flight seconds are also provided for each season in Table 8-44**,** Table 8-45**,** Table 8-46 and Table 8-47. Including swift, which were only included as a target species in summer 2021, a total of 13 target species were recorded flying through the study area during the survey period. Flight lines have been digitised and maps are provided in Appendix III of the accompanying ornithology report (see Appendix 8-1).

Table 8-43: Flight time recorded within 500 m turbine buffer – 2019 to 2021

Target Species	**No. of obs. in 500m turbine buffer** Avg. no. of birds (range)	A: 0-30m (seconds)	B: 30-180m (CRZ) (seconds)	C: >180m (seconds)
Black-headed gull	**5 observations** 9 birds (5-15 birds)		**506**	2,160
Buzzard	**90 observations** 1.4 birds (1-4 birds)	40	**16,454**	18,164
Cormorant	**1 observation** 2 birds		**100**	
Greylag goose	**1 observation** 6 birds		**48**	
Hen harrier	**1 observation** 1 bird		**43**	
Kestrel	**82 observations** 1.05 birds (1 to 3 birds)	293	**4,680**	25
Lesser black-backed gull	**4 observations** 7.75 birds (2 to 13 birds)		**60**	1,560
Merlin	**1 observation** 1 bird	50		
Peregrine	**1 observation** 1 bird		**30**	
Sparrowhawk	**23 observations** 1.04 birds (1-2 bird)	82	**133**	75
Swift Only timed over 1 summer	**6 observations** 3.33 birds (2-5 birds)		**876**	
Whimbrel	**1 observation** 12 birds		**420**	
Whooper swan	**1 observation** 3 birds		**39**	

Table 8-44: Target species flight seconds recorded from VP watches: Winter 2019-20

Target Species	A: <30m	B: 30-180m Collision risk zone	C: >180m
Buzzard	40	**1,745**	1,170
Kestrel	129	**588**	25
Merlin	50		
Sparrowhawk	30	**33**	75

Table 8-45: Target species flight seconds recorded from VP watches: Breeding season 2020

Target Species	A: <30m	B: 30-180m Collision risk zone	C: >180m
Black-headed gull		**506**	
Buzzard		**10,305**	5,144
Hen harrier		**43**	
Kestrel	24	**357**	
Lesser black-backed gull		**60**	
Sparrowhawk	20		

Table 8-46: Target species flight seconds recorded from VP watches: Winter 2020-21

Target Species	A: <30m	B: 30-180m Collision risk zone	C: >180m
Buzzard		**1,216**	1,800
Greylag goose		**48**	
Kestrel		**1,993**	
Peregrine		**30**	
Sparrowhawk	2	**100**	
Whooper swan		**39**	

Table 8-47: Target species flight seconds recorded from VP watches: Breeding season 2021

Target Species	A: <30m	B: 30-180m Collision risk zone	C >180m
Black-headed gull			2,160
Buzzard		**3,188**	10,050

Target Species	A: <30m	B: 30-180m Collision risk zone	C >180m
Cormorant		**100**	
Kestrel	140	**1,742**	
Lesser black-backed gull			1,560
Sparrowhawk	30		
Swift*		**876**	
Whimbrel		**420**	

**Note that summer 2021 was the only season to include swift data in VP watches*

Wildfowl – swans, geese & ducks

Across all the surveys undertaken, there were only two observations of swans or geese recorded within the 500 m turbine buffer during the survey period, including:

- Three **whooper swans** in December 2020, commuting west through the buffer for 13 seconds at 100-150 m - see map in Appendix III of the accompanying ornithology report (see Appendix 8-1).
- Six **greylag geese** in January 2021, commuting east through the buffer for 8 seconds at 80-100 m – see map in Appendix III of the accompanying ornithology report (see Appendix 8-1).

The low level of flight paths recorded through the buffer for both species indicates that the proposed development area is not located on a regular commuting route, e.g. between a roost and foraging area.

Waders

As for wildfowl, all wader activity recorded within the study area during the VP surveys was associated with commuting birds, rather than with birds using the area for breeding and/or foraging. Observations of wader species were notably low, and the following species were recorded during VP watches:

- One **curlew** in November 2019 recorded flying well west of the 500 m turbine buffer around VP1.
- 12 **lapwing** in January 2021 recorded flying east from area of VP1 towards the quarry – the flock did not enter the 500 m turbine buffer.
- 12 **whimbrel** in May-2021 on passage recorded fly east through the middle of the site for 35 seconds at 80 to 100 m

During site walkover surveys a flock of 12 **golden plover** was recorded commuting through the study area in January 2021.

Gulls

Gull species recorded within the 500 m turbine buffer included lesser black-backed gull, herring gull and black-headed gull. The density of use by gull species was relatively low, including:

- One observation of **herring gull**, involving 5 birds foraging within agricultural fields south-east of the 500 m turbine buffer. No flight lines were observed.
- Four observations of **lesser black-backed gulls**, with only two small flocks (2 to 13 birds) recorded flying/commuting through the 500 m turbine buffer. Aggregated flight seconds within the buffer amounted to 1,560 seconds, however only 60 seconds were recorded at collision risk height, with the majority of time at > 180 m. Activity was only observed over the breeding season.
- Five observations of **black-headed gulls**, with only three small flocks (5 to 12 birds) flying/commuting through the 500 m turbine buffer. Aggregated flight seconds within the buffer amounted to 2,160 seconds, with 506 seconds recorded at collision risk height and the majority of time at > 180 m. Activity was only observed over the breeding season.

Cormorant

Over the two-year study only one commuting flight of two birds was recorded within the 500 m turbine buffer, with other observations recorded in the wider area linked to usage of the River Shannon. Given the low-level of usage recorded, the proposed development site is not considered important for cormorant and will not affect populations in the wider area.

Grey heron

This species was not observed foraging within or commuting through the 500 m turbine buffer. Grey heron activity recorded during the VP watches was largely associated with the quarry. Grey herons were recorded a number of times flying over the quarry, as well as flying in a south easterly direction towards the quarry.

Buzzard

Buzzard was the most commonly recorded target species over the baseline study, with 90 observations recorded within the 500 m turbine buffer during VP watches – see map in Appendix III of the accompanying ornithology report (see Appendix 8-1). Buzzard observations generated the highest number of flight seconds (34,658 seconds) over the two-year study, with the majority occurring at heights within the collision risk zone (16,454 seconds). Typically, single birds were recorded regularly foraging or commuting through the buffer, with occasionally up to 4 birds observed simultaneously. As shown in Figure 8-15, there were two buzzard territories located within the proposed development site, one territory within the long-established woodland in the western part of the site and the other in a mature treeline in the southern part of the site. Further breeding/territorial behaviour was observed at three other locations within the 2 km turbine buffer. It is considered that the area supports 2 to 3 pairs of breeding buzzard.

Kestrel

After buzzards, kestrels were the most regularly recorded target species within the 500 m turbine buffer with 4,680 flight seconds recorded within the collision risk zone over the two-year study. As shown in by the flightline maps in Appendix III of the accompanying ornithology report (see Appendix 8-1), kestrels regularly foraged through the 500 m turbine buffer over both the winter and breeding seasons. One pair was identified as breeding within the 2 km turbine buffer (see Figure 8-15) and the breeding season home range of these birds falls within the 500 m turbine buffer. No breeding sites were identified in the 500 m turbine buffer.

Therefore, based on flight activity within the 500 m turbine buffer this site is important to at least one pair of breeding kestrel and is also utilised over the winter. Within the proposed development site, the mosaic of different habitats creates lots of edge effects which can be exploited by foraging kestrels. There are breeding options within the proposed development site; however, the closest active nest site identified during the baseline study was *c.* 1 km from the closest proposed turbine.

Sparrowhawk

Sparrowhawks were recorded hunting and flying through the area over both the breeding season and non-breeding season – see flight line map in Appendix III of the accompanying ornithology report (see Appendix 8-1). A total of 290 seconds was recorded within the 500 m turbine buffer, of which 133 seconds was determined to be within collision risk height (30-185m). One sparrowhawk breeding territory was identified within the 500 m turbine buffer, with two other territories located in the wider area – see Figure 8-15. In 2021 and again in 2022. Breeding territories within the proposed development area were located with the long-established woodland.

Hen harrier

No hen harriers were recorded breeding or roosting within the 2 km turbine buffer and the habitat within the 500 m turbine buffer was considered to have limited suitability for breeding or roosting. Over the 2 years of the baseline study, there were a total of three hen harrier records, including:

- 19-May-2020: male heading north along plantation in the north-eastern part of the 500 m turbine buffer.
- 26-May-2020: male heading north over the woodland on Lackareagh Mountain, north of the 500 m turbine buffer.
- 24-Mar-2021, female was observed commuting west from the area of the quarry.

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 proposed development site and surrounding area was not found to be important for hen harriers. Furthermore, the low usage of the proposed development site over the baseline study demonstrates that the area is not ecologically linked to SPAs designated for hen harrier.

Merlin

Over the 2-year baseline study usage of the 500 m turbine buffer was found to be exceptionally low and limited to a single bird over the winter. No roosts or breeding sites were detected within the 2 km turbine buffer. There was no suitable nesting for breeding merlin within the 500 m turbine buffer.

Peregrine falcon

Over the 2-year baseline study usage of the 500 m turbine buffer was found to be exceptionally low and limited to a single bird over the winter. There is no suitable nesting habitat for peregrine within the 2 km turbine buffe

Swift

Swifts were observed foraging within the 500 m turbine buffer six times during the 2021 breeding season, will foraging parties ranging from 2 to 6 birds. Flight lines are shown in Appendix III of the accompanying ornithology report (see Appendix 8-1). Flocks were recorded foraging for prolonged periods at 80 to 150 m, with aggregated flight time in the collisions risk zone amounting to 876 seconds.

8.3.7.3 Hinterland Surveys

Breeding Raptor Survey

Table 8-48 and Table 8-49 show the number of raptor observations recorded on each survey date in the wider area throughout the 2020 and 2021 breeding seasons, respectively. A total number of 7 target species were recorded during the wider area surveys undertaken in summer 2020. Of these species, common buzzard was the most frequently recorded with 13 observations over the 6 survey dates. In summer 2021, a total number of 5 target species were recorded during the wider area surveys undertaken. Of these species, common buzzard was again the most frequently recorded with 46 observations over the 8 survey dates.

Table 8-48: Counts of target species recorded in the wider area - summer 2020

Species	26 May 2020	28 May 2020	09 Jun 2020	15 Jun 2020	21 Jul 2020	30 Jul 2020
Buzzard	1	5		1	4	2
Kestrel				2	2	
Hen harrier	1					
Sparrowhawk		1		6		
Lesser black-backed gull	1		5			
Cormorant				1		
Mallard				2		

Table 8-49: Counts of target species recorded in the wider area - summer 2021

Species	24 Mar 2021	25 Mar 2021	03 Apr 2021	25 Apr 2021	17 May 2021	31 May 2021	21 Jun 2021	26 Jun 2021
Buzzard	6	7	3	6	6	7	6	5
Hen harrier	1							

Species	24 Mar 2021	25 Mar 2021	03 Apr 2021	25 Apr 2021	17 May 2021	31 May 2021	21 Jun 2021	26 Jun 2021
Kestrel	3	4	4	1	4	2	4	3
Sparrowhawk	3	1	2	1		1	1	1
Whooper swan		29						

Based on the results of the wider area breeding raptor surveys carried out in summer 2020 and 2021, breeding territories were identified for buzzard, sparrowhawk, kestrel and barn owl within the 500m and 2km buffer, which are shown in Figure 8-15. Based on observations of breeding/territorial behaviour recorded over the 2021 and 2022 breeding seasons, it is estimated that there is:

- One barn owl territory extends over the quarries on the southwestern boundary of the 500 m turbine buffer. The other barn owl territory at Ballyknavin/Kilroughil, as shown in Figure 8-15 was a site report by locals. However, buildings in this area were not found to be occupied when surveyed in 2020 and 2021. It is thought that the two sites may be interchangeable.
- One kestrel territory, with the nest located south of the 500 m turbine buffer and adjacent to the quarries.
- Three sparrowhawk territories were recorded, with one nest site located within the 500 m turbine buffer, with the pair found breeding in the beech woodland in the western part of the site. The other two pairs were recorded on the periphery of the 2 km turbine buffer.
- Five buzzard territories, with two sites located within the 500 m turbine buffer and a further three sites within the 2 km turbine buffer. Not all the areas where breeding/territorial behaviour was observed were occupied in both years and it is thought there are two, possibly three pairs within the 2 km turbine buffer.

A total of four species, including barn owl, kestrel, sparrowhawk and buzzard were recorded breeding within the 2 km turbine buffer (see Figure 8-15 for breeding territories). No hen harrier, peregrine or merlin were recorded breeding within the 2 km turbine buffer.

There was only a single merlin observed over the 2 years, which was a female recoded during the winter – see map in Appendix III of the accompanying ornithology report (see Appendix 8-1). Hen harriers were recorded within the 500 m and 2 km turbine buffers, however there were only a total of three observations over the 2-year survey period, including:

- From VP2 on 19-May-2020, a male hen harrier was recorded for 43 seconds in the north-eastern part of the 500 m turbine buffer. This male was noted foraging and travelling north along the boundary of the conifer plantation – see map in Appendix III of the accompanying ornithology report (see Appendix 8-1).
- During the wider area breeding raptor surveys on 26-May-2020, a male hen harrier was recorded travelling north over the woodland on Lackareagh Mountain, north of the 500 m turbine buffer.
- During wider area breeding raptor surveys on 24-Mar-2021, a female hen harrier was observed commuting west from the area of the quarry.

The closest areas of potentially suitable habitat for breeding merlin and hen harrier were on Lackareagh Mountain. However, disturbance from quad bike and scrambler enthusiasts was considered likely to limit usage of the area by merlin and hen harrier. As identified by the desk-based study, the larger expanses of open upland habitat and associated forestry located *c.* 2.5 km north of the 500 m turbine buffer, stretching north from Glennagalligh Mountain and onto Slieve Bearnagh, are considered to provide more substantive home range options for breeding hen harriers and merlin.

In relation to potential breeding cliff for peregrine falcons, the wider area surveys confirmed that there were no suitable cliffs within 2 km of the proposed development site. The quarry to the south of the site did have low sandy edges and these were assessed as highly unlikely to be occupied by breeding peregrine. Over the 2 year study, peregrines were only recorded once flying through the 500 m turbine buffer over the winter – see map in Appendix III of the accompanying ornithology report (see Appendix 8-1).

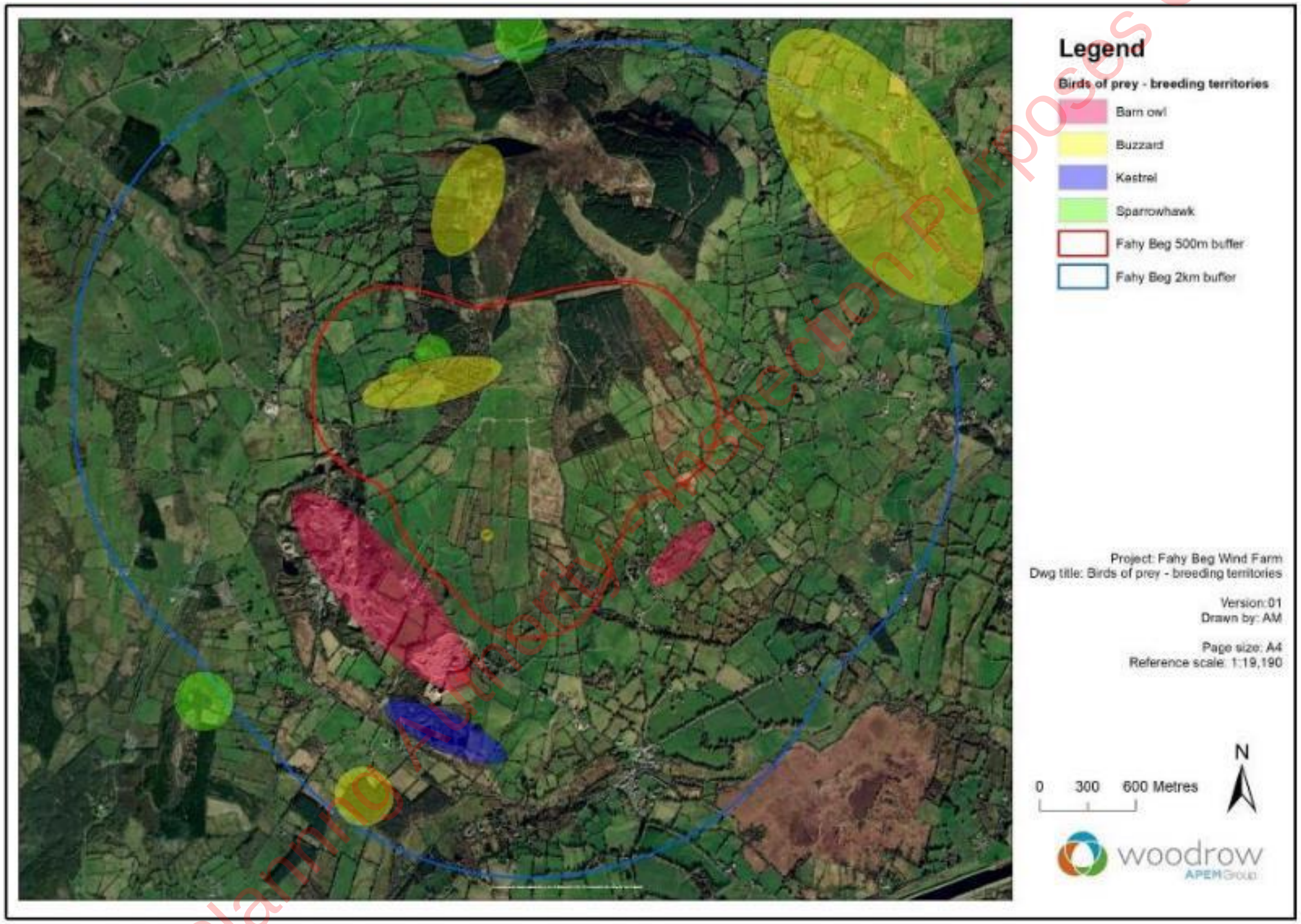


Figure 8-15: Breeding raptor territories identified within 2km of the proposed wind farm

Hen harrier roost searches

Though some suitable roost habitat exists within the 2 km turbine buffer, no hen harrier roosts were identified during the targeted hen harrier roost searches that were undertaken over winter 2019-20, winter 2020-21 and winter 2021-22. No hen harriers were recorded over the winter survey period during any of the surveys, including wider area surveys. The three hen harrier recorded where breeding 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. Similarly, survey effort for roost searches in the wider area provides strong evidence that there are no regularly utilised roosts, although there is some potentially suitable roosting habitat. The closest areas of potentially suitable habitat on Lackareagh Mountain were observed to be utilised by quad bike and scrambler enthusiasts creating periodic disturbance events likely to limit suitability.

Wintering waterbird surveys

Table 8-50 and Figure 8-16 show the number of wintering waterbirds recorded on each survey date and their location in relation to the survey area. As can be seen in Figure 8-16, waterbird activity was very limited within the 2 km turbine buffer, with the majority of activity recorded along the River Shannon c. 3km to the southeast of the proposed development. The only waterbirds noted within the survey area were a pair of commuting mallards. These findings determined that there were no potentially sensitive wintering waterbird populations occurring in significant numbers within the zone of influence of the proposed wind farm development, in particular, no whooper swans or migratory geese.

There are no potential wetlands within the 2 km turbine buffer capable of support roosting swans or geese. Therefore, repetition of wider area waterbird surveys in Year 2 (winter 2020-21) was not required.

Table 8-51 shows any other species noted during the wider area surveys. As found in the other surveys carried out across the survey period, buzzard activity was notably higher than any other species especially during the March visit when buzzard soaring (territorial) behaviour was noted over the broadleaved woodland in the western part of the site. Displaying sparrowhawk were also active over this woodland in March.

Table 8-50: Wintering waterbird numbers in the wider area during winter 2019-20

Species	13 December 2019	16 March 2020	17 March 2020
Black-headed gull	9		
Coot	9		
Cormorant	12		
Great crested grebe	2		
Grey heron	1		
Lapwing	10		
Mallard	6		2
Scaup (Greater)	5		
Snipe		1	
Tufted duck	545		
Whooper swan	3		

Table 8-51: Other species recorded within the wider area during winter 2019-20

Species	17-Oct-2019	13-Dec-2019 5 km search	16/17-Mar-2020 2 km search
Buzzard		1	Max. count 5 birds (3 sub-adult) -soaring (territorial) behaviour observed over broadleaved wood in site
Kestrel			1 hunting
Sparrowhawk			Territorial behaviour observed over broadleaved wood in site

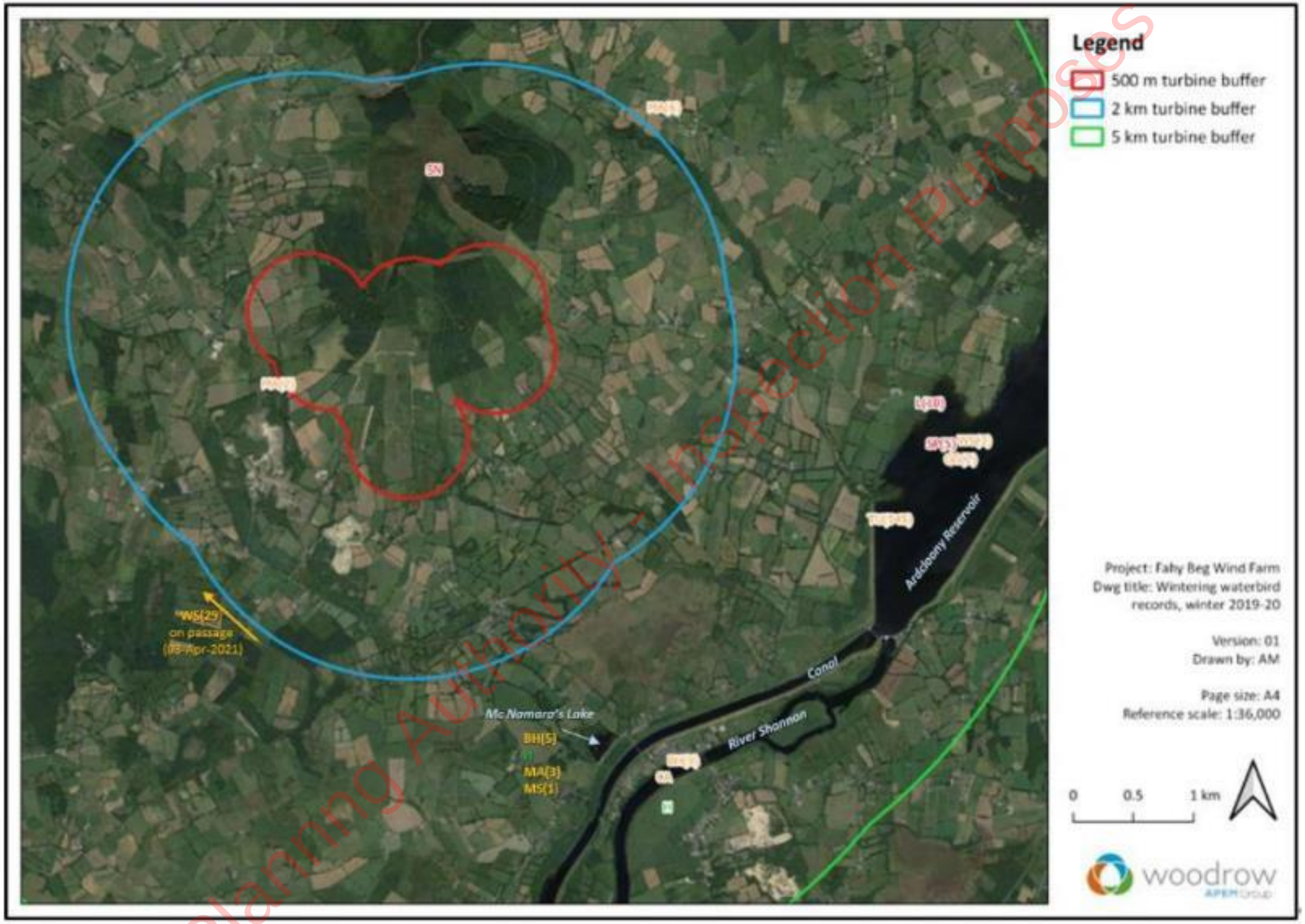


Figure 8-16: Wider area wintering waterbird records

8.3.7.4 Breeding bird surveys

Maps showing the distribution of breeding activity from target species across the site are provided in Appendix IV of the accompanying ornithology report (see Appendix 8-1). Birds are labelled red, amber or green to indicate BoCCI status (Gilbert *et al*. 2021).

Breeding bird walkovers covering the wind farm site were undertaken five times during the 2020 breeding bird season. As well as this, four dusk surveys were carried out targeting crepuscular species such as breeding woodcock. All breeding bird surveys were conducted under optimal weather conditions for surveying, as can be seen in Appendix V of the accompanying ornithology report (see Appendix 8-1).

A total of 36 different bird species were recorded during the walkover surveys in summer 2020. Table 8-52 lists the species recorded during breeding bird surveys (including dusk surveys) in 2020. Within these, no Annex 1 species were recorded; a total of two are red listed (both applicable to breeding population) and five are amber listed (all applicable to breeding population). The remainder are green-listed.

Target species are indicated in column 2 and birds that were noted to be exhibiting breeding/territorial behaviour are indicated in column 3 and highlighted in **bold**. A total of nine species, namely blackbird, chaffinch, dunnock, great tit, robin, song thrush, stonechat, whitethroat and wren were confirmed as breeding in the study area. All of these species are green listed.

The dates each species was recorded are detailed in the accompanying ornithology report (see Appendix 8-1).

No woodcock were recorded during the dusk surveys. The only target species to be recorded over the dusk surveys carried out was a barn owl on 19th May 2020 at 21:50 heading west along the quarry located south-west of the 500m turbine buffer. In addition, recently fledged barn owls were recorded on the periphery of the quarry while surveyors were conducting bat surveys, confirming breeding in the area of the quarry.

Table 8-52: Summary of breeding bird walkover and dusk surveys carried out in summer 2020

Species	Target species	Recorded Breeding	Red/Amber applicable season*
Barn Owl *Tyto alba*	Yes	No	B
Barn Swallow *Hirundo rustica*	Yes	No	B
Blackbird *Turdus merula*	**No**	**Yes**	
Blue tit *Cyanistes caeruleus*	No	No	
Bullfinch *Pyrrhula pyrrhula*	No	No	
Chaffinch *Fringilla coelebs*	**No**	**Yes**	
Chiffchaff *Phylloscopus collybita*	No	No	
Common Buzzard *Buteo buteo*	Yes	No	
Common Kestrel *Falco tinnunculus*	Yes	No	B
Coal tit *Periparus ater*	No	No	
Cuckoo *Cuculus canorus*	No	No	
Dunnock *Prunella modularis*	**No**	**Yes**	

Species	Target species	Recorded Breeding	Red/Amber applicable season*
Eurasian Sparrowhawk *Accipiter nisus*	Yes	No	
Goldcrest *Regulus regulus*	No	No	B
Goldfinch *Carduelis carduelis*	No	No	
Great tit *Parus major*	**No**	**Yes**	
Hooded crow *Corvus cornix*	No	No	
Jay *Garrulus glandarius*	No	No	
Jackdaw *Corvus monedula*	No	No	
Long-tailed tit *Aegithalos caudatus*	No	No	
Magpie *Pica pica*	No	No	
Mistle thrush *Turdus viscivorus*	No	No	
Pheasant *Phasianus colchicus*	No	No	
Pied wagtail *Motacilla alba*	No	No	
Reed bunting *Emberiza schoeniclus*	No	No	
Robin *Erithacus rubecula*	**No**	**Yes**	
Rook *Corvus frugilegus*	No	No	
Sand Martin *Riparia riparia*	No	No	B
Song thrush *Turdus philomelos*	**No**	**Yes**	
Starling *Sturnus vulgaris*	No	No	B
Stonechat *Saxicola rubicola*	**No**	**Yes**	
Whitethroat *Sylvia communis*	**No**	**Yes**	
Willow Warbler *Phylloscopus trochilus*	No	No	B
Wood pigeon *Columba palumbus*	No	No	
Wren *Troglodytes troglodytes*	**No**	**Yes**	

**Note Red & Amber status is applicable to specific seasons. These are indicated in column 4 (B = breeding season; W= winter season).*

In summer 2021, five breeding bird surveys were carried out and four dusk surveys were undertaken. During this, 33 different bird species were recorded, as listed in Table 8-53. Within these, no Annex 1 species were recorded; a total of two are red listed (both applicable to breeding population) and seven are amber listed (all applicable to breeding population). The remainder are green listed.

Again, target species are indicated in column 2 and birds that were noted to be exhibiting breeding/territorial behaviour are indicated in column 3 and highlighted in **bold**. A total of 15 species, namely blackbird, chaffinch, chiffchaff, coal tit, crossbill, dunnock, goldcrest, great tit, reed bunting, robin, song thrush, whitethroat, willow warbler and wren were confirmed as breeding in the study area. Within these, goldcrest and willow warbler are amber listed. The remainder are green listed.

The dates each species was recorded are detailed in the accompanying ornithology report (see Appendix 8-1).

No target species or species of interest were recorded during the four dusk surveys undertaken.

Table 8-53: Summary of breeding bird walkover and dusk surveys carried out in summer 2021

Species	Target species	Recorded Breeding	Red/Amber applicable season*
Blackbird *Turdus merula*	**No**	**Yes**	
Blackcap *Sylvia atricapilla*	**No**	**Yes**	
Blue tit *Cyanistes caeruleus*	No	No	
Bullfinch *Pyrrhula pyrrhula*	No	No	
Chaffinch *Fringilla coelebs*	**No**	**Yes**	
Chiffchaff *Phylloscopus collybita*	**No**	**Yes**	
Common Buzzard *Buteo buteo*	Yes	No	
Common Kestrel *Falco tinnunculus*	Yes	No	B
Coal tit *Periparus ater*	**No**	**Yes**	
Crossbill *Loxia curvirostra*	**No**	**Yes**	
Cuckoo *Cuculus canorus*	No	No	
Dunnock *Prunella modularis*	**No**	**Yes**	
Goldcrest *Regulus regulus*	**No**	**Yes**	**B**
Great tit *Parus major*	**No**	**Yes**	
Herring gull *Larus argentatus*	Yes	No	B/W
House sparrow *Passer domesticus*	No	No	B
Jay *Garrulus glandarius*	No	No	
Linnet *Linaria cannabina*	No	No	B
Long-tailed tit *Aegithalos caudatus*	No	No	
Mallard *Anas platyrhynchos*	Yes	No	B/W
Meadow pipit *Anthus pratensis*	No	No	B
Pheasant *Phasianus colchicus*	No	No	
Pied wagtail *Motacilla alba*	No	No	
Raven *Corvus corax*	No	No	
Reed bunting *Emberiza schoeniclus*	**No**	**Yes**	

Species	Target species	Recorded Breeding	Red/Amber applicable season*
Robin *Erithacus rubecula*	**No**	**Yes**	
Sedge warbler *Acrocephalus schoenobaenus*	No	No	
Song thrush *Turdus philomelos*	**No**	**Yes**	
Spotted flycatcher *Muscicapa striata*	No	No	B
Stonechat *Saxicola rubicola*	No	No	
Whitethroat *Sylvia communis*	**No**	**Yes**	
Willow Warbler *Phylloscopus trochilus*	**No**	**Yes**	**B**
Wren *Troglodytes troglodytes*	**No**	**Yes**	

**Note Red & Amber status is applicable to specific seasons. These are indicated in column 4 (B = breeding season; W= winter season).*

8.3.7.5 Winter site walkovers

Maps showing target species winter bird activity and distribution across the site are provided in Appendix III of the accompanying ornithology report (see Appendix 8-1). Birds are labelled red, amber or green to indicate their BoCCI status (Gilbert *et al*. 2021).

Winter site walkovers covering the wind farm site were undertaken twice during the 2019-20 non-breeding season. All winter site walkovers were conducted under optimal weather conditions for surveying. A total of 41 different bird species were recorded during the surveys. Table 8-54 lists the species recorded with target species indicated in column 2. Within these, no Annex 1 species were recorded; a total of seven are red listed (however, red list status is only applicable to wintering populations for two of these species, namely redwing and snipe) and five are amber listed (none are applicable to wintering populations). The remainder are green listed.

The dates each species was recorded are detailed in the accompanying ornithology report (see Appendix 8-1).

Table 8-54: Summary of winter walkover surveys carried out in winter 2019-20

Species	Target species	Red/Amber applicable season*
Blackbird *Turdus merula*	No	
Blue tit *Cyanistes caeruleus*	No	
Bullfinch *Pyrrhula pyrrhula*	No	
Chaffinch *Fringilla coelebs*	No	
Common Buzzard *Buteo buteo*	Yes	

Species	Target species	Red/Amber applicable season*
Common Kestrel *Falco tinnunculus*	Yes	B
Coal tit *Periparus ater*	No	
Crossbill *Loxia curvirostra*	No	
Dunnock *Prunella modularis*	No	
Eurasian Sparrowhawk *Accipiter nisus*	Yes	
Fieldfare *Turdus pilaris*	No	
Goldcrest *Regulus regulus*	No	B
Goldfinch *Carduelis carduelis*	No	
Great tit *Parus major*	No	
Greenfinch *Chloris chloris*	No	B
Grey wagtail *Motacilla cinerea*	No	B
Hooded crow *Corvus cornix*	No	
House sparrow *Passer domesticus*	No	B
Jackdaw *Corvus monedula*	No	
Jay *Garrulus glandarius*	No	
Lesser redpoll *Acanthis flammea*	No	
Linnet *Linaria cannabina*	No	B
Long-tailed tit *Aegithalos caudatus*	No	
Mistle thrush *Turdus viscivorus*	No	
Magpie *Pica pica*	No	
Meadow pipit *Anthus pratensis*	No	B
Pied wagtail *Motacilla alba*	No	
Raven *Corvus corax*	No	
Reed bunting *Emberiza schoeniclus*	No	
Redwing *Turdus iliacus*	No	W
Robin *Erithacus rubecula*	No	
Rook *Corvus frugilegus*	No	
Siskin *Spinus spinus*	No	
Snipe *Gallinago gallinago*	Yes	B/W
Song thrush *Turdus philomelos*	No	
Starling *Sturnus vulgaris*	No	B

Species	Target species	Red/Amber applicable season*
Treecreeper *Certhia familiaris*	No	
Woodcock *Scolopax rusticola*	Yes	B
Wood pigeon *Columba palumbus*	No	
Wren *Troglodytes troglodytes*	No	
Yellowhammer *Emberiza citrinella*	No	B

**Note Red & Amber status is applicable to specific seasons. These are indicated in column 4 (B = breeding season; W= winter season).*

During the 2020-21 non-breeding season, winter walkovers covering the wind farm site were undertaken six times. A total of 37 different bird species were recorded during the walkover surveys. Table 8-55 lists the species recorded. Within these, two Annex 1 species (golden plover and peregrine falcon) were recorded; a total of seven are red listed (however, red list status is only applicable to wintering populations for three of these species, namely golden plover, redwing and snipe) and four are amber listed (none are applicable to wintering populations). The remainder are green listed.

Table 8-55: Summary of winter walkover surveys carried out in winter 2020-21

Species	Target species	Red/Amber applicable season*
Blackbird *Turdus merula*	No	
Blue tit *Cyanistes caeruleus*	No	
Bullfinch *Pyrrhula pyrrhula*	No	
Chaffinch *Fringilla coelebs*	No	
Common Buzzard *Buteo buteo*	Yes	
Common Kestrel *Falco tinnunculus*	Yes	B
Coal tit *Periparus ater*	No	
Dunnock *Prunella modularis*	No	
Eurasian Sparrowhawk *Accipiter nisus*	Yes	
Fieldfare *Turdus pilaris*	No	
Goldcrest *Regulus regulus*	No	B
Goldfinch *Carduelis carduelis*	No	
Great tit *Parus major*	No	
Grey wagtail *Motacilla cinerea*	No	B
Golden plover *Pluvialis apricaria*	Yes	B/W
Hooded crow *Corvus cornix*	No	

Species	Target species	Red/Amber applicable season*
Jackdaw *Corvus monedula*	No	
Jay *Garrulus glandarius*	No	
Long-tailed tit *Aegithalos caudatus*	No	
Mistle thrush *Turdus viscivorus*	No	
Magpie *Pica pica*	No	
Meadow pipit *Anthus pratensis*	No	B
Peregrine falcon *Falco peregrinus*	No	
Pheasant *Phasianus colchicus*	No	
Pied wagtail *Motacilla alba*	No	
Reed bunting *Emberiza schoeniclus*	No	
Redwing *Turdus iliacus*	No	W
Robin *Erithacus rubecula*	No	
Rook *Corvus frugilegus*	No	
Snipe *Gallinago gallinago*	Yes	B/W
Song thrush *Turdus philomelos*	No	
Starling *Sturnus vulgaris*	No	B
Stonechat *Saxicola torquatus*	No	
Willow warbler *Phylloscopus trochilus*	No	
Woodcock *Scolopax rusticola*	Yes	B
Wood pigeon *Columba palumbus*	No	
Wren *Troglodytes troglodytes*	No	

**Note Red & Amber status is applicable to specific seasons. These are indicated in column 4 (B = breeding season; W= winter season).*

8.3.8 Aquatic Ecology

8.3.8.1 Description of Watercourses in the study area

The proposed Fahy Beg windfarm is in the Lower Shannon catchment (turbines T3 – T8) and Shannon Estuary North catchment (turbines T1 & T2). The portion of the wind farm within the Lower Shannon catchment is drained by the River Black (O'Briensbridge) and it's tributaries which enter the Shannon just downstream of Parteen Weir. The portion within the Shannon Estuary North catchment is drained by the Broadford River, which joins the Owenogarney which enters the Shannon Estuary at Bunratty.

The GCR is located within the Lower Shannon catchment. The GCR traverses the Blackwater (Clare), Glenomra Wood Stream, and Bridgetown/Black catchments.

The TDR is located within the Lower Shannon and Shannon Estuary South catchments; all TDR Nodes intersecting watercourses are within the Lower Shannon catchment. The TDR Nodes located at watercourses are Nodes 20 and 23 which are located on the Ballyteige 25 and Ardcloony Rivers respectively.

The Lower Shannon catchment covers an area of 1,820km^2 and comprises Lough Derg as well as the Mulkear catchment. The catchment is characterised by flat limestone plains, a small proportion of which are karstified to the east of Lough Derg (EPA, 2021). The River Shannon flows into Lough Derg at Portumna and travels c. 39rkm through Lough Derg. The Shannon flows out of Lough Derg through the steep-sided gap between the Slieve Bernagh and Arra Mountains where the towns of Ballina and Killaloe are located on the east and the west bank of the river respectively (EPA, 2021).

Downstream of Killaloe, the Lower River Shannon flows into Parteen Reservoir. Parteen Weir is located c. 6rkm downstream. At Parteen Regulating Weir, the river is diverted via a 12.6km headrace which travels to the 86MW hydroelectric generating station at Ardnacrusha. Downstream of Ardnacrusha hydroelectric station, the tailrace canal is c. 2.1km in length, and joins with the River Shannon c. 660m downstream of Parteen bridge. Downstream of Parteen Regulating Weir, the old River Shannon main channel flows south-west, through Castleconnell, Castletroy and then continues to Limerick City where it is joined by the tailrace canal c. 500m downstream of the Lax weir ruin.

The Shannon Estuary North Catchment includes the River Fergus catchment and all watercourses entering the tidal area between Thomond Bridge and George's Head, Co. Clare. The catchment drains a total area of 1,658 km^2. The catchment includes the southern tip of the Clare Peninsula, east to the Slieve Bearnagh Hills and north to Ballyvaughan including most of the central and southern parts of the Burren. From Loop Head to Kildysart much of the catchment is drained by small rivers. The River Fergus which rises southeast of Kilfenora is the largest tributary in the catchment. The Owenogarney River, another significant tributary rises near the summit of Moylussa flowing through Sixmilebridge, Bunratty to the Shannon Estuary.

Black [O'Briensbridge] Catchment

The River Black [O'Briensbridge] catchment is a minor catchment located in Co. Clare. The river rises in a forestry area on Lackareagh Mountain. It is also joined by the 2nd order River Bridgetown (Clare) from the west. The River Black [O'Briensbridge] then joins the River Shannon just downstream of Parteen Weir where it is siphoned into the Shannon. The EPA carries out biological water quality monitoring at one site in the catchment which was rated Q4 in 2017 equivalent to WFD status "Moderate". The catchment is considered "Not at Risk" of not meeting its objectives as set out in the WFD by 2027. The TDR and GCR traverse this catchment. The TDR has one crossing point in this catchment and the GCR route has one also.

Broadford River

The Broadford River (EPA code: 27B02) rises in the west of the site and drains an area near two proposed wind turbines. These are Turbines 1 and 2. This is a minor stream which is part of the River Owenogarney (EPA Code: 27O01). The stream rises at the site and flows north-west as far as Doon Lough (EPA Segment Code: 27_121). On reaching Doon Lough it is a 3rd order river having been joined by the several 1st order streams and the 2nd order River Clooncnry Beg (EPA code: 27C17). Doon Lough is drained by the 4th order River Owenogarney which flows in a south-southwest direction through Sixmilebridge and flows into the River Shannon estuary at Bunratty. The upper reaches of this river are "At risk" of not meeting their WFD objectives by 2027. Pressures in the catchment include invasive species, agriculture, hydromorphology and unknown anthropogenic pressures.

In the most recent round of monitoring by the EPA the Broadford River was described as "*In the Broadford River, Station 0500 improved from poor to moderate ecological condition. Station 0600 continued to be of good ecological quality. Station 0700 was assessed for the first time since 1991 and was found to be in good ecological condition, this is a deterioration from high ecological condition at the last assessment. The lowermost station 0800 has declined from high to moderate ecological condition since the previous assessment*."

Blackwater [Clare] Catchment

The River Blackwater [Clare] (EPA code: 25B06) rises in a forestry area north of Woodcock Hill, Co. Clare. It flows easterly from here and is joined by the 4th order River Snaty 25 (EPA code: 25S34). The river is also joined by the 2nd order O' Neill stream (EPA code: 25O02) and River Mountrice 25 (EPA code: 25M03), the 1st order Knockdonagh (EPA code: 25K84) and the 3rd order Glemomra Wood Stream (EPA code: 25G12). It is also joined by several small 1st order streams. From where the river rises it flows in an easterly direction to where it crosses the regional road R465. From here the River Blackwater [Clare] flows south to where it crosses under the Ardnacrusha Headrace Canal after which it turns easterly again before redirecting south and entering the River Shannon at Plassey. The section of the River Blackwater [Clare] c. 300m upstream of its confluence with the River Shannon is designated as part of the Lower River Shannon Special Area of Conservation.

The Water Framework Directive sets out objectives to be met by river waterbodies in Ireland before 2027. Waterbodies are then assessed for their potential risk of not meeting these objectives set out by WFD, and therefore are assigned a Risk rating. Waterbodies that are At Risk can then be prioritised for implementation of measures. The River Blackwater [Clare] is within the Shannon [Lower]_SC_100 sub catchment. Of the four waterbodies in the River Blackwater [Clare] two are considered "At Risk" and two are considered "Not at Risk". The upper reaches are "At Risk". In the previous waterbody risk assessment, the risks to these waterbodies were forestry and agriculture.

Ardcloony River

The Ardcloony River (EPA code: 25A03) is another minor river in the Lower Shannon catchment. The river rises in the Ballycuggaran area at the foot of Moylussa. The river is joined by one 2nd order stream which is the Cassagh Stream (EPA code: 25C95). From the river's source is flows south-southeast to where it flows into the River Shannon at Parteen reservoir upstream of Parteen Weir. There is one recent EPA monitoring station on the river (EPA Station Code: 25A03 0100) which was rated Q5 in 2019 equivalent to WFD status "High". This river does not drain any of the proposed wind farm site, however the TDR does cross it between Sites 18 and 17.

The section of the Ardcloony River c. 300m upstream of where it flows into Parteen Reservoir is designated as part of the Lower River Shannon Special Area of Conservation.

Ballyteige 25 River

The River Ballyteige 25 (EPA code: 25B17) is also a minor catchment. This river rises in the Ballycuggaran. The river is joined by two 1st order streams in the upper reaches on of which is an unnamed waterway (EPA Segment Code: 25_784) and the other is the Gortmagy Stream (EPA code: 25G78). In the upper reaches this river drains forestry while the lower reaches drain mostly agricultural lands. The river is considered "At risk" of not meeting its WFD objectives by 2027. Wastewater discharges are a pressure (eutrophication and main suspected cause of pollution) as are dams, barriers, locks and weirs.

8.3.8.2 Desktop Study

Inland Fisheries Ireland surveyed two sites on the Broadford River in 2013 located directly upstream of Doon Lough and at Broadford village. There were six fish species recorded in the Broadford during the 2013 survey which were gudgeon, salmon, perch, brown trout, three-spined stickleback and minnow (Kelly *et al.* 2014).

In 2016 Inland Fisheries Ireland carried out an electrofishing survey on the River Kilmastulla at five sites. There was a total of seven fish species recorded which were brown trout, European eel, lamprey sp, minnow, salmon, stone loach and 3-spined stickleback (Kelly *et al.* 2017).

A review of the National Biodiversity Data Centre maps was undertaken to evaluate the aquatic ecology of the area, but no relevant records were identified. NPWS data for the hectads overlapping the proposed development has been assessed. Records include European otter, brook lamprey, river lamprey, sea lamprey, opposite-leaved pondweed and white-clawed crayfish.

An aquatic ecology assessment was carried out for the Killaloe Bypass project. The survey was visual only and no sampling was undertaken (Roughan & O' Donovan Consulting Engineers 2012).

8.3.8.3 Aquatic Ecology Baseline Results

Wind Farm

Survey Site 1

Survey Site A1 was located on the River Black [O'Briensbridge] (EPA Segment Code: 25_1163). The river at the site was c. 4m in wetted width. The average depth was c. 25cm with a maximum of c. 35cm. There were very low levels of instream vegetation however canopy cover was high at c. 80%. The dominant habitat here was glide. Siltation was heavy on the inner bank which had a low gradient. On the outer side the substrate was courser consisting of gravel. The bank here was also steeper. Both banks were well vegetated. There were no filamentous algae present, overall the gradient was medium and no filamentous algae were present. Siltation levels were normal.

Downstream of this site there is a culvert / siphon that brings the river under Ardnacrusha headrace and into the River Shannon below Parteen weir. This structure is a fish migration barrier affecting Salmon and River and Sea Lampreys.

Salmonid nursery habitat was present at this site. Lamprey habitat was also present at the site. There were good stocks of brown trout recorded at this site. Brown trout were recorded in small numbers with a Catch Per Unit Effort (CPUE) of 1.6 fish caught per minute. Three-spined stickleback and stone loach were recorded as Present. Brook lamprey were recorded. There were 5 individuals. The CPUE for lamprey was 1.67 fish caught per minute. Biological water quality was assigned a rating of Q4 equivalent to WFD status "Good".

Survey Site 2

Survey Site A2 was located on the River Black [O'Briensbridge] (EPA Segment Code: 25_2293). The river at the site has a wetted width of c. 4m. The average depth was c. 20cm. There were very low levels of instream vegetation and canopy cover was c. 60%. Both banks were heavily vegetated. The dominant habitat at the site was riffle and the substrate was mostly cobble. The overall gradient was moderate. Siltation was normal. As for Site A1 there is a culvert/siphon downstream blocking upstream fish migration.

There was salmonid nursery habitat present. Lamprey habitats were also present. There were good stocks of brown trout recorded at this site. Brown trout were recorded in small numbers with a CPUE 2.4 fish caught per minute. Three-spined stickleback and stone loach were recorded as present. The CPUE for both species was 0.8 and 0.2 fish caught per minute respectively. Brook lamprey were recorded in small numbers. There were 6 individuals recorded with a CPUE of 2 fish caught per minute. Biological water quality was assigned a rating of Q4 equivalent to WFD status "Good".

Survey Site 3

Survey Site A3 was located on the River Black [O'Briensbridge] (EPA Segment Code: 25_2648). The river at the site was tiny and very overgrown. There was a bridge at the site. Destructive works were ongoing with gravel being laid very close to the river and vegetation clearance had occurred. Due to this there was a lot of exposed soil also. The wetted width at the site was c. 1m and a depth of c. 10cm. The habitat was a mixture of riffle and glide. Siltation at this site was high and eroding banks were present. The site had undergone artificial drainage.

There was salmonid nursery habitat present. Lamprey habitats were present. Brown trout were the only species recorded at this site. They were recorded as Present. The CPUE for brown trout was 0.4 fish caught per minute.

Biological water quality was assigned a rating of Q4 equivalent to WFD status "Good". However, the river is impacted downstream of the bridge due to a one-off house development which has included infilling of the stream.

Survey Site 4

Survey Site A4 was located on the River Black (O'Briensbridge). The site was dry during the survey and no fishing was carried out. However, as this is a small section of the stream Survey Site A3 is considered sufficient to provide baseline data on this stretch of river.

Survey Site 5

Survey Site A5 was located on the Kilroughil Stream (EPA segment code: 25_2711). The stream was small with a wetted width of c. 1m. The average depth was c. 20cm. The substrate present at the site was a mixture of rock/cobble and the habitat was riffle. There was c. 55% canopy cover. The gradient at the site was medium. Siltation levels were normal.

There was salmonid nursery habitat present. There was no lamprey habitat present. Brown trout were the only species recorded at this site. They were recorded as Present. The CPUE for brown trout was 0.6 fish caught per minute.

Biological water quality was assigned a rating of Q4 equivalent to WFD status "Good".

Survey Site 6

Survey Site A6 was located on the River Bridgetown (Clare) (EPA Segment code: 25_1163). The river at the site had a wetted width of c. 3m and the channel had been drained. Some recent development works had taken place. There were several large boulders in the stream. There was also c. 40% instream vegetation. The gradient was low, and siltation was high. Eroding banks were present. Filamentous algae were also recorded at this site. Canopy cover was low overall. There were clear water quality issues at this site.

Salmonid and lamprey spawning / nursery habitats were present. Four bony fish species were recorded at this site. These were brown trout, minnow, three-spined stickleback and stone loach. Brown trout were common with a CPUE of 7.4 fish caught per minute. Three-spined stickleback were common with a CPUE of 2 fish caught per minute. Both minnow and stone loach were recorded as Present with a CPUE of 0.6 fish per minute for both species. Brook lamprey were recorded in small numbers. There were 3 individuals recorded with a CPUE of 1 fish caught per minute fishing.

Biological water quality was assigned a rating of Q3 equivalent to WFD status “Poor”. An overall evaluation of “Moderate” was given to this site.

Survey Site 7

Survey Site A7 was located on the River Bridgetown (Clare) (EPA Segment Code: 25_474). The wetted width at the site was c. 1m. The gradient at the site was low and siltation high. There were eroding banks present. There have recently been extensive river works at this site and therefore it was not electrofished. The site was visually assessed, however. The river appeared sluggish and there were high levels of fringing instream vegetation. There was some salmonid habitat present upstream and Lamprey habitat was present. It was considered likely that brown trout and brook lamprey do occur at the site.

The overall status of the site was considered less than “Good”.

Survey Site 8

Survey Site A8 was located on the River Bridgetown (Clare) (EPA Segment Code: 25_2517). The river here was dry during the survey. The banks appeared steep and were well vegetated.

Survey Site 9

Survey Site A9 was located on the Broadford River. This site was not fished. The site was partially dry during the survey and considered too small for electrofishing. The stream had a wetted with of c. 1m with a low gradient and high siltation. Eroding banks were present. The channel has previously been drained. Cattle have access to the stream and the banks were very muddy. Canopy cover was c. 40%. The stream was very small and had no fisheries potential.

Survey Site 10

Survey Site A10 was located on the Broadford River. This site was not fished or kick sampled as it was a tiny stream with no fish habitat present. The stream had a wetted with of c. 1m with a low gradient and high siltation. Eroding banks were present. The channel has previously been drained. Canopy cover was c. 75% and the banks were heavily vegetated.

Grid Connection

Survey Site 7

Survey Site A7 as detailed above is also applicable to the GCR. The Bridgetown (Clare) runs parallel to the GCR for c. 320m where the route follows the R466.

Survey Site 11

Survey Site A11 was located on the River Blackwater [Clare] (EPA Segment Code: 25_3883). The river at the site had a wetted width of c. 6m. There was a medium gradient to the river. No filamentous algae were recorded, and siltation levels were normal. Floating river vegetation was present here. Canopy cover at the site was c. 50% and the habitat was a mixture of riffle and glide.

There was salmonid nursery and fishery habitat present at the site. There was no coarse fishery or nursery habitat. Lamprey habitat was recorded.

There were seven fish species recorded at this site. Species recorded as Present include dace, stone loach, three-spined stickleback, minnow and eel. The CPUE for stone loach and three-spined stickleback was 0.2 fish caught per minute. The CPUE for eel and dace was 0.2 fish caught per minute. Brown trout were recorded in small numbers and salmon were common. There was 1 brown trout caught per minute fished and 7.6 salmon. There were two lamprey species recorded at this site. There were 12 individual brook lamprey found and 2 river lamprey transformers. Overall, there were 4 lamprey caught per minute fished.

Biological water quality was assigned a rating of Q4 equivalent to WFD status "Good". Overall, this was a high quality river of Special Area of Conservation standard.

Survey Site 12

Survey Site A12 is located on the River Blackwater [Clare] (EPA Segment Code: 25_3221). The site had a wetted width of 6m. The gradient was low overall, and siltation was normal. The river here is deep and sluggish. The habitat was predominantly glide and canopy over was c. 40%.

The site was visually assessed as it is very deep and there are access issues. Therefore, electrofishing and Q-sampling were not carried out. There is salmonid nursery habitat present but no salmonid fishery habitat. There was lamprey habitat at the site. The culvert downstream was also visited. The fish pass was inspected and found to be not working. Several of the boards on the pass were broken. This culvert blocks river lamprey migration.

The site was not assessed but it is considered likely to have a biological water quality status of Q4 equivalent to an overall status of "Good".

Survey Site 13

Survey Site A13 was located on the River Blackwater [Clare] (EPA Segment Code: 25_13109). The site had a wetted width of 6m. There was a medium gradient and moderate siltation. Eroding banks and artificial features were both present at the site. This artificial feature was a road / slipway that went into the river and was used as a cattle crossing. There were water quality issues at the site from agricultural impacts. The river is culverted downstream, and this results in an upstream migration barrier for River and Sea Lamprey.

There was salmon nursery habitat present at the site, but salmon fishery habitat was absent. There was no coarse nursery or fishery habitat present. Lamprey habitat did occur at the site.

Salmon and Brown Trout were both recorded at this site. There were recorded as Present and in Small Numbers respectively. There were 0.6 Salmon caught per minute fished and 1.2 Brown Trout. This indicated that Salmon do pass the downstream culvert. Three-spined stickleback and Stone loach were recorded as Present and Minnow in Small Numbers. The CPUE for the 3 species was 0.4, 0.8 and 1 fish caught per minute respectively.

Biological water quality was assigned a rating of Q3-4 equivalent to WFD status "Moderate".

Survey Site 14

Survey Site A14 was located on the Glenomra Wood Stream (EPA Segment Code: 25_3221). The wetted width at this site was c. 2m. The gradient overall was low, and siltation was normal. Eroding banks were present. There was low canopy cover at c. 15%. The habitat was a mixture of riffle and glide.

Important salmonid nursery habitat was present. There was no salmonid fishery habitat at the site. There was no coarse fishery or nursery habitat present. There was no lamprey habitat present at the site.

Brown Trout were considered likely to be present. They were recorded as Present and 0.6 fish were caught per minute.

Biological water quality was assigned a rating of Q4 equivalent to WFD status “Good”.

Survey Site 15

Survey Site A15 was located on the Glenomra Wood Stream (EPA Segment Code: 25_13111). This was a small stream with a wetted width of c. 1m. The gradient at the site was low and siltation was normal.

This site was considered too small to be suitable for electrofishing or Q-sampling. Salmonid nursery habitat was present. There was no salmonid fishery habitat at the site. There was no coarse fishery or nursery habitat present. There was no lamprey habitat present at the site.

Brown Trout are considered to be present at this site.

The stream was not assessed but it is considered likely to be Q3-4 and less then Good status overall.

Turbine Delivery Route

Survey Site 17

Survey Site A17 was located on the River Ardcloony (EPA Segment Code: 25_2596). The wetted width at this site was c. 5m. The gradient was medium and siltation was normal. Eroding banks were present and the channel had not been drained.

Salmonid nursery habitat and spawning habitat was present. There was no coarse fishery or nursery habitat present. There was no lamprey habitat present at the site.

This site was not fished and it is considered that the site is similar to the upstream site (Survey Site A18). The ESB dam downstream blocks fish migration to this stream. Salmon are likely to be present and are likely stocked from Parteen Hatchery. Brown trout, brook lamprey, stone loach and three-spined stickleback are likely present.

The river was not assessed however it is considered to be Q4 Good status.

Survey Site 18

Survey Site A18 was located on the River Ardcloony (EPA Segment Code: 25_2596). The site had a wetted width of 5m. The gradient of the site was medium and siltation was normal. There were eroding banks at the site. The habitat at the site was mostly glide with some riffle habitat also present. Canopy cover was high at c. 70%. The banks at the site were steep and vegetated.

Salmonid nursery habitat and spawning habitat was present. There was no coarse fishery or nursery habitat present. There was no lamprey habitat present at the site.

There were five fish species recorded at this site. Salmon and brown trout were both recorded in small numbers. There was one age class of salmon present. These salmon appeared to have been stocked fish. The CPUE for salmon was 0.8 fish caught per minute and for brown trout was 2.2. Minnow, three-spined stickleback and stone loach were recorded as present. The CPUE for each was 1, 1, and 0.4 fish caught per minute respectively.

The river was not considered suitable for Q-sampling however it is considered to be Q4 Good status.

Survey Site 22

Survey Site A23 was located on the River Ballyteige 25 (EPA Segment Code: 25_2794). This river is known locally at the River Killestry. The river at the site had a wetted width of 3m. The river had a medium gradient and moderate siltation. Filamentous algae was present as were eroding banks. This site had been drained. There have been some recent river works upstream and downstream some rehabilitation works have been undertaken. There is a bridge with a wire fence across the river between survey Site A22 and A23 which appears to block livestock access upstream and downstream.

There was salmonid nursery habitat present at the site but no fishery habitat. There was no coarse fishery or nursery habitat at the site. Lamprey habitat was present.

This site was not assessed but is considered to be the same is the upstream site (Survey Site A23). There was evidence of otter downstream of the bridge (prints at a cattle trough).

Survey Site 23

Survey Site A23 was located on the River Ballyteige 25 (EPA Segment Code: 25_2794). This river is known locally at the River Killestry. The river at the site had a wetted width of 3m. The river had a medium gradient and moderate siltation, Filamentous algae was present as were eroding banks. This site had been drained. There have been some recent river works upstream.

There was salmonid nursery habitat present at the site but no fishery habitat. There was no coarse fishery or nursery habitat at the site. Lamprey habitat was present.

There were two fish species recorded at this site. These were brown trout present in small numbers and stone loach recorded as present. Brown trout CPUE was 0.8 fish caught per minute fished. There were 0.2 stone loach caught for every minute fished. Brook lamprey were also recorded. There were two individuals recorded resulting in a CPUE of 0.67 brook lamprey caught per minute fished. This site was considered to be Q3-4 equivalent to WFD status "Moderate".

8.3.8.4 White-clawed Crayfish

No white-clawed crayfish were detected within the study area during surveys.

Annex I Habitat

There is floating river vegetation at the lower reaches of the Blackwater (Clare) including at Site 11, 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').

8.3.8.5 Non-native Invasive Species

No invasive species were recorded during aquatic surveys.

8.3.9 Marsh Fritillary

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 two Hectads (R66 & R67) overlapping the proposed wind farm site. There are no larger-scale records overlapping the proposed site.

A detailed survey of the proposed site focused on habitats with potential to support marsh fritillary's larval food plant (devil's bit scabious *Succisa pratensis*). A number of locations supporting *S. pratensis* were recorded and mapped.

Areas with *S. pratensis* were searched thoroughly for larval webs and marsh fritillary caterpillars. This search recorded a total of four larval webs, with caterpillars also present at all. All confirmed larval webs with caterpillars were located in wet grassland and dry/humid acidic grassland fields east of T5 and north of a section of proposed access track. All of these records are outside the proposed development footprint and the proposed footprint does not overlap any areas with *S. pratensis* at this location.

Elsewhere in the site, limited areas (total of 152m^2) of *S. pratensis* are overlapped by proposed access tracks and a part of the T2 hard standing. The T2 hard standing and access track running south-east from T1 overlap parts of the largest area of *S. pratensis* outside the fields east of T5. A total of four potential marsh fritillary larval webs were observed in this area (outside the proposed footprint); however, no caterpillars were present to assign the webs definitively to this species. The majority of these webs were old and degraded.

While there is sufficient density of *S. pratensis* to support marsh fritillary in this area, the habitat condition was observed to be sub-optimal for larvae (grazing was light and vegetation was high and dense). This area appears to be less favoured by cattle due to soft ground and abundant rushes.

One further potential marsh fritillary larval web with no caterpillars was recorded in a smaller area of *S. pratensis* located in a field where no infrastructure is proposed.

Path: R:\Map Production\2020\P20-003\Workspace\EIAR\Ecology\P20-003_GIS_Fig8-17_Marsh_Fritillary_Survey_A3.mxd

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
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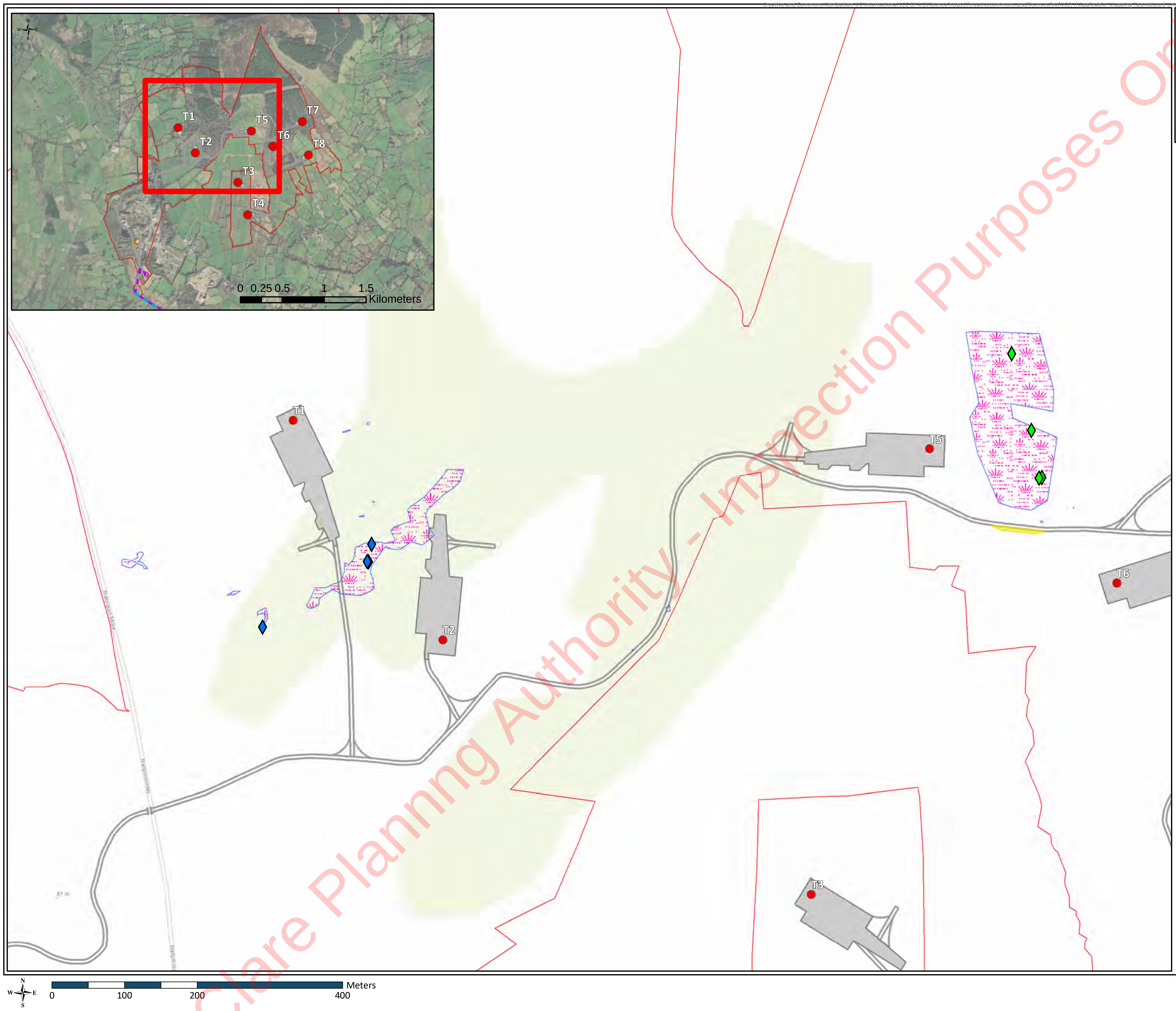

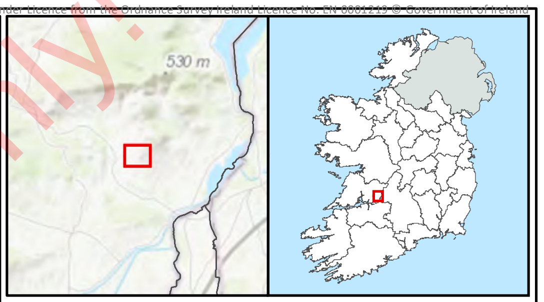

Legend

🟥	Wind Farm Site Boundary
●	Proposed Turbine Layout
—	Onsite Access Roads
▨	Turbine Hardstanding Area
🟨	Passing Bays
▨	Devil's Bit

Marsh Fritillary Survey Points

◆	Marsh Fritillary Larval Web
◆	Potential Larval Web

TITLE:
Marsh Fritillary Survey

PROJECT:
Fahy Beg Wind Farm, Co. Clare

FIGURE NO:	8.17		
CLIENT:	RWE Renewables Ireland Ltd.		
SCALE:	1:5000	**REVISION:**	0
DATE:	24/11/2022	**PAGE SIZE:**	A3

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8.3.10 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 squares (R66 and R67) overlapping the study area.

8.3.10.1 Amphibians

Common frog *Rana temporaria* has been recorded within both 10 km grid squares overlapping the study area. Smooth newt *Lissotriton vulgaris* has been recorded within 10 km grid square R66. There are no high-resolution records (up to 2 km^2) of either species overlapping the proposed wind farm site, and no records of these species whtin the 1 km grid squares overlapping the GCR.

8.3.10.2 Invertebrates

Apart from marsh fritillary which is covered separately in 8.3.9, no protected terrestrial invertebrates have been recorded in the 10 km grid squares overlapping the proposed wind farm. A number of near threatened vulnerable or endangered invertebrates including butterfly, bee and snail species have been historically recorded in the 10 km grid squares overlapping the proposed wind farm. These are listed below in Table 8-56.

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

Table 8-56: Rare terrestrial invertebrate species (NBDC records for R66 & R67)

Species	Grid square	Date of last record	Designation
Lepidoptera (Butterflies & Moths)			
Large Heath (*Coenonympha tullia*)	R66	03/06/2021	Threatened Species: Vulnerable
Small Heath (*Coenonympha pamphilus*)	R66	11/06/2020	Threatened Species: Near threatened
Apoidea (Bees)			
Gipsy Cuckoo Bee (*Bombus (Psithyrus) bohemicus*)	R67	09/08/1983	Threatened Species: Near threatened
Gooden's Nomad Bee (*Nomada goodeniana*)	R66	30/04/2021	Threatened Species: Endangered
Large Red Tailed Bumble Bee (Bombus (*Melanobombus) lapidarius*)	R66 R67	02/08/2020	Threatened Species: Near threatened
Moss Carder-bee (*Bombus (Thoracombus) muscorum*)	R67	27/07/1981	Threatened Species: Near threatened
Gastropoda (Slugs & Snails)			
Common Whorl Snail (*Vertigo (Vertigo) pygmaea*)	R67	17/04/1982	Threatened Species: Near threatened

Species	Grid square	Date of last record	Designation
Marsh Whorl Snail (*Vertigo (Vertigo) antivertigo*)	R66 R67	17/04/1982	Threatened Species: Vulnerable
Heath Snail (*Helicella itala*)	R67	31/12/1914	Threatened Species: Vulnerable
Smooth Grass Snail (*Vallonia pulchella*)	R66 R67	17/04/1982	Threatened Species: Vulnerable
Tree Snail (*Balea (Balea) perversa*)	R67	17/04/1982	Threatened Species: Vulnerable
Whirlpool Ramshorn (*Anisus (Disculifer) vortex*)	R66 R67	17/04/1982	Threatened Species: Vulnerable

8.3.10.3 Other Invertebrates

Cinnibar moth (*Tyria jacobaeae*) (Least Concern; Allen et. al, 2016) was recorded in the quarry in the vicinity of the proposed temporary compounds.

8.3.11 Habitat Evaluation

8.3.11.1 Habitat Evaluation Summary

Table 8-57 below outlines the ecological resources in the form of habitat types found within the study area. Key receptors as per NRA guidance (NRA, 2009a), for which impact assessment is to be carried out, are also indicated.

The habitats within the proposed wind farm site are dominated by mixed broadleaved woodland WD1, conifer plantation WD4, improved agricultural grassland GA1 and wet grassland GS4.

The dominant habitat along the GCR outside the wind farm site is buildings and artificial surfaces BL3 represented by road surfaces, bounded by dry meadows and grassy verges GS2. The roads are also bounded by hedgerows WL1, treelines WL2 and a mosaic of these habitats. Other habitats abutting the grid connection include improved agricultural grassland GA1, wet grassland GS4, amenity grassland GA2, wet willow- alder-ash woodland, WN6, mixed broadleaved woodland WD1 and conifer plantation WD4. The proposed GCR does not overlap the woodland habitats listed above.

The GCR intersects Lowland rivers FW2 at five locations. Existing crossing structures are in place at these points. The habitats along the GCR are subject to disturbance due to their close proximity to roads and dwellings.

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. Mesotrophic lakes FL4 is present in the vicinity of one Node (Node 27).

Similarly to the GCR, the habitats at TDR Nodes are subject to disturbance due to their proximity to roads and dwellings.

Habitats evaluated as Local Importance (Higher Value) 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 Local Importance (Lower Value) are not classified as key receptors

Table 8-57: Summary of Habitat Evaluations and Identification of Key Receptors

Fossitt Habitat Classification (Code)	Evaluation	Rationale	Key Receptor	Relevant Study Area		
				WF	GCR	TDR
Improved Agricultural Grassland (GA1)	Local Importance – Lower Value	Intensively managed and artificial habitat of limited biodiversity value.	No	✓	✓	✓
Amenity grassland (GA2)	Local Importance – Lower Value	Intensively managed and artificial habitat of limited biodiversity value.	No	x	✓	✓
Dry meadows and grassy verges (GS2)	Local Importance – Higher Value	Semi-natural habitat affected by proposed onsite substation. Also present along GCR.	Yes	✓	✓	✓
Dry humid acid grassland (GS3)	Local Importance – Higher Value	Habitat of moderate species diversity. Provides greater plant species diversity and ecosystem services than areas of intensively managed pastoral lands. Outside proposed footprint.	No	✓	x	x
Wet grassland (GS4)	Local Importance – Higher Value	A habitat likely to be of local importance to avifauna and small mammals as a viable foraging habitat and localised refuge. Wet grassland within the study area is isolated and typically surrounded by improved grassland habitats. This habitat is overlapped by proposed access tracks and hard standings.	Yes	✓	✓	✓
Wet grassland (GS4) (Annex I linked)	County Importance – Higher Value	Two areas of diverse and flushed wet grassland on peaty soils located near the northern boundary of the site correspond to the Annex I grassland habitat 'Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) (6410)'. These wet grassland habitats are evaluated as being of County Importance. This habitat is outside the proposed infrastructure footprint.	No	✓	x	x
Dense bracken (HD1)	Local Importance – Lower Value	A habitat of poor floristic value. However dense bracken can provide suitable cover and refuge for faunal species in the locality in terms of cover, refuge and connectivity. Outside proposed footprint.	No	✓	x	x
Scrub (WS1)	Local Importance – Higher Value	A habitat of moderate floristic value. However, scrub habitats provide valuable ecosystem services for other semi-natural habitats and faunal	Yes	✓	x	✓

Fossitt Habitat Classification (Code)	Evaluation	Rationale	Key Receptor	Relevant Study Area		
				WF	GCR	TDR
		species in the locality in terms of cover, refuge and connectivity. Overlapped by proposed access tracks and turbine hard standings.				
Immature woodland (WS2)	Local Importance – Higher Value	Semi-natural habitat outside proposed footprint.	No	x	x	✓
Ornamental/non-native shrub (WS3)	Local Importance – Lower Value	Artificial habitat of limited biodiversity value.	No	x	x	✓
Mixed Broadleaved Woodland (WD1) (long-established)	County Importance – Higher Value	The mature beech woodland near the centre of the site, identified as Ballymoloney Wood on OS mapping, is considered to be of County Importance. This is due to the condition of the trees in the canopy and their importance to species such as bats, pine marten and breeding birds. In and of itself, this woodland supports moderate plant species diversity. Most importantly, it represents a large area of broadleaved woodland area within the locality. It is also a long-established woodland that did support historical connectivity with other broadleaved woodland habitats to the south and south-west, including demesne woodland at Ballyquin House and woodlands at Glenomra Wood SAC, located 3.0km south-west. A section of proposed access tracks traverses this woodland.	Yes	✓	x	x
Mixed Broadleaved Woodland (WD1)	Local Importance – Higher Value	The young broadleaved woodland areas associated with the quarry margins are considered to be of Local Importance -Higher Value, given their inherent botanical composition, ecological corridor functionality and ecosystem services for local ecological receptors. A section of proposed access tracks traverses this woodland.	Yes	✓	✓	✓
Mixed Broadleaved Woodland (WD1) (Immature Plantation)	Local Importance – Lower Value	Young ash plantations are considered to be of Local Importance, Lower value as they are young, underdeveloped habitats of poor – moderate species diversity. This area is traversed by a section of proposed access track.	Yes	✓	x	x
Conifer woodland (WD4)	Local Importance – Lower Value	A habitat of poor floristic value. However, conifer woodland can provide suitable habitat for faunal species in the locality in terms of	No	✓	✓	x

Fossitt Habitat Classification (Code)	Evaluation	Rationale	Key Receptor	Relevant Study Area		
				WF	GCR	TDR
		cover, refuge and connectivity. Proposed access tracks and turbine hard standings overlap conifer plantation.				
Oak-birch-holly woodland (WN1)	Local Importance – Higher Value	Small area of young semi-natural woodland. Outside proposed footprint.	No	✓	x	x
Oak-Ash-Hazel Woodland (WN2)	Local Importance – Higher Value	The semi-natural woodland is considered to be Local Importance – Higher Value, due to its species diversity and its importance to species such as bats, pine marten and breeding birds. This woodland is likely to provide valuable ecosystem services for a range of habitats and species in the local area. Overlapped by proposed bridge & access track.	Yes	✓	x	x
Wet Willow-Alder-Ash Woodland (WN6)	Local Importance – Higher Value	Small area of young semi-natural woodland with a poorly developed ground layer. Outside proposed footprint.	No	✓	✓	x
Spoil and bare ground (ED2)	Local Importance – Lower Value	A habitat of low botanical diversity with little ecological services to fauna in the locality. Sections of proposed access track overlap this habitat type.	No	✓	x	✓
Recolonising bare ground (ED3)	Local Importance – Higher Value	This is a habitat of good floristic diversity, primarily ruderal species. These habitats due to their botanical diversity are likely to be of local importance for invertebrate fauna. Overlapped by proposed site compound and access tracks.	Yes	✓	x	✓
Other Artificial Lakes and Ponds (FL8)	Local Importance – Higher Value	A habitat of low botanical diversity. However, this wetland habitat provides valuable cover and suitable habitat for breeding birds and invertebrates. Potentially subject to surface runoff from nearby access tracks.	Yes	✓	x	x
Reed and Large Sedge Swamp (FS1)	Local Importance – Higher Value	A habitat of low botanical diversity. However, this wetland habitat provides valuable cover and suitable habitat for breeding birds and invertebrates. Outside proposed footprint.	No	✓	x	x
Drainage Channels (FW4)	Local Importance – Higher Value	Direct effects where culverts are installed at crossing points. Indirect effects including siltation and pollution could occur.	Yes	✓	✓	✓

Fossitt Habitat Classification (Code)	Evaluation	Rationale	Key Receptor	Relevant Study Area		
				WF	GCR	TDR
Eroding/upland river (FW1)	Local Importance – Higher Value	Direct effects where crossing structures are installed at internal access crossing points. Indirect effects including siltation and pollution could occur.	Yes	✓	x	x
Lowland/depositing rivers (FW2)	Local Importance – Higher Value	Indirect effects including siltation and pollution could occur.	Yes	x	✓	✓
Mesotrophic lakes (FL4)	Local Importance – Higher Value	Adjacent to hedgerow requiring trimming. No direct or indirect effects are predicted.	No	x	x	✓
Hedgerows (WL1)	Local Importance – Higher Value	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. Hedgerows may be affected by limited branch trimming along the GCR. Will be affected by trimming and felling at TDR Nodes.	Yes	✓	✓	✓
Treelines (WL2)	Local Importance – Higher Value	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. Treelines may be affected by limited branch trimming along the GCR. Will be affected by trimming and felling at TDR Nodes.	Yes	✓	✓	✓
Buildings and Artificial Surfaces (BL3) (Buildings)	Local Importance – Higher Value	Roosting bats were recorded in a derelict farmhouse in the northern part of the site. This building is not within the proposed infrastructure footprint.	No	✓	x	x
Buildings and Artificial Surfaces (BL3) (Roads & Hard standings)	Local Importance – Higher Value	Overlapped by proposed access tacks and temporary construction compound. These habitats have no ecological value.	No	✓	✓	✓

8.3.12 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 and are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2019).Table 8-58 below outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance (NRA, 2009a).

Table 8-58: Evaluation of Fauna

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Bats	EU Habitats Directive Annex IV; Wildlife Act (Amendment) 2000	National Importance	Bat activity at wind farm site. Recent records of bat roosts and activity within 10km of the proposed development.	Yes
Badger	Wildlife Act (Amendment) 2000	County Importance	Setts present in areas with potential to be affected by construction activities. Confirmed present by live sighting, trail cameras and active latrines.	Yes
Rabbit	Invasive non-native species	Not of conservation importance	Evidence of presence onsite but not of conservation concern.	No
Fallow Deer	Invasive non-native species Wildlife Act (Amendment) 2000	Not of conservation importance	Present onsite but not of conservation concern.	No
Greater White-toothed Shrew	Invasive non-native species	Not of conservation importance	Present onsite but not of conservation concern.	No
Irish Hare	Wildlife Act (Amendment) 2000	National Importance	Present onsite. Observed in wooded areas.	Yes
Pine Marten	EU Habitats Directive Annex V; Wildlife Act (Amendment) 2000	National Importance	Present onsite. Observed in wooded area in quarry. Abundant scat throughout site.	Yes
Fox	None	Local Importance (lower Value)	Live sightings and trail camera records in wind farm study area. Not of conservation concern.	No
Pygmy Shrew	Wildlife Act (Amendment) 2000	National Importance	No records within the wind farm site but may still use the site.	Yes

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
			The closest record is over 3km northeast of the wind farm site in R676715. This record is of two live animals. A live sighting record with an accuracy of 100m is located c. 600m from the GCR.	
Red Squirrel	Wildlife Act (Amendment) 2000	National Importance	Not recorded within the wind farm site. However, a record with 100m accuracy from 2012 is c. 200m north of the site. Additionally, in 2012, a record with 100m accuracy exists c. 800m northwest of the grid connection.	Yes
Otter	EU Habitats Directive Annex II and Annex IV; Wildlife Act (Amendment) 2000	National Importance	No records for otter exist within the wind farm site. The nearest record (from 1980) is approx. 1km southeast of the site. This species is likely to be present downstream and could be subject to indirect effects. Otter signs were recorded downstream of TDR Node 20. Otter signs were recorded at and in the vicinity if the Blackwater (Clare) and Glenomra wood streams.	Yes
Irish Stoat	Wildlife Act (Amendment) 2000	National Importance	NBDC record 5 km from wind farm site. Not observed during surveys but may still use the wind farm site.	Yes
Red Deer	Wildlife Act (Amendment) 2000	National Importance	No records for red deer exist within the wind farm site. There is potential for red deer to occur onsite, but no potential for negative effects if present (red deer are mobile, adaptable & resilient and can move to find suitable alternative habitats if required).	No
Hedgehog	Wildlife Act (Amendment) 2000	National Importance	The nearest record is c. 1km north of the site boundary. Not observed during surveys but may still use the wind farm site. Records of live animals exist within the vicinity of the GCR. Sightings at R584615 and R587621 in 2007 were approx. 200m south of the GCR.	Yes

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Wood Mouse	None	Local Importance (lower Value)	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
Wild Boar	Invasive non-native species	Not of conservation importance	Records in local area. Not of conservation concern.	No
Marsh Fritillary	EU Habitats Directive Annex II	International Importance	Larval webs present in study area. Larval foodplant abundant in parts of site, partly overlapped by proposed footprint.	Yes
Cinnabar Moth	None	Local Importance (Higher Value)	Observed in quarry. Larval foodplant may occur in site compound footprint.	Yes

8.3.13 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 2019). Table 8-59 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 8-59: Avifauna Key Receptor Evaluations

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

Common Name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Barn owl	Red Listed (Br. only)	National Importance	Likely territory in the vicinity of the quarry.	Yes	High
Black-headed gull	Amber Listed (Br. & Win.)	County Importance	Flight activity recorded within study area. Also recorded at Mac	Yes	Medium

Common Name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			Namara's Lake (adjacent TDR Node 27) in winter.		
Brambling	Amber Listed (Win. only)	County Importance	Present in winter.	Yes	Medium
Buzzard	Green Listed	Local Importance (Higher Value)	Possible breeding recorded within the woodland in the north of the study area and fledged young recorded in 2020. High amount of flight activity recorded within study area.	Yes	Low
Common Goldeneye	Red Listed (Win. only)	National Importance	Desktop records only. No potential breeding habitat present in study area.	No	High
Common Gull	Amber Listed	Local Importance (Higher Value)	No breeding habitat present in study area. Could occasionally forage within site.	Yes	Medium
Common Kingfisher	Annex I Amber Listed (Br. only)	International Importance	Likely to be present downstream of wind farm & GCR. Potentially subject to indirect effects.	Yes	Very High
Common Tern	Annex I Amber Listed (Br. only)	International Importance	Desktop records only. No potential breeding habitat present in study area.	No	Very High
Coot	Amber Listed (Br. & Win.)	County Importance	No suitable breeding habitat within the study area. No flight activity recorded in study area.	No	Medium
Cormorant	Amber Listed (Br. & Win.)	County Importance	Flight activity recorded within study area.	Yes	Medium
Curlew	Red Listed (Br. & Win.)	National Importance	Flight activity recorded near study area. Limited sub-optimal & fragmented breeding habitat in study area. Not	Yes	High

Common Name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			recorded during breeding season.		
Dunlin	Annex I Red Listed (Br. & Win.)	International Importance	Desktop records only. No potential breeding habitat present in study area.	No	Very High
Goldcrest	Amber Listed (Br. only)	County Importance	Common resident. Likely breeding within the beech woodland and conifer plantation.	Yes	Medium
Golden plover	Annex I Red Listed (Br. & Win.)	International Importance	Not recorded within the study area during the breeding season. Flock of 12 birds recorded flying through study area during winter walkover survey.	Yes	Very High
Great crested grebe	Amber Listed (Br. & Win.)	County Importance	Recorded during hinterland surveys only. No suitable breeding habitat within the study area.	No	Medium
Greenfinch	Amber Listed (Br. only)	County Importance	Common resident. Likely breeding in the study area or wider area.	Yes	Medium
Green-listed passerines, wood pigeon and pheasant	Green Listed	Local Importance (Lower Value)	Not of conservation concern/not vulnerable to potential effects.	No	Negligible
Grey heron	Green Listed	Local Importance (Higher Value)	Recorded occasionally flying over or towards quarries south of study area. Recorded at Mac Namara's Lake (adjacent TDR Node 27) in winter.	Yes	Low
Grey wagtail	Red Listed (Br. only)	National Importance	Recorded along the Black River, outside of the survey area. Likely breeding in the wider area. Potential for indirect effects via water quality.	Yes	High

Common Name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Greylag goose	Amber Listed (Win. only)	County Importance	Flight activity recorded within study area.	Yes	Medium
Hen harrier	Annex I Amber Listed (Br. only)	International Importance	Flight activity recorded within study area.	Yes	Very High
Herring gull	Amber Listed (Br. & Win.)	County Importance	Recorded foraging in surrounding area during breeding season; however, no suitable breeding habitat within the study area.	Yes	Medium
House Martin	Amber Listed (Br. only)	County Importance	Could potentially forage within study area.	Yes	Medium
House sparrow	Amber Listed (Br. only)	County Importance	Common resident, likely breeding in residential and agricultural buildings. Potentially forages within the study area.	Yes	Medium
Kestrel	Red Listed (Br. only)	National Importance	Likely breeding in the wider area. Second most active species in study area after Buzzard.	Yes	High
Lapwing	Red Listed (Br. & Win.)	National Importance	Recorded flying near studynear study area during winter 2021.	Yes	High
Lesser black-backed gull	Amber Listed (Br. & Win.)	County Importance	Flight activity recorded within study area.	Yes	Medium
Linnet	Amber Listed (Br. only)	County Importance	Potential breeding habitat within the study area.	Yes	Medium
Little Grebe	Green Listed	Local Importance (Higher Value)	Potential breeding habitat near site entrance.	Yes	Low
Mallard	Amber Listed (Br. & Win.)	County Importance	Recorded in study area & wider area during winter. Also recorded at Mac Namara’s Lake (adjacent TDR Node 27) in winter.	Yes	Medium

Common Name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Meadow pipit	Red Listed (Br. only)	National Importance	Suitable wet grassland habitat on the southern slopes of the site for this ground-nesting species.	Yes	High
Merlin	Annex I Amber Listed (Br. only)	International Importance	Flight activity recorded within study area. Winter record only. Potential breeding habitat within plantation adjacent to open bog habitat, north of the study area boundary.	Yes	Very High
Moorhen	Green Listed	Local Importance (Higher Value)	Potential breeding habitat near site entrance. Desktop record overlapping quarry.	Yes	Low
Mute swan	Amber Listed (Br. & Win.)	County Importance	Recorded at Mac Namara's Lake (adjacent TDR Node 27) in winter.	Yes	Medium
Peregrine	Annex I Green Listed	International Importance	Flight activity recorded within study area. Winter record only.	Yes	Very High
Pochard	Red Listed (Br. & Win.)	National Importance	Desktop records only. No potential breeding habitat present in study area.	No	High
Red Grouse	Red Listed (Br. only)	National Importance	Not recorded during surveys. No suitable habitat within zone of sensitivity (500m)[5].	No	High
Redshank	Red Listed (Br. & Win.)	National Importance	Desktop records only. No potential breeding habitat present in study area.	No	High
Redwing	Red Listed (Win. only)	National Importance	Present during winter.	Yes	High
Ruff	Annex I Amber Listed	County Importance	Desktop records only. Primarily a passage	No	Medium

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

Common Name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
	(Migratory pop. only)		migrant. Small wintering population along southern coast.		
Sand martin	Amber Listed (Br. only)	County Importance	Breeding in quarry.	Yes	Medium
Scaup (Greater)	Red Listed (Win. only)	National Importance	Recorded during hinterland surveys only. No suitable breeding habitat within the study area.	No	High
Snipe	Red Listed (Br. & Win.)	National Importance	Possible breeding habitat within the open bog habitat, north of the study area boundary as well as wet grassland in the south of the site. Not recorded within the study area during the breeding season. Winter records only.	Yes	High
Sparrowhawk	Green Listed	Local Importance (Higher Value)	Breeding site within the beech woodland in the north of the study area. Confirmed breeding in 2022.	Yes	Low
Spotted flycatcher	Amber Listed (Br. only)	County Importance	Pairs recorded during breeding bird surveys and suitable breeding habitat in the form of broadleaf woodland / well vegetated hedgerows.	Yes	Medium
Starling	Amber Listed (Br. only)	County Importance	Common resident. Breeding in the study area and wider area.	Yes	Medium
Swallow	Amber Listed (Br. only)	County Importance	Nesting habitat in abandoned residential / agricultural b buildings. May forage over site.	Yes	Medium
Swift	Red Listed (Br. only)	National Importance	Recorded foraging within the study area.	Yes	High

Common Name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Teal	Amber Listed (Br. & Win.)	County Importance	Desktop records only. No potential breeding habitat present in study area.	No	Medium
Tufted duck	Amber Listed (Br. & Win.)	County Importance	Recorded during hinterland surveys only. No suitable breeding habitat within the study area.	No	Medium
Water Rail	Green Listed	Local Importance (Higher Value)	Potential breeding habitat near site entrance.	Yes	Low
Whimbrel	Green Listed	Local Importance (Higher Value)	Flight activity recorded within study area (1 observation of birds on passage).	Yes	Low
White-throated Dipper	Green Listed	Local Importance (Higher Value)	Dipper nest recorded under Glenomra Stream Bridge (GCR crossing). Desktop records in wider area.	Yes	Low
Whooper swan	Annex 1 Amber Listed (Br. & Win.)	International Importance	Flight activity recorded within study area.	Yes	Very High
Willow warbler	Amber Listed (Br. only)	County Importance	Common resident, breeding within woodland, scrub and treelines.	Yes	Medium
Woodcock	Red Listed (Br. only)	Local Importance (Higher Value)[6]	Though suitable habitat exists within the study area, birds were only observed during the winter seasons. Targeted dusk surveys did not record any roding behaviour.	Yes	Low[6]
Yellowhammer	Red Listed (Br. only)	Local Importance (Higher Value)[7]	Winter records only. Not recorded during breeding bird walkover surveys.	Yes	Low[7]

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

[7] Wintering population is green-listed. Only wintering yellowhammer were recorded at the site.

8.3.14 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 and are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM, 2018). Table 8-60 below outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance (NRA, 2009a).

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

Table 8-60: Aquatic Key Receptor Evaluations

Site no.	Watercourse	EPA code	Evaluation of Importance	Rationale summary
1	River Black [O'Briensbridge]	25B22	Local importance (higher value)	Fisheries value present with salmonid and lamprey habitat recorded at the site; rated as Q4 (good status); brown trout and brook lamprey were recorded.
2	River Black (O'Briensbridge)	25B22	Local importance (higher value)	Fisheries value present with salmonid and lamprey habitat recorded at the site; rated as Q4 (good status); brown trout and brook lamprey were recorded.
3	River Black (O'Briensbridge)	25B22	Local importance (lower value)	Salmonid habitat present and is a small stream; rated Q4 (good status) but there impacts in the form of a one-off house and infilling; low numbers of brown trout were recorded.
4	River Black (O'Briensbridge)	25B22	Local importance (lower value)	No fisheries values as no fish were recorded as watercourse was dry; biological water quality not assessed as river was dry.
5	Kilroughil Stream	25K69	Local importance (higher value)	Salmonid habitat present; brown trout recorded; very small stream rated as Q4 (good status).
6	River Bridgetown (Clare)	25B23	Local importance (higher value)	Salmonid and lamprey habitats present; Brown trout and brook lamprey were recorded, assessed as Q3 (poor status); very heavily silted and evidence of instream works.
7	River Bridgetown (Clare)	25B23	Local importance (higher value)	Unsuitable for assessment as river has been recently dredged. Due to this no fisheries habitat present. It is considered to be less then good status and salmonid habitat does occur upstream. Brown trout and brook lamprey likely present.
8	River Bridgetown (Clare)	25B23	Local importance (lower value)	No fisheries values as no fish were recorded as watercourse as dry; biological water quality not assessed as river was dry.
9	Broadford River	27B02	Local importance (lower value)	No fisheries values as no fish were recorded; watercourse was partially dry; biological water quality not assessed as river was partially dry with lack of flow.

Site no.	Watercourse	EPA code	Evaluation of Importance	Rationale summary
18	River Ardcloony	25A03	Local importance (higher value)	Nursery and spawning salmonid habitat; lamprey habitat present; salmon (likely stocked), brown trout, brook lamprey recorded; migration partially blocked by ESB dams; rated Q4 (good status).
19	River Kilmastulla	25K04	Local importance (higher value) / County Importance	Salmonid and lamprey habitat present; previous survey have recorded salmon, all three lamprey species, dace, minnow, European eel and three-spined stickleback were recorded; river is impacted from mine drainage and arterial drainage.
20	River Kilmastulla	25K04	Local importance (higher value)	Salmonid and lamprey habitat present; previous survey have recorded Salmon, all three lamprey species, dace, minnow, European eel and three-spined stickleback were recorded; river is impacted from mine drainage and arterial drainage.
21	River Roolagh	25R20	Local importance (higher value)	Moderate salmonid nursery habitat present; too small to fully assess but considered Q3 (moderate status).
22	River Ballyteige 25	25B17	Local importance (higher value)	Moderate salmonid nursery habitat present; too small to fully assess but considered Q3-4 (moderate status).
23	River Ballyteige 25	25B17	Local importance (higher value)	Spawning and nursery salmonid habitat and lamprey habitats present; Brown trout, brook lamprey, stone loach, and three-spined stickleback recorded; salmon recorded in previous surveys; recent dredging and river realignment; migration partially blocked by ESB dam. Rated Q3-4 (moderate status).

Site no.	Watercourse	EPA code	Evaluation of Importance	Rationale summary
10	Broadford River	27B02	Local importance (lower value)	Very small stream with no fisheries value; wasn't biologically assessed due to size and lack of flow; no fisheries potential.
11	River Blackwater [Clare]	25B06	County Importance	Salmonid and lamprey habitat present; floating river vegetation present; good numbers of juvenile salmon and brown trout; brook and river lamprey present; rated as Q4 (good status), SAC quality river.
12	River Blackwater [Clare]	25B06	Local importance (higher value)	Salmonid and lamprey habitat present; not assessed as river was deep and sluggish, no spawning habitats present, culvert downstream blocks migration; salmon, brown trout and brook lamprey recorded.
13	River Blackwater [Clare]	25B06	Local importance (higher value) / County Importance	Spawning and nursery salmonid and lamprey habitat present; rated Q3-4 (moderate status); juvenile salmon, brown trout, brook lamprey (significant numbers), minnow and stone loach were present; impacts included cattle crossing and agricultural inputs.
14	Glenomra Wood Stream	25B06	Local importance (higher value)	Important salmonid nursery habitat; brown trout likely present; assigned Q4 (good status).
15	Glenomra Wood Stream	25B06	Local importance (higher value)	Salmonid nursery habitat; trout likely present, considered to be Q3-4 (good status).
16	River Ballyard 15	25B77	Local importance (lower value)	Very small stream; no fish habitat present; not assessed due to small size and low flow but considered likely Q3-4 (moderate).
17	River Ardcloony	25A03	Local importance (higher value)	Nursery and spawning salmonid habitat; lamprey habitat present; salmon (likely stocked), brown trout, brook lamprey, stone loach and three-spined stickleback were recorded, not assessed but likely Q4 (good status) as is Site 18 upstream; migration partially blocked by ESB dams.

8.4 Do Nothing Scenario

If the proposed development does not proceed, the 'do nothing' scenario is that the existing environment and key receptors identified in Section 8.3 are likely to remain as described previously. This assumes the continuation of existing agricultural activities at the wind farm site but excludes forestry operations (thinning, harvesting and replanting).

If forestry management activities proceed, the plantation woodlands onsite will undergo changes as they are harvested and subsequently replanted. Although key ecological receptors can fluctuate in abundance and may be found in different locations during different stages of said forestry operations (e.g. post-felling, plantation habitats can be replaced by scrub habitats, which may cause animals that use wooded habitats to move to different locations in the forestry), overall, the habitats and species found at the project will likely remain as they are currently.

8.5 Potential Impacts on Ecology

8.5.1 Potential effects during the construction phase of the Project

8.5.1.1 European Sites

There are no European sites within the proposed wind farm site and grid connection, therefore no direct impacts are predicted during construction for these elements of the project.

The TDR includes works in close proximity to Curraghchase Woods SAC, Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA. However, no works are required within any of these European sites.

An Appropriate Assessment Screening Report and Natura Impact Statement (NIS) have been prepared 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: it can be concluded beyond reasonable scientific doubt, in view of best scientific knowledge on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed project (the wind farm site, grid connection, TDR and biodiversity enhancement areas) individually or in combination with other plans and projects, will have no likely significant effect on the following European sites (or any other European sites):

- Slieve Bernagh Bog SAC (002312)
- Glenomra Wood SAC (001013)
- Lough Derg (Shannon) SPA (004058)
- Slievefelim to Slivermines Mountains SPA (002319)
- Clare Glen SAC (000930)
- Kilkishen House SAC (004077)
- Silvermines Mountains West SAC (002258)
- Slieve Aughty Mountains SPA (004168)

- Barrigone SAC (000432)
- Askeaton Fen Complex SAC (002279)

A Natura Impact Statement was therefore prepared. The Natura Impact statement concluded that, in the light of the conclusions of the assessment on the implications for the European sites concerned (Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA Danes Hole, Poulnalecka SAC and Curraghchase Woods SAC), that the proposed project will not adversely affect the integrity of any European site either individually or in combination with other plans or projects.

8.5.1.2 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 four pNHAs and one NHA within the ZoI of the wind farm and/or the GCR/TDR overlap European Sites for which no likely significant effects have been identified within the AA Screening Report:

- Glenomra Wood pNHA
- Lough Derg pNHA
- Clare Glen pNHA
- Derrygareen Heath pNHA
- Ayle Lower Bog NHA

Three downstream pNHAs within the ZoI of the wind farm and/or the GCR/TDR overlap European sites which were considered as part of the NIS. The possibility of significant effects to these European sites (Lower River Shnnaon SAC and River Shannon and River Fergus Estuaries SPA) was identified:

- Knockalisheen Marsh pNHA
- Fergus Estuary and Inner Shannon, North Shore pNHA
- Inner Shannon Estuary- South Shore pNHA

Two pNHAs within the ZoI of the wind farm overlap European sites which were considered as part of the NIS. The possibility of significant effects to these European sites (Lower River Shnnaon SAC and Danes Hole, Poulnalecka SAC) was identified:

- Castleconnell (Domestic Dwelling, Occupied) pNHA
- Danes Hole, Poulnalecka pNHA

One pNHA within the ZoI of the TDR overlaps a European site which was considered as part of the NIS. The possibility of significant effects to this European site (Curraghchase Woods SAC) was identified:

- Curraghchase Woods pNHA

The grid connection route does not traverse any designated nature conservation site. The SACs/pNHAs described above are outside the footprint of the grid connection and therefore, no direct effects are predicted.

Along the TDR, additional works are required within the existing road network at TDR Nodes 9, located within the existing road network at Dock Road west roundabout which is partly within the Inner Shannon Estuary – South Shore pNHA (000435). No other TDR Nodes (locations requiring works) are located within any designated sites or sites proposed for designation.

The AA Screening concluded the following:

It can be concluded beyond reasonable scientific doubt, in view of best scientific knowledge on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed project (the wind farm site, grid connection, TDR and biodiversity enhancement areas) individually or in combination with other plans and projects, will have no likely significant effect on the following European sites (or any other European sites):

- Slieve Bernagh Bog SAC (002312)
- Glenomra Wood SAC (001013)
- Lough Derg (Shannon) SPA (004058)
- Slievefelim to Slivermines Mountains SPA (002319)
- Clare Glen SAC (000930)
- Kilkishen House SAC (004077)
- Silvermines Mountains West SAC (002258)
- Slieve Aughty Mountains SPA (004168)
- Barrigone SAC (000432)
- Askeaton Fen Complex SAC (002279)

Overlap between European sites and pNHAs/NHAs is summarised in Table 8-61.

Table 8-61: Overlap between European sites and pNHAs/NHAs

Site	Associated EU site	Type of overlap
Inner Shannon Estuary- South Shore pNHA (Overlaps parts of SAC & SPA)	Lower River Shannon SAC; River Shannon and River Fergus Estuaries SPA	Partial overlap of SAC & SPA – south shore & mudflats from Limerick out to Aughinish
Glenomra Wood pNHA (Overlaps SAC)	Glenomra Wood SAC	Overlaps most of SAC & some additional areas
Lough Derg pNHA (Overlaps SPA & SAC)	Lough Derg (Shannon) SPA Lough Derg, North-east Shore SAC	Overlaps SPA & some additional areas. Overlaps SAC. Larger than SAC
Doon Lough NHA	None	None
Gortacullin Bog NHA	None	None
Cloonlara House pNHA	None	None
Castleconnell (Domestic Dwelling, Occupied) pNHA (Within SAC)	Lower River Shannon SAC	Within SAC

Site	Associated EU site	Type of overlap
Knockalisheen Marsh pNHA (Overlaps part of SAC)	Lower River Shannon SAC	Partial overlap of SAC – marshes north of Limerick City
Cloonloum More Bog NHA	None	None
Woodcock Hill Bog NHA	None	None
Lough O'Grady pNHA	None	None
Loughanilloon Bog NHA	None	None
Castle Lake pNHA	None	None
Clare Glen pNHA (Overlaps SAC)	Clare Glen SAC	Overlaps SAC & small additional area
Fergus Estuary and Inner Shannon, North Shore pNHA (Overlaps parts of SAC & SPA)	Lower River Shannon SAC; River Shannon and River Fergus Estuaries SPA	Partial overlap of SAC & SPA – north shore & mudflats from Limerick out to Aughinish
Lough Cullaunyheeda pNHA	None	None
Derrygareen Heath pNHA (Within SPA)	Slievefelim to Silvermines Mountains SPA	Within SPA
Ayle Lower Bog NHA (Overlaps part of SPA)	Slieve Aughty Mountains SPA	Overlaps small part of SPA

Within 15 km of the wind farm site there are a further five NHAs and three pNHAs:

- Doon Lough NHA
- Gortacullin Bog NHA
- Cloonloum More Bog NHA
- Woodcock Hill Bog NHA
- Loughanilloon Bog NHA
- Cloonlara House pNHA
- Lough O'Grady pNHA
- Castle Lake pNHA

None of these sites are overlapped by any European site.

There are no additional national sites other than those detailed above within the potential ZoI of the GCR and TDR.

Potential Direct Impacts

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

The grid connection route does not traverse any designated nature conservation site. All pNHAs/NHAs previously described are outside the footprint of the grid connection, and therefore no direct effects are predicted.

Along the TDR, additional works are required within the existing road network at TDR Node 9, located at Dock Road west roundabout. The existing road network at this location traverses the Inner Shannon Estuary – South Shore pNHA (000435).
At TDR Node 9, a 'track through' route passing through the existing roundabout is required. This will require placement of load bearing material on the north-western side of the roundabout. Amenity grassland GA2 will be affected at Node 9. There will be no direct effects on the interests for which the Inner Shannon Estuary – South Shore pNHA is selected (mudflats, triangular club-rush and summer snowflake), which are not present within the existing road network where works are proposed.

Amenity grassland GA2 is Locally Important (Lower Value); *Temporary Imperceptible* effects are predicted for this highly artificial habitat. The features of interest for this site are mudflats, waterbirds, triangular club-rush *Scirpus triqueter* and summer snowflake *Leucojuin pestirum.* There are no mudflats at or near TDR Node 9, and similarly no habitat for waterbirds (the closest waterbodies are c. 360m northwest).

There is no suitable habitat for triangular club-rush (this species inhabits tidal riverbanks which are not present at TDR Node 9). Triangular club-rush has been recorded in the 1 km grid square overlapping TDR Node 9 (R5455); however, the record is associated with Bunlickey Lake which is not immediately adjacent to the roundabout (located c. 360m northwest).

While summer snowflake has also been recorded in the 1 km grid square overlapping TDR Node 9 (R5455) this species inhabits wet habitats such as willow/alder carr (wet woodland fringing waterbodies) and wet meadows. Neither of these habitats are present at the roundabout overlapped by Nodes 9, which support habitats originating from artificial landscaping following road construction and as noted support drier habitats including amenity grassland and spoil and bare ground. Therefore, there is no suitable habitat for this species within the footprint of TDR Node 9, as confirmed by its absence and the results of the habitat survey.

As such there is no potential for direct impacts to the Inner Shannon Estuary – South Shore pNHA in terms of its features of interest or any supporting habitats.

No other pNHAs are overlapped by TDR Nodes where additional works are required.

Potential Indirect Impacts

Wind Farm Site

In considering the potential for indirect effects via the hydrological network, the following key information on water regions is of relevance; the wind farm site straddles two catchments:

- Lower River Shannon
- Shannon Estuary North

The Inner Shannon Estuary- South Shore pNHA (000435) is located c. 14.8 km from the proposed wind farm. The features of interest for this pNHA are Mudflats, Wetland/Waterbirds, triangular club-rush and summer snowflake. The proposed wind farm site is located too far from the Shannon estuary to give rise to disturbance of birds using the estuary, and the wind farm site itself is not of value to waterbirds, with only limited, non-breeding waterbird activity having been recorded during ornithological surveys. A downstream hydrological connection between the wind farm site and Inner Shannon Estuary- South Shore pNHA exists via the Shannon and the watercourses draining the proposed site, however the instream distance is over 25 km, making any potential for effects via water quality changes on the features of interest for this pNHA are *Temporary Imperceptible*, at the *Catchment scale* and *Reversible.*

The Fergus Estuary and Inner Shannon, North Shore pNHA (002048) is located c. 13.2 km from the proposed wind farm. The features of interest for this pNHA are Wetland/Waterbirds, Estuary and Triangular club-rush. As noted above, the proposed wind farm site is too far from the Shannon estuary to give rise to disturbance of birds using the estuary, and the wind farm site itself is not of value to waterbirds, with only limited, non-breeding waterbird activity having been recorded during ornithological surveys. Downstream hydrological connections between the wind farm site and Fergus Estuary and Inner Shannon, North Shore pNHA exist via the Shannon/watercourses draining the proposed site, and also via the Broadford and Owenogarney Rivers. However, the associated instream distances are over 25 km and 30 km respectively, making any potential for effects via water quality changes on the features of interest for this pNHA are *Temporary Imperceptible*, at the *Catchment scale* and *Reversible.*

Doon Lough NHA (000337) which is designated for Peatlands, is located c. 8 km downstream of the proposed wind farm, connected via the Broadford River. Due to the terrestrial nature of the qualifying interest for this site (Raised Bog), this NHA is unlikely to be susceptible to significant effects via water quality changes transmitted along the connection detailed above. Effects via water quality changes on the features of interest for this pNHA are *Temporary Imperceptible*, at the *Catchment scale* and *Reversible.*

Castle Lake pNHA (000239) is located c. 17 km downstream of the proposed wind farm, connected via the Broadford River, Doon Lough and Owenogarney River. The features of interest for this pNHA are described as open water, hazel scrub and ash/oak woodland. While there is potential for effects on water quality at this pNHA via the pathway described above, the in-stream distance between the two sites means any potential effects are predicted to be *Temporary Imperceptible*, at the *Catchment scale* and *Reversible.*

Lough Derg pNHA (000011) is upstream of the proposed wind farm, being located c. 6 km upstream of the confluence where the River Black which drains the proposed site, enters the Shannon. This pNHA is of interest features for a number of terrestrial habitats and aquatic species; there is no potential for effects on these receptors due to the upstream location of the pNHA relative to the proposed site. This pNHA is also of interest for waterbirds, including cormorant, tufted duck and common tern. While there is potential for effects on these interests due to their mobility, the ornithological assessment determined the proposed site is not of importance to waterbirds. Observations of waterbirds, including mallard, cormorant, whooper swan, greylag geese, curlew, lapwing, herring gull, black-headed gull and whimbrel occurred infrequently, with these birds being observed outside the site or traversing the site briefly. The ornithological assessment found there is no potential breeding habitat for these species at or near the proposed site, and that the proposed development site is not important for these species. The proposed wind farm will not affect populations in the wider area. Effects are predicted to be *Temporary Imperceptible*, at the *County scale* and *Reversible.*

Knockalisheen Marsh pNHA (002001) is upstream of the proposed wind farm, being located along the north-west bank of the Shannon where before it enters Limerick City. This pNHA is over 23 km downstream of the proposed wind farm and is of interest for wetland habitat occurring within it's boundary, although there is some connectivity with the Shannon. Considering the large instream distance between the two sites, it is highly unlikely that effects via water quality arising from wind farm construction would affect this pNHA. Effects are predicted to be *Temporary Imperceptible*, at the *Catchment scale* and *Reversible.*

Clare Glen pNHA (000930) is upstream of the proposed wind farm, being located upstream of the Mulkear/Shannon confluence north-east of Limerick City. This pNHA is of interest for habitats occurring within it's boundary (old sessile oak woods and Killarney fern), and as such is not susceptible to indirect effects from the proposed wind farm development.

Cloonlara House pNHA (000028) is located c. 7.9 km south of the proposed wind farm. This pNHA is of interest for Leisler's bat. This species has been recorded traveling up to 13.4 km to foraging grounds (McAney, 2006); as such there is potential for Leisler's bats roosting at Cloonlara House to forage at the proposed wind farm site. Moderate-High levels of activity were assigned by Ecobat analysis for Leisler's bat for both years of static detector surveys. This species was recorded using woodlands, and linear habitats including woodland edges and hedgerows/treelines at the proposed site as foraging grounds. While foraging habitat for this species will be affected at the proposed site, it is noted that felling will create new edge habitats in addition to the loss and alteration of existing linear features. The loss of potential foraging habitat within the study area has been minimised by design, and similar habitats (broadleaved and conifer woodland, scrub and hedgerows/treelines) are common in the wider landscape, which retains a relatively high amount of semi-natural characteristics. Considering these factors, it is considered that construction of the proposed wind farm will result in *Long-term, Significant Reversible effects* at the *Regional* level*;* however, Leisler's bats associated with Cloonlara House pNHA using the proposed site to forage will be able to do continue to do so during and after construction.

Castleconnell (Domestic Dwelling, Occupied) pNHA (000433), located c. 8.3 km south of the proposed site, is of interest for Daubenton's bat. The primary foraging habitat for this species is rivers, a high-quality example of which is represented by the River Shannon adjacent to this pNHA (c. 60m from roost). As such it is highly unlikely Daubenton's bats using this roost would occur at the proposed site. The potential for indirect effects due to pollution of watercourses is *Temporary Imperceptible* at the *Catchment scale* and *Reversible.*

Lough Cullaunyheeda pNHA (001017), located c. 14.1 km south of the proposed site, is of interest for waterbirds, including tufted duck and lapwing. This site is not hydrologically connected with the proposed wind farm. As such it is only of interest in terms of potential connectivity via it's mobile features of interest, i.e. birds. As noted above in the case of Lough Derg pNHA, the ornithological assessment determined the proposed site is not of importance to waterbirds. Mallard, cormorant, whooper swan, greylag geese, curlew, lapwing, herring gull, black-headed gull and whimbrel occurred infrequently in and around the proposed site. There is no potential breeding habitat for these species at or near the proposed site, and the proposed development site is not important for these species and the proposed wind farm will not affect populations in the wider area. Effects are predicted to be *Temporary Imperceptible*, at the *County scale* and *Reversible.*

Lough O'Grady pNHA (001019) located c. 12.4 km north of the proposed site, is of interest for waterbirds, including Greenland white-fronted geese, mallard and lapwing. This site is not hydrologically connected with the proposed wind farm. No Greenland white-fronted geese were recorded at or near the proposed site. The ornithological assessment determined the proposed site is not of importance to waterbirds. Mallard and lapwing occurred infrequently in and around the proposed site. There is no potential breeding habitat for these species at or near the proposed site, and the proposed development site is not important for these species and the proposed wind farm will not affect populations in the wider area. Effects are predicted to be *Temporary Imperceptible*, at the *County scale* and *Reversible.*

The following sites: Glenomra Wood pNHA (001013), Gortacullin Bog NHA (002401), Cloonloum More Bog NHA (002307), Woodcock Hill Bog NHA (002402), Loughanilloon Bog NHA (001020), Derrygareen Heath pNHA (000931) and Ayle Lower Bog NHA (000993) are of interest for habitats occurring within their boundaries and are not ecologically linked with the proposed site. As such potential indirect effects are excluded for these sites.

Grid Connection

The rivers crossed by the proposed grid connection drain to the Shannon, and as such the only hydrologically linked pNHAs are the Inner Shannon Estuary- South Shore pNHA (000435) and the Fergus Estuary and Inner

Shannon, North Shore pNHA (002048) which are situated downstream of the GCR. The instream distance from the closest GCR watercourse crossing to these pNHAs is c. 9 km.

As such, there is potential for indirect effects via changes in water quality to occur. The aquatic assessment identified the potential for grid connection works to give rise to *slight* negative, *short-term* effects in the local context. Considering the in-stream distance of 9 km and localised context of potential effects, it is considered on a precautionary basis that the GCR works could result in *Imperceptible Short-term effects* at the *Catchment* scale which area *Reversible* on the Inner Shannon Estuary- South Shore pNHA and the Fergus Estuary and Inner Shannon, North Shore pNHA.

Potential indirect construction phase effects on aquatic ecology, in the absence of mitigation, are assessed as being *slight negative, short-term* in the *local* context and *reversible*.

No other NHAs or pNHAs are susceptible to indirect effects from the proposed GCR.

Turbine Delivery Route

As noted above, no direct effects are predicted to result to the Inner Shannon Estuary – South Shore pNHA from works at TDR Node 9. The spread of the invasive species Norway maple or non-native small-leaved lime is not predicted to arise from the enabling works, since tree felling will not be required, and due to the habitats for which the pNHA is designated not being present adjacent to the identified works areas. Any runoff of sediment towards the pNHA will not result in negative effects due to the limited scale of works (placement of load bearing surface and removal of road signs). The Inner Shannon, North Shore pNHA (002048) is not susceptible to changes in water quality for the same reason (limited scale of works). Effects are predicted to be *Temporary Imperceptible*, at the *Local scale* and *Reversible.*

As no designated sites are within the potential ZoI of any other node with invasive species present, the spread of invasive species to designated sites is not predicted.

Disturbance of waterbirds using the Inner Shannon Estuary – South Shore pNHA is extremely unlikely due to the limited scale of works, and the distance between works and the nearest waterbodies in the pNHA (c 360m away). Existing heavy traffic in this area creates a baseline of pre-existing noise. In addition, screening vegetation in the form of blocks of mature woodland and treelines are present in the intervening area.

Works are required at TDR Nodes 20 and 23 which are over 23 km upstream of the Inner Shannon Estuary – South Shore pNHA and Inner Shannon, North Shore pNHA. The proposed works at these locations consists of tree trimming (Nodes 20 and 23) and placement of a load bearing surface in the road verge (Node 23). As such considering their limited scale and distance upstream will not give rise to effects on these downstream pNHAs located along the Shannon Estuary.

TDR Nodes 20 and 23 are not located within the core sustenance zones (CSZs) of any pNHAs which include bat species as their conservation interests.

TDR Node 6 (N69 tree canopy) includes trimming of overhanging branches along the N69, hich could include trees within c. 100m of Curraghchase Woods pNHA. The pNHA is designated for lesser horseshoe bat. Although the proposed works are within the core sustenance zone for the bat species, there is no tree removal proposed and this species does not roost in trees (BCI and Vincent Wildlife Trust [8]). Potential for the spread of invasive species via machinery used at other TDR nodes was identified as a *Long-term Slight Effect*.

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[8] Accessed December 2022

8.5.1.3 Habitats and Flora

Potential Direct Impacts

Table 8-62 details the areas covered by all habitats and habitat mosaics within the habitat survey study area. Habitats and mosaics which are not subject to loss are not discussed further in terms of habitat loss.

Table 8-62 below summarises the habitat loss which will result from the proposed development. Table 8-63 summarises habitat loss for linear habitats. Areas of habitat loss are depicted in Figure 8-18.

Table 8-62: Habitat loss (habitat areas) within the wind farm site

Habitat	Key receptor?	Area (Ha) within Ecology Study Area	% of total Study Area	**Option 1** *Hub height 106m* *Blade length 65.5m*		**Option 2** *Hub height 102.5m* *Blade length 66.5m*		**Option 3** *Hub height 110m* *Blade length 66.5m*		**Option 4** *Hub height 105m* *Blade length 68m*		**Option 5** *Hub height 107.5m* *Blade length 69m*	
				Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)
ED2- Spoil and bare ground	No	1.1	0.5%	0.3	27%	0.3	27%	0.3	27%	0.3	27%	0.3	27%
ED3- Recolonising bare ground	Yes	1.4	0.6%	0.3	21%	0.3	21%	0.3	21%	0.3	21%	0.3	21%
GA1- Improved agricultural grassland	No	59.7	26.9%	4.4	7%	4.4	7%	4.4	7%	4.4	7%	4.4	7%
GA1/GS2 - Improved agricultural grassland/ Dry meadows and grassy verges	Yes	1.2	0.5%	0.2	17%	0.2	17%	0.2	17%	0.2	17%	0.2	17%

Habitat	Key receptor?	Area (Ha) within Ecology Study Area	% of total Study Area	Option 1 *Hub height 106m* *Blade length 65.5m*		Option 2 *Hub height 102.5m* *Blade length 66.5m*		Option 3 *Hub height 110m* *Blade length 66.5m*		Option 4 *Hub height 105m* *Blade length 68m*		Option 5 *Hub height 107.5m* *Blade length 69m*	
				Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)
GA1/GS4- Improved agricultural grassland/ Wet grassland	Yes	12.1	5.4%	1.2	10%	1.2	10%	1.2	10%	1.2	10%	1.2	10%
GS4- Wet grassland	Yes	13.2	5.9%	0.9	7%	0.9	7%	0.9	7%	0.9	7%	0.9	7%
GS4/WS1- Wet grassland/Scrub	Yes	3.4	1.5%	0.8	23%	0.9	26%	0.8	23%	0.9	26%	0.9	26%
WD1- Mixed broadleaved woodland	Yes	30.9	13.9%	1.8	6%	2.0	6%	1.8	6%	2	6%	1.9	6%

Habitat	Key receptor?	Area (Ha) within Ecology Study Area	% of total Study Area	Option 1 Hub height 106m Blade length 65.5m		Option 2 Hub height 102.5m Blade length 66.5m		Option 3 Hub height 110m Blade length 66.5m		Option 4 Hub height 105m Blade length 68m		Option 5 Hub height 107.5m Blade length 69m	
				Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)
WD1/WS1- Mixed broadleaved woodland/Scrub	Yes	5.7	2.6%	0.6	10%	0.6	10%	0.6	10%	0.6	10%	0.6	10%
WD4- Conifer plantation	No	50.2	22.6%	8.3	16%	8.6	17%	8.2	16%	8.6	17%	8.5	17%
WN2- Oak-ash-hazel woodland	Yes	1.7	0.8%	0.05	3%	0.05	3%	0.05	3%	0.05	3%	0.05	3%
WS1- Scrub	Yes	13.7	6.2%	1.5	11%	1.6	12%	1.4	10%	1.6	12%	1.6	12%
WS1/ED2- Scrub/Spoil and bare ground	Yes	0.1	0.05%	0.01	10%	0.01	10%	0.01	10%	0.01	10%	0.01	10%

Habitat	Key receptor?	Area (Ha) within Ecology Study Area	% of total Study Area	Option 1 *Hub height 106m* *Blade length 65.5m*		Option 2 *Hub height 102.5m* *Blade length 66.5m*		Option 3 *Hub height 110m* *Blade length 66.5m*		Option 4 *Hub height 105m* *Blade length 68m*		Option 5 *Hub height 107.5m* *Blade length 69m*	
				Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)	Loss (area) (Ha)	% loss of total habitat type (%)
WS1/ED3-Scrub/Recolonising bare ground	Yes	7.1	3.2%	0.8	11%	0.8	11%	0.8	11%	0.8	11%	0.8	11%
WS1/HD1-Scrub/Dense bracken	Yes	1.5	0.7%	0.02	1%	0.02	1%	0.02	1%	0.02	1%	0.02	1%

Table 8-63: Habitat loss/alteration (linear habitats) as a result of the wind farm site

Habitat	Key receptor?	Total length within study area (m)	Option 1		Option 2		Option 3		Option 4		Option 5	
			Loss (length) (m)	% Of total habitat type loss (%)	Loss (length) (m)	% Of total habitat type loss (%)	Loss (length) (m)	% Of total habitat type loss (%)	Loss (length) (m)	% Of total habitat type loss (%)	Loss (length) (m)	% Of total habitat type loss (%)
Hedgerows WL1	Yes	8,802	989	11%	1,098	12%	920	10%	1,082	12%	1,062	12%
Treelines WL2	Yes	4,657	197	4%	206	5%	190	4%	205	5%	201	5%
Upland eroding river FW1	Yes	4,867	32	0.7%	32	0.7%	32	0.7%	32	0.7%	32	0.7%

Wind Farm Site

The construction of access roads, temporary compound, on-site substation, foundations and hard standings as well as the excavation of cable trenches and drainage 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 eight proposed turbines (foundations, hard standings, and associated felling 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 26.9 % (59.7 Ha) of the study area. This is followed by conifer plantation which accounts on its own for 22.6 % (50.2 Ha) of the study area. Mixed broadleaved woodland is the third most abundant habitat within the study area, accounting for 13.9 % (30.9 Ha) of the total.

The footprint of the proposed development including felling buffers, will range between c. 21.0 – 21.7 Ha or c. 9 - 10 % of the total study area.

Approximately 7 % (4.4 Ha) of improved agricultural grassland (GA1) will be lost within the proposed development footprint. 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.

A range of semi-natural grassland habitats and mosaics are present in the study area. Three of these are overlapped by the proposed footprint. In terms of collective loss of all grassland habitats, c. 7 % (6.7 Ha) of this grouping will be lost. When focused on semi-natural grasslands only (omitting pure improved agricultural grassland), the same percentage of c. 7 % (2.3 Ha) will be lost.

The most abundant type, wet grassland, will be subject to loss of c. 7 % (0.9 Ha) of the total of this type within the study area. It is noted that there will be no loss of Annex I- linked wet grassland, which is located outside the proposed footprint. A *Long-term Slight Reversible* effect at the *Local scale* is predicted for this habitat.

Improved agricultural grassland/ wet grassland will be subject to loss of c. 10 % (1.2 Ha) of the total of this mosaic within the study area. Improved agricultural grassland/ dry meadows and grassy verges will be subject to loss of c. 17 % (0.2 Ha) of the total of this mosaic within the study area. A *Long-term Not Significant Reversible* effect at *Local scale* is predicted for these more artificial habitats.

In terms of collective loss of mature/semi-mature wooded habitats (including conifer plantation), c. 12 % (10.7 11.3 Ha) of this grouping will be lost. When focused on more natural mature/semi-mature wooded habitats only (omitting conifer plantation), the percentage loss is c. 6 - 7 % (2.5 – 2.7 Ha).

The highest amount of woodland habitat loss will apply to conifer plantation, with between 16 – 17 % (8.2 – 8.6 Ha) of this habitat 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.

An additional 3.2 Ha (6 %) of immature conifer plantation will also be felled in order to convert the area north of T5 to broadleaved (oak) woodland, in order to facilitate habitat enhancement measures. As such, this felling is identified as a separate category than felling to facilitate the wind farm development.

Mixed broadleaved woodland is present within the proposed footprint. A total of c. 6 % (1.8 – 2.0 Ha) of this habitat type will be lost. It is important to distinguish between the lower and higher value locally important sub-types represented by immature ash plantations and semi-mature woodland around the quarry margins, and the long-established woodland represented by Ballymoloney Woods. The latter is of county importance, and loss of this sub-type is limited to 0.4 Ha, or c. 2% or the total amount of long-established woodland in the study area. The felling is associated with a section of access track, which has been positioned to make use of an existing track through the woodland in order to minimise felling. The track has also been positioned near the eastern edge of the woodland to minimise habitat fragmentation. The higher value locally important mixed broadleaved woodland will be subject to loss of between 0.5 – 0.6 Ha (c. 10 - 12% of sub-type), while loss of lower value locally important mixed broadleaved woodland will be between 1.2 – 1.3 Ha (c. 19 – 21% of sub-type) The higher and lower value locally important mixed broadleaved woodland will be subject to a *Long-term Not Significant Reversible* effect at the *Local scale*.

Considering the maturity of Ballymoloney Woods, but also the small percentage which will be lost and minimisation of habitat fragmentation, a *Permanent Slight Reversible* effect at the *County scale* is predicted for this woodland.

Oak-ash-hazel woodland growing in the steep-sided valley carved by the River Black is overlapped by a section of proposed access track and clear span bridge. A total of c. 3 % (0.05 Ha) of this habitat type will be lost. A *Long-term Moderate Reversible* effect at the *Local scale* is predicted for this habitat type.

Mixed broadleaved woodland/Scrub is also present within the proposed footprint. A total of c. 10 % (0.6 Ha) of this habitat type will be lost. A *Long-term Slight Reversible* effect at the *Local scale* is predicted for this habitat type.

Scrub is also present within the proposed footprint. Between c. 10-12 % (1.4 – 1.6 Ha) of this habitat type will be lost. A variety of habitat mosaics comprised of scrub and open habitats will also be affected. Wet grassland/scrub will be subject to loss of c. 23 – 26% (0.8 - 0.9 Ha) of the total area of this mosaic within the study area. Scrub/spoil and bare ground will be subject to loss of c. 10 % (0.01 Ha) of the total area of this mosaic within the study area.

A total of c. 11% (0.8 Ha) of scrub/recolonising bare ground within the study area will be lost. Scrub/dense bracken will be subject to loss of c. 1 % (0.02 Ha) of the total area of this mosaic within the study area.

Scrub and mosaics containing scrub will be subject to *Medium-term Not Significant Reversible* effects at the *Local scale*.

Two disturbed habitats will also be subject to loss. A total of c. 27 % (0.3 Ha) of spoil and bare ground will be lost. This is comprised of existing gravel access tracks which will be converted to wind farm access tracks This disturbed and artificial habitat is of negligible ecological value and as such is not considered further.

Recolonising bare ground will be subject to loss of c. 21 % (c. 0.3 Ha) of the total area of this mosaic within the study area. This is attributable primarily to the southern temporary construction compound. A *Medium-term Not Significant Reversible* effect at the *Local scale* is predicted for this habitat type.

Between 920m and 1,098m of hedgerows will be lost within the development footprint. This represents between 10-12 % of the total length of hedgerow within the study area. This is considered to translate into a *Long-term Moderate Reversible* effect at the *Local scale*.

Between 190m and 206m of treelines will be lost within the development footprint. This represents between 4-5 % of the total length of treelines within the study area. Considering the relatively small proportion of this habitat which will be lost and localised nature of loss, a *Long-term Slight Reversible* effect at the *Local scale* is predicted.

A section of unmapped upland eroding river 27m in length will be culverted beneath the proposed T7 hard standing. This section is an unmapped ephemeral stream with no fisheries value draining towards the Kilroughil stream. The upper reaches of the River Black are intersected by an access track between T5 and T6. The proposed crossing method of installing a precast box culvert will affect 5m of this watercourse, also categorised as upland eroding river. Similar to the un-mapped stream discussed above, the River Black at this point has no fisheries value. The overall figure of 32m represents 0.7 % of the total length of upland eroding rivers within the study area. Considering the small proportion of this habitat which will be lost, localised nature of loss and lack of fisheries value, a *Long-term Imperceptible Reversible* effect at the *Local scale* is predicted.

Upland eroding river represented by the River Black is intersected by a section of proposed access track; however, habitat loss will not occur at this location as the bridge will not directly affect the stream bed. As such no impact in terms of aquatic habitat loss will occur at this location. Potential effects on water quality are discussed in Section 8.5.1.7.

Grid Connection

The proposed grid connection traverses the wind farm site before exiting the site and travelling south-east along the R466. The habitat loss within the wind farm site associated with the GCR is encompassed within the footprint of proposed access tracks. The section along public roads may result in the temporary loss of limited sections of dry meadows and grassy verges along road edges. Any potential effects on hedgerows and/or treelines will be limited to branch trimming and will not decrease the overall length of these habitats.

Lowland/depositing Rivers are within the proposed GCR footprint; however, habitat loss will not occur as this habitat will be traversed via existing crossing structures (minor watercourses) or HDD (EPA mapped rivers). The proposed entry and exit points and associated work areas are within the public road corridor. Potential effects on water quality are discussed in Section 8.5.1.7

The proposed crossing methodology for the Blackwater, Glenomra Wood Stream, Glenlon South and Bridgetown (Clare) watercourses is horizontal directional drilling (HDD) which will avoid instream works and thereby avoid direct impacts on Lowland/Depositing Rivers. The predicted impact to habitats due to construction of the grid connection is predicted to be a *Short-term Imperceptible Reversible* effect at the *Local scale*.

Turbine Delivery Route

Habitat loss associated with the TDR is detailed in Section 8.3.5.3 and is limited to laying of temporary hardcore along road verges and grassed areas, trimming of vegetation, hedgerow cutting and tree felling. The habitats at TDR Nodes are largely made up of buildings and artificial surfaces, with adjacent vegetated habitats including hedgerows, treelines, hedgerow/treeline mosaic, ornamental non-native shrub, mixed broadleaved woodland, amenity grassland, dry meadows and grassy verges, stone walls and other stonework, drainage ditches and immature woodland.

Where minimal hedgerow/vegetation trimming, trimming or cutting of ornamental/non-native shrub, and temporary placement of hardcore is required, a *Short-term Imperceptible Reversible Local* effect will occur.

Where tree felling is required, *Long-term Moderate Reversible Local scale* effects to treelines and hedgerows may occur. Felling affecting treelines and hedgerows is required at TDR Nodes 30-33.

Potential Indirect Impacts

Indirect impacts on habitats and flora include the spread of invasive species which could be spread during construction works. During the site walkovers a total of seven invasive and/or non-native species were observed at the wind farm site, namely Japanese knotweed, Himalayan knotweed, cherry laurel, fuchsia, Wilson's honeysuckle, Lawson cypress and New Zealand holly. None of these species are overlapped by or in close proximity to proposed infrastructure. The risk of impact and legal status of these species is detailed in Table 8-27.

A total of 14 invasive and/or non-native species were recorded along the grid connection route. These were butterfly bush, cherry laurel, fuchsia, giant hogweed, Himalayan honeysuckle, Japanese knotweed, montbretia, red osier dogwood, snowberry, sycamore, traveller's joy, wall cotoneaster, Wilson's honeysuckle and winter heliotrope. The risk of impact and legal status of these species is detailed in Table 8-28. A number of these species including giant hogweed, montbretia, snowberry and winter heliotrope could potentially be spread by grid cable installation activities due to their close proximity to the route.

A total of 12 invasive and/or non-native species were recorded across 12 locations at TDR Nodes. The species recorded are red osier dogwood, traveller's joy, butterfly bush, Norway maple, Japanese rose, winter heliotrope, small-leaved lime, snowberry, giant butterbur, sycamore, Wilson's honeysuckle and fuchsia. A historical record of Spanish bluebell at Node 8 is also considered to be relevant. Of the species recorded, red osier dogwood, traveller's joy, butterfly bush, snowberry, sycamore, Wilson's honeysuckle and winter heliotrope occur in areas which could be affected by TDR works. The risk of impact and legal status of these species is detailed in Table 8-29.

Construction works within the wind farm site, GCR and TDR could affect the existing environment by facilitating the spread of these species. It is considered that prior to mitigation a *Long-term Moderate Reversible* effect at the *County scale* 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. 6) identified the wind farm site as a major construction site, which will result in the sedimentation of watercourses occurring up to 100m from the source, with PM10 deposition and effects on vegetation occurring up to 25m (potential for reduction in photosynthesis through shading or chemical interference; potential for adverse reactions if alkaline dust enters water; potential for alterations to soil chemistry). A *Short-term Moderate Reversible* effect at the *Local scale* 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* effect at the *Local scale.* Potential effects on the aquatic receiving environment are considered in detail in Section 8.5.1.7.

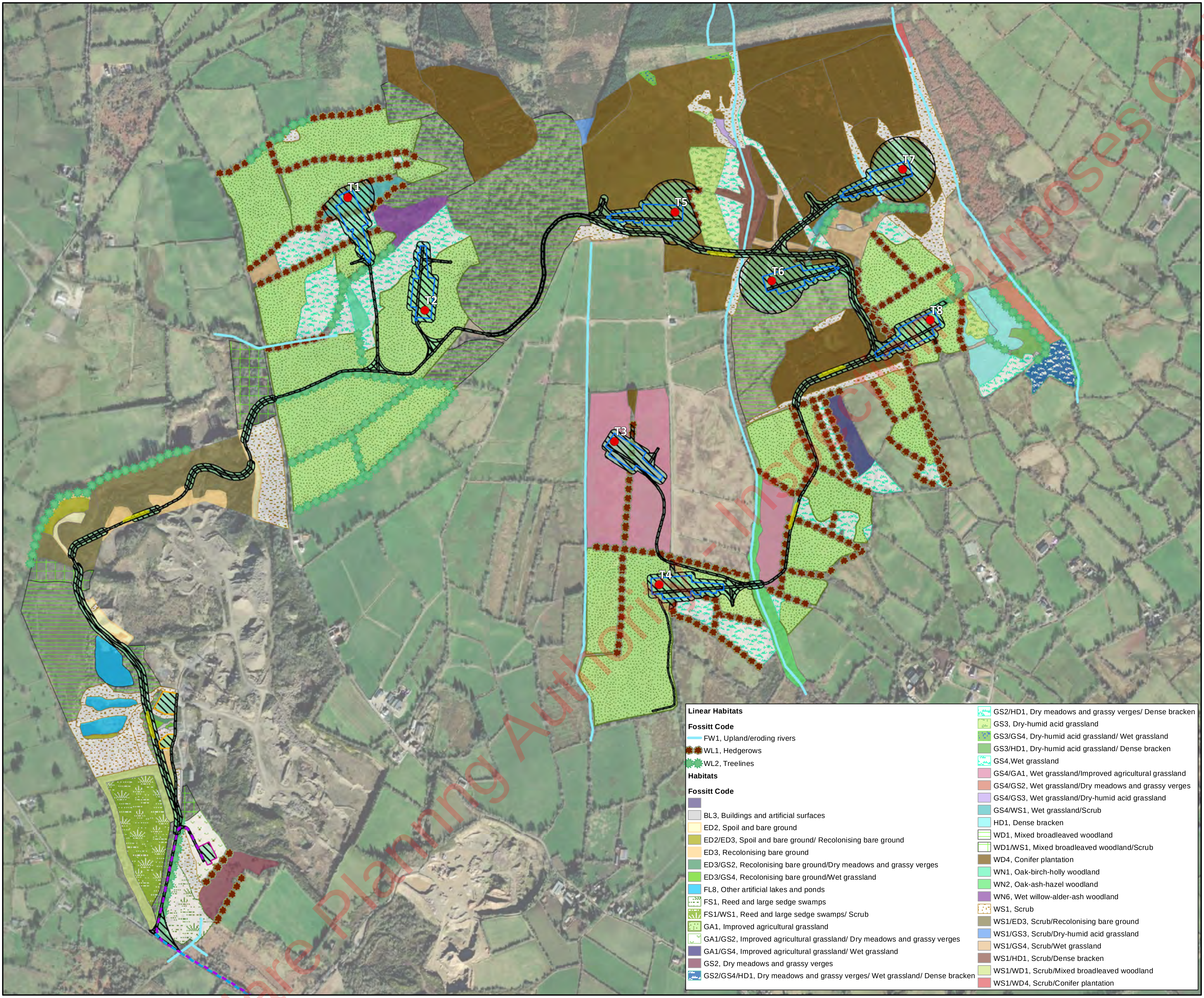
Other artificial lakes and ponds (FL8) could potentially be subject to surface runoff from nearby access tracks. This habitat is not considered sensitive to the limited risk of siltation posed by this source however and as such any effects are predicted to be *Short-term Imperceptible* at the *Local scale*.

Any alterations in surface water flows will be temporary and are predicted to result in *Temporary Imperceptible Reversible* effects on terrestrial habitats at the *Local scale*.

The dewatering of excavations for turbine base construction could result in the drying out of surrounding habitats, including wet grassland/scrun, conifer plantation, scrub and improved agricultural grassland/wet grassland. As dewatering is a temporary measure, *Temporary Slight-Moderate Reversible* effects are predicted at the *Local scale*.

Path: R:\Map Production\2020\P20-003\Workspace\EIAR\Ecology\P20-003_GIS_Fig8-18_Habitat_Loss_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Linear Habitats

Fossitt Code

- FW1, Upland/eroding rivers
- WL1, Hedgerows
- WL2, Treelines

Habitats

Fossitt Code

- ▨
- BL3, Buildings and artificial surfaces
- ED2, Spoil and bare ground
- ED2/ED3, Spoil and bare ground/ Recolonising bare ground
- ED3, Recolonising bare ground
- ED3/GS2, Recolonising bare ground/Dry meadows and grassy verges
- ED3/GS4, Recolonising bare ground/Wet grassland
- FL8, Other artificial lakes and ponds
- FS1, Reed and large sedge swamps
- FS1/WS1, Reed and large sedge swamps/ Scrub
- GA1, Improved agricultural grassland
- GA1/GS2, Improved agricultural grassland/ Dry meadows and grassy verges
- GA1/GS4, Improved agricultural grassland/ Wet grassland
- GS2, Dry meadows and grassy verges
- GS2/GS4/HD1, Dry meadows and grassy verges/ Wet grassland/ Dense bracken
- GS2/HD1, Dry meadows and grassy verges/ Dense bracken
- GS3, Dry-humid acid grassland
- GS3/GS4, Dry-humid acid grassland/ Wet grassland
- GS3/HD1, Dry-humid acid grassland/ Dense bracken
- GS4,Wet grassland
- GS4/GA1, Wet grassland/Improved agricultural grassland
- GS4/GS2, Wet grassland/Dry meadows and grassy verges
- GS4/GS3, Wet grassland/Dry-humid acid grassland
- GS4/WS1, Wet grassland/Scrub
- HD1, Dense bracken
- WD1, Mixed broadleaved woodland
- WD1/WS1, Mixed broadleaved woodland/Scrub
- WD4, Conifer plantation
- WN1, Oak-birch-holly woodland
- WN2, Oak-ash-hazel woodland
- WN6, Wet willow-alder-ash woodland
- WS1, Scrub
- WS1/ED3, Scrub/Recolonising bare ground
- WS1/GS3, Scrub/Dry-humid acid grassland
- WS1/GS4, Scrub/Wet grassland
- WS1/HD1, Scrub/Dense bracken
- WS1/WD1, Scrub/Mixed broadleaved woodland
- WS1/WD4, Scrub/Conifer plantation

▨ Habitat Loss Buffer - Option 2 (maximum footprint)
🟩 Habitat Loss Buffer - Option 3 (minimum footprint)
● Proposed Turbine Layout
— Onsite Access
- - - Turbine Delivery Route
- - - Grid Connection Route
☐ Substation Compound
☐ Construction Compound
☐ Turbine Hardstanding
🟨 Passing Bays

TITLE:
Habitat Loss

PROJECT:
Fahy Beg Wind Farm, Co. Clare

FIGURE NO: 8.18
CLIENT: RWE Renewables Ireland Ltd.
SCALE: 1:10000 **REVISION:** 0
DATE: 05/12/2022 **PAGE SIZE:** A3

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8.5.1.4 Mammals (excluding Bats)

Potential Direct Impacts

The construction of new tracks, turbine hardstanding areas, substation in addition to felling buffers will lead to a permanent loss of approximately 21.0 – 21.7 Ha or c. 9 - 10 % of habitats within the study area.

In parallel, the felling and maintenance of buffer zones surrounding turbines located in plantation woodlands, scrub and near hedgerows/treelines will result in habitat alteration (from wooded to open habitats). The majority of wooded 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 wind farm site will not result in a significant negative impact on the distribution of local protected mammal fauna including Pygmy Shrew, Irish Hare, Irish Stoat, and Hedgehog.

Any unmitigated effects on these species will be a *Short-term Imperceptible Reversible* effect at the *Local scale*.

No effects on mammals (excluding bats) are envisaged as a result of habitat loss along the TDR or grid connection route as the habitats are highly modified/disturbed and due to the limited footprint of works.

Badger

A total of six badger setts were noted within the study area, including subsidiary, outlier, annex and main setts.

Within these, a total of three setts are located in areas which may be impacted (indirectly) by the proposed development. The closest sett is located c. 19 m from a proposed access track felling corridor and c. 10m from proposed woodland fencing. No setts will be lost within the footprint of the proposed development. One sett will require hard blocking, while two more will require either seasonal restrictions (50m buffer during breeding season) or hard blocking outside the breeding season. The remaining three setts do not require any actions other than monitoring.

Details on the location and status of badger setts are included in the confidential Appendix [Badger Setts].

If construction and/or felling were to be carried out in close proximity to an active sett particularly during the breeding season (December to June), this could result in a *Medium-term Significant Reversible* effect at the *Local scale* (prior to mitigation).

Pine Marten

The presence of this species was within the proposed site was confirmed by frequent and widely distributed observations of scat, and a trail camera image of pine martin traversing woodland within the quarry. No pine marten dens were observed. As the presence of pine marten has been confirmed, a precautionary approach is required, and it is assumed that they could occur in any area of woodland where felling is proposed.

Dens are normally used only during the breeding season. Pine marten use refuge sites outside these periods which are less visible and more casual. Therefore, it is considered that the limited loss of wooded habitats is unlikely to impact negatively on the local pine marten population. There is however still the possibility that pine marten breeding or resting sites may be disturbed during any felling operations. It is considered that prior to mitigation a *Short-term Significant Reversible* effect on pine marten could arise at the *Local scale*.

Red Squirrel

This species was not recorded during surveys, but occurs in desktop records in the locality, and the wooded habitats onsite are suitable for red squirrel. The total loss of mature/semi-mature wooded habitats within the land ownership boundary will be between 10.7 -11.3 Ha or 12 % of the total habitat type within the study area. There are however ample areas of conifer plantation and mixed broadleaved woodland 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 of woodland where felling is proposed. It is noted the presence of pine marten is also favourable for red squirrel as they prey on grey squirrel, reducing competitive and pathogenic pressures from this non-native species.

There is therefore the possibility that breeding red squirrel or squirrels in a state of semi-torpor may be disturbed during any clear-felling operations. It is considered that prior to mitigation a *Short-term Significant Reversible* effect on red squirrel could occur at the *Local scale*.

Otter

No holts were recorded during surveys at watercourses within 150m of any elements of the proposed wind farm. Therefore, there shall be no direct effects on otter during wind farm construction.

Otter activity was recorded on the Blackwater (Clare) river and Glenomra wood stream at and within 150m of these crossing points. Prints were recorded, in addition to an inactive slide c. 100m downstream of the Blackwater (Clare) crossing point.

Otter prints were recorded downstream of TDR Node 20 (along Ballyteige 25 River) during aquatic surveys; no holts or couch sites were recorded. Considering the non-invasive nature of works proposed at this node (tree trimming) and that no otter resting or breeding places were recorded within 150m, there shall be no direct effects on otter during TDR accommodation works. No otter signs were recorded at any other TDR nodes.

Considering the limited amount of activity recorded and absence of holts within 150m of the proposed project, direct effects on otter are limited to potential disturbance. Effects have been identified as *Temporary, Not significant Local* and *Reversible*.

Potential Indirect Impacts

The construction phase of the development may result in temporary disturbance to fauna, however as this will be temporary in duration, and given the habitats present in the wider environment, affected mammals will be able to move to other locations in the wider area until the disturbance has ceased. There is the potential for disturbance to badger setts within and in close proximity to construction works (closest sett is located c. 19m form proposed access track felling buffer; two other setts are within 50m of proposed infrastructure). As such, the potential exists for a *Short-term Significant Reversible* effect on badger at the *Local scale,* prior to mitigation.

Prior to mitigation, there is potential for indirect effects to otter through the transport of pollutants and/or contaminants to downstream watercourses which could negatively affect the aquatic animals such as salmonids on which otter depend. These effects could occur as the result of felling and/or construction activities. As such, any effects on otter prior to mitigation are predicted to be *Short-term Significant* at the *Local scale*. and *Reversible*.

Considering the non-invasive nature of works proposed at TDR nodes intersecting rivers, and that no otter resting or breeding places were recorded within 150m of these nodes, there shall be no indirect effects on otter during TDR accommodation works.

8.5.1.5 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
3. Disturbance to foraging bats
4. Lighting

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

Wind Farm Site

Direct effects on bats during construction include vegetation removal, resulting in a loss of potential roost sites in mature trees.

No demolition or modification of existing buildings has been proposed as part this project, notably the derelict building occupied by small numbers of common pipistrelle and lesser horseshoe bat 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, felling required to implement proposed turbulence reduction buffers/bat feature buffers has the potential to directly affect roosting bats.

Felling is proposed for the following areas around turbines:

- Scrub removal and surgery of broadleaf trees to facilitate the sub-station and access track through the Roadstone quarry.
- The removal or surgery of broadleaf trees within the Ballymoloney woodland for the construction of the access track between turbines.
- The removal of ash and hawthorn treeline at T1
- The removal of the hawthorn hedgerow near T3, T4, & T8
- The removal of conifer plantation at T5 & T6. There is a single ash tree of moderate potential within 100m of the turbine location T5; this is within the minimum proposed bat felling buffer for T5
- The removal of conifer and mixed broadleaf plantation surrounding T7.

As highlighted in the baseline survey results, the beech woodland in the west of the site supports mature trees, classed as having largely moderate PRFs with the occasional high PRF. The proposed assess track through this woodland will require vegetation removal including the felling of trees with the potential to support bat roosts and in absence of mitigation the risk of directly impacting bat roosts is high.

The assessment of negligible potential for roost sites within conifer plantation likely to be affected by vegetation clearance means that direct effects on roosting bats is highly unlikely within this habitat type where is occurs around proposed turbines and along wind farm access tracks. The conifer plantation at the proposed location of turbine T5 contains a single tree of moderate potential which was surveyed, and no roost was recorded. The broadleaf treeline within the felling area of T4 was classed as having low roost potential. Other hedges, scrub and woodland within likely felling areas around proposed turbine locations was classed as supporting negligible or low PRFs and therefore direct effects on roosting bats is considered unlikely across much of the proposed construction area.

Using Table 2 from Wray et al. 2010 to assess the value of roost types, the presence of any potential roosts within the likely felling buffers are of *Local* importance. Therefore, the removal of these trees in the absence of mitigation are considered to be *Significant* at the Local level.

Grid Connection

No direct effects to trees with low bat roosting potential along the GCR are predicted, as these trees will be retained.

Two bridges along the GCR were confirmed as bat roosts. Two *Myotis* sp. bats were observed in a large crevice just inside the upstream face of the Glenlon south bridge. Prior to the emergence survey at the same location the bridge was checked again, and no bats were recorded. The emergence survey recorded no bats emerging from the bridge. The bridge is a confirmed bat roost but is used infrequently and by low numbers of bats. The bats present were considered likely to be Natterer's bat, but this could not be confirmed. During the survey both Common and Soprano Pipistrelles were active in the area.

The emergence survey undertaken the Blackwater (Clare) bridge confirmed the bridge as a Soprano Pipistrelle roost. The number of bats that emerged from the bridge was c.5 individuals. A small number of Daubenton's bats were also recorded at this site later in the survey. They were not observed emerging from the bridge but were recorded foraging on the river.

Due to the proposed crossing methodology (HDD), no direct effects to the roosting features at these bridges are anticipated. Limited disturbance

Turbine Delivery Route

Two mature ash trees with dense ivy cladding are present at TDR Node 31. These trees have low bat roosting potential and are within the proposed felling footprint. Therefore, the removal of these trees in the absence of mitigation is considered *Short-term Significant Reversible* at the at the *Local level*.

Potential Indirect Impacts

Wind Farm Site

Potential secondary effects on bats resulting from construction works are limited to the loss of foraging and commuting habitats/features utilised by bats, and disturbance.

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. Any potential night-time activities will be limited to occasional delivery of turbine components and pre-dawn starts for turbine foundation pours.

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 beech woodland and connecting treelines and hedgerows are highly active foraging grounds for bats. These features are of particular importance to lesser horseshoe bats which are heavily reliant on features for commuting and foraging. Vegetation removal as a result of the proposed felling detailed in the previous section will also affect bat foraging patterns within the site, particularly given the high levels of activity seen in conifer plantations (including edges and firebreaks). The removal of vegetation capable of disrupting connectivity within the site is likely to occur at all turbine locations, with the except of T2 and at the proposed substation.

In the absence of mitigation, vegetation removal has the potential for indirect effects on bats to be *Long-term Significant* and *Reversible* at the *Regional* scale (south-western region).

Danes Hole, Poulnalecka Cave SAC/pNHA (000030) is a lesser horseshoe bat SAC/pNHA of which the eastern most point lies within 8.5km of the site. Given that the migratory range between summer and winter roosting sites for this species is 10km (Collins 2016), there is potential for individuals which hibernate in the to the SAC to utilise the wind farm site for summer roosting and foraging. For this reason there are potential impacts from this the removal of foraging and commuting habitat on the lesser horseshoe bat population ecologically linked to this SAC.

Grid Connection

Mature ash trees with dense ivy cladding are present along the GCR at two locations. These trees have low bat roosting potential (potential to host individuals or low numbers of bats) but if bats were present they could potentially be subject to disturbance from works.

Two bridges along the GCR were confirmed as bat roosts. Two *Myotis* sp. bats were observed in a large crevice just inside the upstream face of the Glenlon south bridge. c. 5 a Soprano Pipistrelles were observed emerging from the Blackwater (Clare) bridge.

Due to the proposed crossing methodology (HDD), no direct effects to the roosting features at these bridges are anticipated. Limited disturbance caused by noise and vibration from HDD operations may occur

Considering the low roosting potential of the trees align the GCR and limited duration and magnitude of noise/vibration from HDD operations, in the absence of mitigation the potential for disturbance is considered *Temporary Slight Reversible* at the *Local level*.

Turbine Delivery Route

A low potential PRF was noted in a semi-mature Norway maple at TDR Node 8, however the surrounding habitats, traffic disturbance and poor connectivity reduce the likelihood of bats (individuals or low numbers) roosting here. Considering the low roosting potential of this tree, in the absence of mitigation the potential for disturbance is considered *Temporary Imperceptible Reversible* at the at the *Local level*.

8.5.1.6 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 wind farm, particularly the construction of turbines and the associated road network.

Consideration of the survey data against Table 8-59 indicates that six ‘Very High’ sensitivity species have been recorded within the wind farm study area (500m turbine buffer) and wider area (5 km turbine buffer) which have been identified as key receptors:

- Golden plover (Annex I, Red-listed)
- Hen harrier (Annex I, Amber-listed)
- Kingfisher (Annex I, Amber-listed)
- Merlin (Annex I, Amber-listed)
- Peregrine (Annex I, Green-listed)
- Whooper swan (Annex I, Amber-listed)

Consideration of the survey data against Table 8-59 indicates that nine ‘High’ sensitivity species have been recorded within the study area wind farm (500m turbine buffer) and wider area (5 km turbine buffer) which have been identified as key receptors:

- Barn owl (Red-listed)
- Curlew (Red-listed)
- Grey wagtail (Red-listed)
- Kestrel (Red-listed)
- Lapwing (Red-listed)
- Meadow pipit (Red-listed)
- Redwing (Red-listed)
- Snipe (Red-listed)
- Swift (Red-listed)

'Medium' sensitivity species are also considered in this assessment. The 19 medium sensitivity species recorded within the wind farm study area (500m turbine buffer) and wider area (5 km turbine buffer) which have been identified as key receptors are:

- Black-headed gull (Amber-listed)
- Brambling (Amber-listed)
- Common Gull (Amber -listed)
- Cormorant (Amber-listed)
- Goldcrest (Amber-listed)
- Greenfinch (Amber-listed)
- Greylag goose (Amber-listed)
- Herring gull (Amber-listed)
- House Martin (Amber-listed)
- House sparrow (Amber-listed)
- Lesser black-backed gull (Amber-listed)
- Linnet (Amber-listed)
- Mallard (Amber-listed)
- Mute swan (Amber-listed)
- Sand martin (Amber-listed)
- Spotted flycatcher (Amber-listed)
- Starling (Amber-listed)
- Swallow (Amber-listed)
- Willow warbler (Amber-listed)

A total of 10 'Low' sensitivity species are considered in this assessment:

- Buzzard (Green-listed)
- Moorhen (Green -listed)
- Little Grebe (Green -listed)
- Water Rail (Green -listed)
- Grey heron (Green -listed)
- Sparrowhawk (Green -listed)
- Whimbrel (Green -listed)
- White-throated Dipper (Green -listed)
- Woodcock (Red-listed/wintering population Green-listed)
- Yellowhammer (Red-listed/wintering population Green-listed)

It is noted that the construction of the proposed grid connection will progress in a sequential manner along the grid connection route and therefore, 375m per week, or 75m per day). Because the works will progress relatively quickly along a linear corridor, any fugitive noise will be highly localised, temporary and are not expected to be of sufficient magnitude to create any disturbance or displacement impacts outside of areas contiguous or adjacent to the corridor. The adjacent habitats, as described in section 8.3.4.2 above, are widespread in the surrounding area therefore any resident species can easily move in response to any temporary disturbance. The final section of the GCR traverses dry meadow/improved agricultural grassland habitat. This habitat is not of high value to birds and similar displacement habitats are widely available in the surrounding area.

8.5.1.6.1 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. Some species (for example sand martin) could potentially be affected through material extraction requirements for construction purposes.

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 felling of broadleaved woodland, scrub, conifer plantation and hedgerows 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 eight proposed turbines. Felling will be required at seven of the turbines. Habitat that will be lost will be dominated by Improved agricultural grassland, followed by conifer plantation and mixed broadleaved woodland.

During additional works along several areas of the TDR there will be trimming of hedgerows and treelines which will result in a temporary loss of foliage within these habitats. Tree felling and lowering of hedgerows will cause long term effects and greater alteration of habitats.

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 (kingfisher considered separately).
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 wind farm site is dominated by a mix of natural and semi-natural woodland of varying maturity, plantation woodlands (broadleaved and conifer) and pasture (improved agricultural grassland and wet grassland), which provides suitable habitat for a range of passerine species.

The proposed development will result in the loss of 8.2 – 8.6 Ha r(16 – 17 % of habitat type) of conifer plantation, with an additional 3.2 Ha (6 %) of immature conifer plantation proposed to be felled in order to replant the area with oak woodland. A total of 1.8 – 2.0 Ha (6 % of habitat type) of (mixed) broadleaved woodland will be lost;

it is noted that within this type, a total of 0.4 Ha (2% of sub-type) of long-established woodland will be lost. A total of 0.05 Ha of oak-ash-hazel woodland (3% of habitat type) will be lost. A total of 0.6 Ha of mixed broadleaved woodland/scrub (10 % of habitat type) will be lost.

Collective loss of mature/semi-mature wooded habitats (including conifer plantation) will be c. 12 % (10.7 - 11.3 Ha). When omitting conifer plantation, the percentage loss is c. 6 - 7 % (2.5 – 2.7 Ha).

There will be a loss of 4.4 Ha (7 % of habitat type) of improved agricultural grassland, 0.9 Ha (7 % of habitat type) of wet grassland, 1.2 Ha (10 % of habitat type) of improved agricultural grassland/ wet grassland and 0.2 Ha (17 % of habitat type) of improved agricultural grassland / dry meadows and grassy verges. It is noted the overall habitat loss for grassland habitats combined is 6.7 Ha or 7 %. When improved agricultural grassland is omitted, the same percentage of c. 7 % (2.3 Ha) will be lost.

Linear habitat loss includes 920 – 1,098m (10-12 % of habitat type) of hedgerows, 190 - 206m (4-5 % of habitat type) of treelines. Additional works along the TDR at Nodes will result in the trimming of hedgerows and limited tree felling.

Goldcrest, greenfinch, house sparrow, linnet, spotted flycatcher and willow warbler (Percival sensitivity: Medium), are species which may use the wooded habitats and hedgerows at the Site to nest and forage within. Brambling (Percival sensitivity: Medium) is a winter visitor which may forage in the wooded habitats and hedgerows at the Site. Greenfinch and linnet may also forage for seeds in wet grassland onsite. These are habitats which are common in the area of the development. Similar habitat is present at a number of TDR Nodes but is less suitable due to high levels of disturbance. The higher impact Percival magnitude: medium (5-20% habitat loss for woodland) 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*.

Yellowhammer (Percival sensitivity: Low), was recorded during winter surveys only, and may forage in hedgerows and fields at the proposed site. This species is associated primarily with arable land, which is not present in and around the proposed wind farm. As such, the site is not used by breeding yellowhammer, and therefore any potential impact caused by habitat loss would affect wintering birds only. As the red listing applies only to breeding yellowhammer, this species has been categorised as low sensitivity in the context of the proposed site. The higher impact Percival magnitude: medium (5-20% habitat loss for hedgerows/treelines and open habitats) applies, resulting in a Percival impact significance of **Very 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 wind farm site to breed and forage. Meadow pipit were observed to be active in wet grassland in the southern part of the study area. 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 clear-felled habitat is revegetated 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 wind farm 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* effect is predicted for redwing due to the abundance of similar agricultural habitats in the area and mobility of wintering flocks.

Sand martin (Percival sensitivity: Medium) is a summer visitor which nests in sandy cliffs, foraging on the wing. A sand martin colony is present north of a section of proposed access track (c. 90m north of felling corridor). This colony, consisting of burrows in a sandy cliff face, will not be affected directly as it is outside the proposed footprint, and is at a great enough distance to preclude indirect effects via disturbance. No sand extraction within the quarry is proposed as part of the project. Potential feeding habitat for this species is abundant in the wider landscape. Percival impact significance is **Low** based on medium magnitude (5-20 % habitat loss for grassland and wooded habitats). Considering that this species has a broader foraging range than the site scale and forages over a variety of habitats, a *Local Temporary Imperceptible Reversible* effect is predicted for sand martin.

Swift (Percival sensitivity: High), house martin and swallow (Percival significance: Medium) are aerial species which forage over open habitats. There will be some loss of improved grassland and wet grassland. As felled areas become revegetated, they will provide more foraging habitat for these species. Percival impact significances are **High** (Swift) and **Low** (house martin and swallow) based on medium magnitude (5-20 % habitat loss for grassland and wooded 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 (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 the potential for mature trees with cavities to occur within and adjacent the proposed wind farm footprint, a *Local Short-term Slight* 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.

Neither species will be subject to the direct effect of habitat loss. A dipper nest was recorded under the bridge over the Glenomra Wood Stream along the GCR. Percival impact significance is not assigned as there will be no habitat loss with potential to affect these species. The section of upland/eroding river proposed to be culverted under the T7 hard standing does not provide suitable habitat or prey abundance for these birds. The bridge structures along the GCR will not be subject to direct impacts due to the use of horizontal directional drilling (HDD) to install cables under watercourses along the route.

There is potential for goldcrest, greenfinch, house sparrow, linnet, spotted flycatcher willow warbler, brambling, yellowhammer and starlings to experience *Slight Medium-term Local Reversible* effects at the *Local level* due to tree felling and trimming associated with TDR accommodation works. Any effects due to vegetation trimming for GCR construction are *Imperceptible Short-term Local Reversible* effects.

Birds of Prey, Gulls, Waders/Waterfowl and Kingfisher – Other Target Species

Table 8-64 below displays the direct impact character during construction as well as the significance of impacts without the implementation of mitigation.

Table 8-64: Impact of habitat loss to other target species

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Barn owl (High)	Barn owl were recorded in the quarry which is traversed by proposed access tracks. The quarries south of the proposed turbines, and another area at Ballyknavin were identified as barn owl territories by the ornithological assessment. Juveniles were recorded, confirming the quarry is within a breeding territory. No features representing breeding habitat for barn owl will be affected. Potential effects are limited to loss of foraging habitat. While rough grassland is known to be favoured by hunting barn owl, this species is also known to hunt along hedgerows. Effects on open agricultural habitat potentially used for hunting will be minimal-moderate (loss of 0.9 Ha/ 7% of wet grassland) Loss of hedgerow will be between 920 – 1,098m (10 – 12% of total within study area). It is noted that the figures quoted apply only to the wind farm 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 **Medium** (5-20% 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 Significant effect,*** reducing over time to a ***Local Long-term Moderate effect*** as revegetating access track felling corridors provide new hunting habitat, and considering the abundance of similar habitats in the surrounding area. (Criteria: EPA, 2022)
Black-headed gull (Medium)	Black-headed gull was observed infrequently during summer VP surveys in 2020 and 2021. These birds were observed flying within the study area. No observations of birds foraging within the site were recorded. This species could potentially forage infrequently at the proposed site. Surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 6.7 Ha (7 % 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)
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 CRZ. Possible breeding was recorded within the woodland in the north of the study area (Ballymoloney Woods; see Figure 8-15) and fledged young were recorded in 2020.	Magnitude of effects is assessed as **Medium** (5-20 % 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)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	There will be the permanent loss of 0.4 Ha (2%) of long-established woodland, which is the prime nesting habitat available in the area. Effects on open agricultural habitats and open scrub mosaics used for foraging will be minimal-moderate (loss of 6.7 Ha/ 7% of combined grassland types; loss of 1.6 Ha/ 11% of combined open scrub mosaics).	
Cormorant (Medium)	This species was recorded once during the two years of VP surveys. This observation involved two birds commuting through the study area. There is no suitable habitat onsite for this species.	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)
Curlew (High)	This species was recorded once during the two years of VP surveys. This observation involved one bird flying to the west of the study area (500m turbine buffer) during winter 2019-20. No breeding curlew or any other observations of this species were recorded. The habitats present onsite are suboptimal for both wintering and breeding waders, consisting of fragmented areas of heathland and wet grassland interrupted by woodland/forestry plantations and more intensively managed grassland. Effects on open agricultural habitats potentially used for foraging or breeding will be minimal (loss of 0.9 Ha/7 % of Wet grassland, loss of 2.3 Ha/7 % of combined semi-natural grassland types & mosaics). These habitats are common in the general area.	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **High**, overall effect significance is **High** (Criteria: Percival, 2003). Considering the suboptimal & fragmented nature of potential wader habitats onsite, combined with the absence of breeding or foraging Curlew records from site walkovers, the assessment cannot be based solely on the proportion of *potential* sub-optimal wader 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)
Golden plover (Very High)	This species was recorded once during the two years of surveys. This observation involved 12 birds flying through the study area (500m turbine buffer) during winter 2020-21 walkover surveys. Based on limited habitat availability on the upland slopes of the site where woodland impinges into the heathland, it was considered unlikely the area would consistently support any significant numbers of wintering waders. Open heathland north of the 500 m turbine buffer has potential to support	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Very High**, overall effect significance is **Very High** (Criteria: Percival, 2003). Considering the suboptimal & fragmented nature of potential wader habitats onsite, combined with the absence of foraging

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	upland breeding waders including golden plover and curlew. However, the fragmented nature of the open bog, due to commercial forestry, means it is unlikely to support viable breeding wader populations. Effects on open agricultural habitats potentially used for foraging will be minimal (loss of 0.9 Ha/7 % of wet grassland, loss of 2.3 Ha/7 % of combined semi-natural grassland types & mosaics). More suitable breeding habitat in the form of open heathland is present to the north, outside the proposed footprint.	Golden plover records from site walkovers and absence of breeding habitat within the proposed footprint, the assessment cannot be based solely on the proportion of <u>*potential*</u> 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)
Common gull (Medium)	Desktop records only. No breeding habitat present in study area. 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 6.7 Ha (7 % 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 **Low**, 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)
Grey heron (Low)	Recorded occasionally flying over or towards quarries south of study area. Recorded at Mac Namara's Lake (adjacent TDR Node 27) in winter. 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)
Greylag goose (Medium)	This species was recorded once during the two years of VP surveys. This observation involved six birds commuting through the study area. There is no suitable habitat onsite for this species.	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)
Hen harrier (Very High)	This species was recorded once during the two years of VP surveys, and also recorded twice during wider area surveys (2 km turbine buffer). The three	Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low**

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	hen harrier recorded where breeding 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. The closest areas of potentially suitable habitat on Lackareagh Mountain was observed to be utilised by quad bike and scrambler enthusiasts creating periodic disturbance events likely to limit suitability. As identified by the desk-based study, the larger expanses of open upland habitat and associated forestry located c. 2.5 km north of the 500 m turbine buffer, stretching north from Glennagalligh Mountain and onto Slieve Bearnagh, are considered to provide more substantive home range options for breeding hen harriers. 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 proposed development site and surrounding area 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.	(Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Local Long-term Imperceptible effect*** (Criteria: EPA, 2022)
Herring gull (Medium)	One observation of herring gull was recorded, involving five birds foraging within agricultural fields south-east of the 500 m turbine buffer. No flight lines were observed. 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 6.7 Ha (7 % 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)
Kestrel (High)	Over the two-year study period, kestrels regularly foraged through the 500 m turbine buffer over both winter and breeding seasons. One pair was identified as breeding within the 2 km turbine buffer (see Figure 8-15) and the breeding season home range of these birds falls within the 500 m turbine buffer. No breeding site were identified in the 500 m turbine buffer.	Magnitude of effects is assessed as **Medium** (5-20% 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 Significant effect,*** reducing

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	Based on recorded activity, this site is important to at least one pair of breeding kestrel and is also utilised over the winter. Within the proposed development site, the mosaic of different habitats creates lots of edge effects which can be exploited by foraging kestrels. There are breeding options within the proposed development site; however, the closest active nest site identified during the baseline study was c. 1 km from the closest proposed turbine. The proposed development will alter the habitat mosaics present, however new edge effects will be created through this process. Mature/semi-mature broadleaved woodland habitats potentially of use to nesting kestrel ranging between 2.5 – 2.7 Ha (6 – 7%) will be lost. It is noted however that no Kestrel breeding territories were recorded within the proposed footprint. Effects on open agricultural habitats and open scrub mosaics potentially used for hunting will be minimal-moderate (loss of 0.9 Ha/ 7% of Wet grassland; loss of 1.61 Ha/ 11% of open scrub mosaics). The latter are abundant in the locality, particularly around the quarries and conifer plantation margins outside the proposed footprint. Loss of hedgerow will be between 920 – 1,098m (10 – 12% of total within study area). It is noted that the figures quoted apply only to the wind farm 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.	over time to a ***Local Long-term Moderate effect*** as revegetating access track felling corridors provide new hunting habitat, and considering the abundance of similar habitats in the surrounding area. (Criteria: EPA, 2022)
Kingfisher (Very High)	No Kingfisher were observed at the proposed site and the streams onsite do not provide suitable habitat for this species (no fisheries value or nesting habitat). While limited loss/alteration of upland eroding watercourses will occur, similarly to all streams throughout the site, the affected sections are of no value to this species.	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)
Lapwing (High)	This species was recorded once during the two years of VP surveys, and also recorded during wider area surveys (5 km turbine buffer). A flock of 12 was recorded flying east from area of VP1 towards the	Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **High**, overall effect significance is **Very Low**

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	quarry – the flock did not enter the 500 m turbine buffer. Ten lapwing were also recorded at Ardclooney Reservoir to the east of the site during wider area surveys. Based on the limited habitat availability on the upland slopes of the site, where woodland impinges into the heathland, it was considered unlikely the area would consistently support any significant numbers of wintering waders. The proposed site was not identified as providing potential breeding habitat by the ornithological assessment. As such the potential for wintering or breeding lapwing to use the habitats onsite is negligible.	(Criteria: Percival, 2003). The proposed impact of habitat loss will be a ***Local Long-term Imperceptible effect*** (Criteria: EPA, 2022)
Lesser black-backed gull (Medium)	This species was recorded infrequently during summer VP surveys and also during wider area surveys in winter. This species could occasionally forage in agricultural fields within site. Ef Surveys indicate that the site does not contain breeding habitat for gulls. There will be a loss of 6.7 Ha (7 % 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)
Little Grebe (Low)	Desktop records only. 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 **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)
Mallard (Medium)	Recorded in study area & wider area during winter. Also recorded at Mac Namara's Lake (adjacent TDR Node 27) in winter. 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)
Merlin (Very High)	Merlin was recorded once during VP surveys, in winter 2019-20.	Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**,

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	The closest area of potentially suitable habitat for breeding merlin was on Lackareagh Mountain. However, disturbance from quad bike and scrambler enthusiasts was considered likely to limit usage of the by merlin. As identified by the desk-based study, the larger expanses of open upland habitat and associated forestry located c. 2.5 km north of the 500 m turbine buffer, stretching north from Glennagalligh Mountain and onto Slieve Bearnagh, are considered to provide more substantive home range options for breeding merlin. No roosts or breeding sites were detected within the 2 km turbine buffer. There was no suitable nesting for breeding merlin within the 500 m turbine buffer. Therefore, beyond providing habitat for the occasional foraging bird over the winter, the proposed development site and surrounding area was not found to be important for merlin. As such the potential for roosting or breeding merlin to use the habitats onsite is negligible.	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)
Moorhen (Low)	Desktop records only. 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 **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)
Mute swan (Medium)	Recorded at Mac Namara's Lake (adjacent TDR Node 27) and wider area in winter. No records at proposed wind farm site. There is no suitable habitat onsite for this species.	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 exceptionally low and limited to a single bird over the winter. There is no suitable nesting habitat for peregrine within the 2 km turbine buffer, which likely explains the relatively low levels of activity	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)	Construction Direct Impact Character	Significance without mitigation
	recorded in the general area. The quarries south of the proposed turbines were checked and determined not to contain any suitable cliffs for nesting peregrine falcons. 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.	The proposed impact of habitat loss will be a ***Local Long-term Imperceptible effect*** (Criteria: EPA, 2022)
Snipe (High)	Recorded during winter walkover surveys and wider area surveys only. Based on limited habitat availability on the upland slopes of the site where woodland impinges into the heathland, it was considered unlikely the area would consistently support any significant numbers of wintering waders. Open heathland north of the 500 m turbine has potential to support upland breeding waders including snipe. However, the fragmented nature of the open bog, due to commercial forestry, means it is unlikely to support viable breeding wader populations. The agriculturally improved grassland in the southern part of the 500 m turbine buffer is largely unsuitable for supporting breeding waders, although there are some less managed fields dominated by *Juncus* species providing potential cover for nesting curlew 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 0.9 Ha/7 % of Wet grassland, loss of 2.3 Ha/7 % of combined semi-natural grassland types & mosaics). These habitats are common in the general area.	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **High**, overall effect significance is **High** (Criteria: Percival, 2003). Considering the suboptimal & fragmented nature of potential wader habitats onsite, combined with the absence of breeding Snipe records from site walkovers, low number of wintering Snipe records (3 individuals recorded in total) and tendency of wintering Snipe to be habitat generalists, the assessment cannot be weighted solely on the proportion of sub-optimal Snipe habitat loss at the proposed site. As such, the proposed impact of habitat loss will be a ***Local Long-term Slight effect*** (Criteria: EPA, 2022)
Sparrowhawk (Low)	A relatively high level of sparrowhawk activity was recorded in the study area during VP surveys (23 observations). The total flight time was low however, as can be expected from this species which often makes low darting flights in and out of cover. Three sparrowhawk territories were recorded, with one nest site and a pair found breeding within the 500 m turbine buffer in the mature beech woodland in the western part of the site. The other two pairs	Magnitude of effects is assessed as **Medium** (5-20 % 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)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	were recorded on the periphery of the 2 km turbine buffer. Mature/semi-mature broadleaved woodland habitats potentially of use to nesting sparrowhawk ranging between 2.5 – 2.7 Ha (6 – 7%) will be lost. It is noted however that the breeding territories recorded were outside the proposed footprint. Effects on open agricultural habitats and open scrub mosaics potentially used for hunting will be minimal-moderate (loss of 0.9 Ha/ 7% of Wet grassland; loss of 1.61 Ha/ 11% of open scrub mosaics). The latter are abundant in the locality, particularly around the quarries and conifer plantation margins outside the proposed footprint. Loss of hedgerow potentially of use for hunting will be between 920 – 1,098m (10 – 12% of total within study area).	
Water Rail (Low)	Desktop records only. 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 **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)
Whimbrel (Low)	This passage migrant was recorded traversing the site once during VP surveys (12 birds observed in May 2021). There is no suitable habitat onsite for this species.	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)
Whooper swan (Very High)	Three whooper swans were observed during winter VP surveys, commuting west through the buffer for 13 seconds at 100-150 m. During wider area surveys in March 2021, a flock of 29 whooper swans were recorded approximately 2 km south-west of the site and the flock was observed to be commuting north-west. There is no suitable habitat onsite for this species.	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***

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
		Imperceptible effect (Criteria: EPA, 2022)
Woodcock (Low)	Based on the low frequency of flight activity, limited utilisation of foraging habitat and lack of suitable roosts in the area, the proposed development is assessed as being highly unlikely to affect most wintering waders, with the possible exceptions of woodcock and snipe utilising the site. Wintering woodcock and small numbers of snipe could be displaced by construction activities, with removal of woodland potentially having a longer-term displacement on woodcock. Likewise, the absence of breeding waders within the study area means the proposed development will not affect any wader populations of conservation concern, including woodcock. In terms of collective loss of mature/semi-mature wooded habitats (including conifer plantation) which could be used by wintering woodcock, c. 12 % (10.7 11.3 Ha) of this grouping will be lost.	Magnitude of effects is assessed as **Medium** (5-20 % 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)

8.5.1.6.2 Disturbance and Displacement

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

Additional impacts may occur during the construction process due to road works along turbine delivery routes, the laying of cabling, the placement of underground cabling, and excavation of materials.

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 8-65 below:

Table 8-65: Indirect Construction Impacts on Avifauna

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Barn owl (High)	Disturbance to barn owl using the breeding territory overlapping the quarry could occur during the breeding season. Nesting barn owl could potentially be disturbed by noise from felling and construction activities if a nest site was located within 50-100m of the proposed development. No nest sites were identified in the roadstone quarry. There is limited potential for quarry buildings and machinery north of the proposed development to be used as nesting sites. Some avoidance of foraging habitat may occur in the event of works being carried out at dusk or during darkness, however this is not predicted to occur regularly and will affect only limited parts of the foraging habitat resource.	Potential for 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).
Black-headed 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).
Brambling (Medium)	Possible noise/visual intrusion disturbance to wintering birds foraging within the site may occur.	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).
Buzzard (Low)	Possible noise/visual intrusion disturbance to breeding and hunting birds within the site may occur. A buzzard breeding territory overlaps part of the proposed development and as such disturbance to breeding birds is likely to occur. Breeding buzzard can experience disturbance at distances between 100-200m and have low-medium sensitivity to disturbance (SNH, 2022).	Probability of temporary to short-term impacts. Sensitivity: **Low**. Magnitude assessed as **High**. Overall significance assessed as **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
Common 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: **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).
Cormorant (Medium)	Cormorants commuting through the site may alter course or altitude slightly due to increased human presence.	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).
Curlew (High)	This species was recorded once during the two years of VP surveys. This observation involved one bird flying to the west of the study area (500m turbine buffer) during winter 2019-20. No breeding curlew or any other observations of this species were recorded. The habitats present onsite are suboptimal for both wintering and breeding waders, consisting of fragmented areas of heathland and wet grassland interrupted by woodland/forestry plantations and more intensively managed grassland. There is a remote possibility individual or limited numbers of curlew could forage at the site occasionally. While this species is sensitive to disturbance, the low probability of their occurrence onsite reduces the magnitude of effects.	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 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 found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via felling of woodland 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).
Golden plover (Very High)	This species was recorded once during the two years of surveys. This observation involved 12 birds flying through	Probability of temporary to short-term disturbance to winter birds. Sensitivity: **Very High**. Magnitude

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	the study area (500m turbine buffer) during winter 2020-21 walkover surveys. Based on limited habitat availability on the upland slopes of the site where woodland impinges into the heathland, it is considered unlikely the area would consistently support any significant numbers of wintering waders. Open heathland north of the 500 m turbine has potential to support upland breeding waders including golden plover. However, the fragmented nature of the open bog, due to commercial forestry, means it is unlikely to support viable breeding wader populations. The site contains limited foraging habitat for this species. The suboptimal potential breeding habitat (open heathland to north of 500m turbine buffer) is outside the disturbance range for this species (200-500m) (SNH, 2022). It is also noted the Irish breeding range of this species is limited to northwest Ireland. 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.	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 (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 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 occasionally flying over or towards quarries south of study area. Recorded at Mac Namara's Lake (adjacent TDR Node 27) in winter. No habitats of potential value to this species will be lost. No breeding activity has been observed at the wind farm 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).
Grey wagtail (High)	Grey Wagtail was recorded once along the River Black. 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. 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). Disturbance and/or displacement

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
		will be a ***Local Short-term Significant effect*** (Criteria: EPA, 2022).
Greylag goose (Medium)	This species was recorded once during the two years of VP surveys. This observation involved six birds commuting through the study area. There is no suitable habitat onsite for this species. Geese commuting through the site may alter course or altitude slightly due to increased human presence.	Magnitude of effects is assessed as **Negligible**, species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Disturbance and/or displacement will be a ***Local Short-term Imperceptible effect*** (Criteria: EPA, 2022).
Hen harrier (Very High)	This species was recorded once during the two years of VP surveys, and also recorded twice during wider area surveys (2 km turbine buffer). The three hen harrier recorded where breeding season records. Survey results provide a high level of confidence that there is not a roost in regular use at the proposed site over the winter. The closest areas of potentially suitable habitat on Lackareagh Mountain were observed to be utilised by quad bike and scrambler enthusiasts creating periodic disturbance events likely to limit suitability. The larger expanses of open upland habitat and associated forestry located c. 2.5 km north of the 500 m turbine buffer, stretching north from Glennagalligh Mountain and onto Slieve Bearnagh, are considered to provide more substantive home range options for breeding hen harriers. 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 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 felling and construction works. Based on the limited occurrence of hen harrier at the proposed site however, he 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

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
		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).
House sparrow (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 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. One pair was identified as breeding within the 2 km turbine buffer (see Figure 8-15). Based on recorded activity, this site is important to at least one pair of breeding kestrel and is also utilised over the winter. Within the proposed development site, the mosaic of different habitats creates lots of edge effects which can be exploited by foraging kestrels. There are breeding options within the proposed development site; however, the closest active nest site identified during the baseline study was c. 1 km from the closest proposed turbine. The closest kestrel territory is beyond the range of disturbance (100-200m; SNH, 2022) from the proposed wind farm, but the GCR is within the disturbance range for this territory. Considering the lower level of construction activity and shorter duration of works for grid cable installation (c. 75m completed per day), the magnitude of potential disturbance is reduced. 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 **Medium**. Overall significance assessed as **High**. (Criteria: Percival, 2003). Disturbance and/or displacement will be a ***Local Short-term Significant effect*** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Kingfisher (Very High)	No Kingfisher were observed at the proposed site and the streams onsite do not provide suitable habitat for this species (no fisheries value or nesting habitat). Kingfishers are known to occur along watercourses downstream of the proposed development (Balmer et al., 2013). While there are watercourses within the 500 m turbine buffer (see Figure 3), these 1st order streams were considered too small to support any substantial kingfisher foraging or commuting activity. In addition, the banks of the streams were found to be unsuitable for breeding kingfishers and did not provide any of the exposed banks favoured by this species. As such the mode of disturbance most likely to occur is indirect via pollution of watercourses which could affect foraging habitat. Given the potential for harmful emissions prior to mitigation, effects in this category must be considered.	Probability of temporary to short-term impacts. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or displacement will be a ***Local Short-term Moderate effect*** (Criteria: EPA, 2022).
Lapwing (High)	A flock of 12 lapwing was recorded flying east from area of VP1 towards the quarry – the flock did not enter the 500 m turbine buffer. Ten lapwing were also recorded at Ardclooney Reservoir to the east of the site during wider area surveys. Based on the limited habitat availability on the upland slopes of the site, it is considered unlikely the area would consistently support any significant numbers of wintering waders. The proposed site was not identified as providing potential breeding habitat by the ornithological assessment. As such the potential for wintering or breeding lapwing to use the habitats onsite is negligible and disturbance is unlikely to occur.	Probability of temporary to short-term disturbance to winter birds. Sensitivity: **High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or displacement will be a ***Local Temporary Imperceptible 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 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	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
	construction on open habitats; these activities could also cause indirect disturbance.	Disturbance and/or displacement will be a ***Local Short-term Slight effect*** (Criteria: EPA, 2022).
Little Grebe (Low)	This species could potentially be subject to disturbance from felling activities and GCR works near the reed swamp at the proposed site entrance. Considering the dense cover provided by the reed swamp, potential impacts are limited to disturbance from noise and vibration of limited duration.	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 Slight effect*** (Criteria: EPA, 2022).
Mallard (Medium)	Recorded in study area & wider area during winter. Also recorded at Mac Namara's Lake (adjacent TDR Node 27) in winter. Mallard commuting over the site could alter course or altitude due to human presence. This species could also use the reed swamp at the proposed site entrance. Mallard using the reed swamp or Mac Namara's Lake could be subject to 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).
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).
Merlin (Very High)	Merlin was recorded once during VP surveys, in winter 2019-20. The closest area of potentially suitable habitat for breeding merlin was on Lackareagh Mountain. However, disturbance from quad bike and scrambler enthusiasts was considered likely to limit usage of the by merlin. The larger expanses of open upland habitat and associated forestry located c. 2.5 km north of the 500m turbine buffer provide more substantive home range options for breeding merlin. No roosts or breeding sites were detected within the 2 km turbine buffer. There was no suitable nesting for breeding merlin within the 500 m turbine buffer. Therefore, beyond providing habitat for the occasional foraging bird over the winter, the proposed development site and surrounding area was not found to be important for merlin. Disturbance to birds hunting within the site and birds breeding/hunting near the site could potentially occur	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).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	during felling and construction works. Based on the limited occurrence of merlin at the proposed site however, he likelihood disturbance resulting in significant effects is unlikely.	
Moorhen (Low)	This species could potentially be subject to disturbance from felling activities and GCR works near the reed swamp at the proposed site entrance. Considering the dense cover provided by the reed swamp, potential impacts are limited to disturbance from noise and vibration of limited duration.	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 Slight effect*** (Criteria: EPA, 2022).
Mute swan (Medium)	Recorded at Mac Namara's Lake (adjacent TDR Node 27) and wider area in winter. No records at proposed wind farm site. There is no suitable habitat at the proposed wind farm site for this species. Swans using Mac Namara's Lake could potentially be subject to limited noise disturbance and visual intrusion, however no TDR accommodation works are proposed immediately adjacent to the lake.	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).
Peregrine (Very High)	Over the two years of surveys peregrine records were limited to a single bird over the winter. There is no suitable nesting habitat for peregrine within the 2 km turbine buffer. The quarries south of the proposed turbines were checked and determined not to contain any suitable cliffs for nesting peregrine falcons. 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. Any potential disturbance would be limited to hunting or commuting birds.	Probability of temporary to short-term impacts. Sensitivity: **Very High**; magnitude **Negligible**. 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 transect surveys to south of quarries; no records in proposed wind farm 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 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).
Sand martin (Medium)	A sand martin colony is present north of a section of proposed access track (c. 90m north of felling corridor).	Probability of temporary to short-term impacts. Sensitivity:

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	This colony is at a great enough distance from proposed works to preclude indirect effects via disturbance. Human presence is unlikely to alter the foraging patterns of this species, and potential feeding habitat for sand martin is abundant in the wider landscape.	**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).
Snipe (High)	Considering the suboptimal & fragmented nature of potential wader habitats onsite, combined with the absence of breeding snipe records from site walkovers, low number of wintering snipe records (3 individuals recorded in total) and tendency of wintering snipe to be habitat generalists, the potential for disturbance to result in significant impacts is minimal. Such disturbance would be temporary and localised, and large areas of displacement habitat at the proposed site and in the surrounding area would remain available for use. During felling/construction activities, wintering snipe may be disturbed whilst resting/foraging within the site or nearby.	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).
Sparrowhawk (Low)	Three sparrowhawk territories were recorded, with one nest site and a pair found breeding within the 500 m turbine buffer in the mature beech woodland in the western part of the site. The other two pairs were recorded on the periphery of the 2 km turbine buffer. The breeding territory within the 500m buffer partly overlapped T1 in 2020 and 2021 and was located deeper within Ballymoloney Woods in 2022 (c. 200m from T1 hardstand). This territory must be presumed to overlap the proposed development on a precautionary basis. As such there is potential for disturbance to this breeding territory. 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 **Very High**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or displacement will be a ***Local Short-term Moderate effect*** (Criteria: EPA, 2022).
Spotted flycatcher (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 felling of woodland 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

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
		will be a ***Local Short-term Slight 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).
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).
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).
Water Rail (Low)	This species could potentially be subject to disturbance from felling activities and GCR works near the reed swamp at the proposed site entrance. Considering the dense cover provided by the reed swamp, potential impacts are limited to disturbance from noise and vibration of limited duration.	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 Slight effect*** (Criteria: EPA, 2022).
Whimbrel (Low)	Whimbrel overflying the site may alter course or altitude slightly due to increased human presence.	Probability of temporary to short-term impacts. Sensitivity: **Low**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival,

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
		2003). Disturbance and/or displacement will be a ***Local Short-term Imperceptible effect*** (Criteria: EPA, 2022).
White-throated Dipper (Low)	A dipper nest was recorded under the bridge over the Glenomra Wood Stream along the GCR. Dipper could be subject to impacts if disturbance or pollution of foraging habitat occurred during the breeding season. While the bridge structures along the GCR will not be damaged or modified due to the use of HDD to install cables under watercourses along the route, dipper nesting under bridges could be subject to disturbance from increased human presence, noise and vibration.	Probability of temporary to short-term impacts. Sensitivity: **Low**. Magnitude assessed as **High**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or displacement will be a ***Local Temporary Slight effect*** (Criteria: EPA, 2022).
Whooper swan (Very High)	Three whooper swans were observed during winter VP surveys, commuting west through the buffer for 13 seconds at 100-150 m. During wider area surveys in March 2021, a flock of 29 whooper swans were recorded approximately 2 km south-west of the site and the flock was observed to be commuting north-west. There is no suitable habitat onsite for this species. Swans commuting through the site may alter course or altitude slightly due to increased human presence.	Magnitude of effects is assessed as **Negligible**, species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Disturbance and/or displacement will be a ***Local Short-term Imperceptible 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 felling of woodland, 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).
Woodcock (Low)	During felling/construction activities, this species may be disturbed whilst resting/foraging within the site or nesting nearby. Wintering woodcock could be displaced by construction activities, with removal of woodland potentially having a longer-term displacement on woodcock. Such disturbance would be localised, and large areas of displacement habitat at the proposed site and in the surrounding area would remain available for use.	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 Slight effect*** (Criteria: EPA, 2022).
Yellowhammer (Low)	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	Probability of temporary to short-term impacts. Sensitivity: **Low**; magnitude **Low**. Overall impact is

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
	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.	**Very Low**. (Criteria: Percival, 2003). Disturbance and/or displacement loss will be a ***Local Short-term Imperceptible effect*** (Criteria: EPA, 2022).

8.5.1.7 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 clearance of trees/vegetation, particularly conifer plantation to build site access roads, turbine foundations, hardstanding areas, 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 wind farm 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.

Wind Farm Site

The watercourses on the proposed Wind Farm site itself are all small 2nd and 1st order streams. The survey sites on the watercourses draining the proposed wind farm site are in the upper reaches of the Broadford River, River Bridgetown (Clare) and River Black (O'Briensbridge). Of the total of 10 survey sites on these watercourses, two sites were dry during the survey and another three were unsuitable for a fishery survey due to lack of habitat and recent river dredging works. 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 wind farm site is drained by the River Fahy (Clare), River Black (O' Briensbridge) and the River Kilroughill. These are all located in the River Black (O' Briensbridge) catchment. The River Broadford also drains the northern most section of the wind farm site. In addition, the Wind Farm is c. 4rkm upstream from the River Shannon. While the watercourses onsite are not sensitive the River Shannon is a sensitive ecological area.

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 tree felling, 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 wind farm site is not common and does not occur on the Broadford River or the upper reaches of the River Black (O'Briensbridge) and River Bridgetown (Clare) at the survey sites which were dry.

The proposal also includes for four stream crossings at the wind farm site. These are located upstream of site 10, between sites 3 and 4, at site 4 and on an unmapped stream to the west of T7. There are no sensitive ecological receptors at site 4, upstream of site 10 or between sites 3 and 4. There may be some fisheries habitat between sites 3 and 4 in the form of low-quality brown trout habitat. Upstream of site 10 and at site 4 box culverts will be installed. Between sites 3 and 4 a clear span bridge will be put in place. The fourth crossing point (west of T7) which will be a box culvert, is located on an unnamed stream on the windfarm site. This stream is not considered to be of any ecological importance.

Engineering works in the vicinity of streams and at stream crossings can also impact directly on physical habitat, for example nursery areas for fish. Permanent loss of aquatic habitats can also occur where access roads are constructed over or in close proximity to streams/rivers. Obstruction to upstream movement of fish, particularly salmon and trout, due to construction of culverts can also potentially occur.

'Improved' drainage of the site 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 wind farm 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 laying of cable route as well as any works required to facilitate the indicative turbine delivery route. 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.

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 wind farm 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 *Slight Negative, Short-term* and in the *local context*. Mitigation is required to avoid potential effects.

Grid Connection Route

The grid connection route crosses the River Blackwater [Clare] catchment. The survey sites are located on the River Blackwater [Clare] and Glenomra Wood Stream. The survey sites in this region ranged from Q3-4 to Q4. Some of the sites were of very high quality and up to Special Area of Conservation standard. Annex II species recorded in this area include salmon, river Lamprey, brook lamprey and at one site sea lamprey are also likely to be present. This river flows into the River Shannon downstream. There are some fish passage issues in this catchment.

Direct Impacts

The grid connection route crosses the Glenon South Stream east of Ardnacrusha. It also crosses the River Blackwater [Clare] and the Glenomra Wood Stream. These sites are all in the River Blackwater [Clare] Catchment. The route also crosses the upper reaches of the River Bridgetown [Clare] where it connects to the wind farm site.

There is potential for releases of suspended solids and other substances associated with these types or works. Vegetation clearance will be required as well as some excavations works. These activities could result in increased silt runoff. Suspended solids in even quite small quantities may have a serious effect on the spawning sites of salmonids.

Engineering works in the vicinity of streams and at stream crossings can also impact directly on physical habitat, for example nursery areas for fish. There is salmonid and lamprey nursery and spawning habitats at some of these sites. Salmon and brook lamprey are present along the proposed grid connection route. Mitigation is required to avoid these potential effects. Any instream works required will be limited to an existing culvert channelling a field drain along the GCR which was identified as potentially requiring replacement. There are no sensitive ecological receptors at this location.

Indirect Impacts

The most likely potential effects during the construction phase of the grid connection route on receiving watercourses and aquatic habitats arises indirectly via impacts affecting water quality, such as accidental releases of silt laden runoff and vegetation removal resulting in erosion. There are sensitive ecological receptors downstream including the lower reaches of the River Blackwater [Clare], River Shannon and Lower River Shannon SAC.

For EPA-mapped watercourses, horizontal drilling will be employed to install grid connection cables under the riverbed. Where existing culverts are in place ducts will be installed over or under the existing culvert. One existing culvert channeling a field drain along the GCR was identified as potentially requiring replacement (instream works) there are no sensitive ecological receptors at this location, however mitigation is required to prevent indirect effects to sensitive aquatic receptors downstream.

The grid connection will be underground for its entire length. Impacts could occur from the associated excavation works. 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.

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 effects on aquatic invertebrate and instream flora. Aquatic species listed on Annex II of the EU Habitats Directive (1992) occurring within the study area include brook lamprey, sea lamprey, river lamprey and salmon. Potential impacts affecting these species could occur as a result of water quality impacts arising through accidental pollution events including the increased erosion which may give rise to elevated suspended solids and siltation effects. These species are located in the River Blackwater [Clare] catchment. There is also floating river vegetation at the lower reaches of this river. This is potentially Annex I habitat *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation (3260) which is a qualifying interest of the Lower River Shannon SAC. This habitat can be effected by water quality deterioration, increased siltation and invasive non-native species. Floating river vegetation was also recorded at site 11 located upstream of the Lower River Shannon SAC.

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 *Slight Negative, Short-term* and in the *local context*. Mitigation is required to avoid potential effects.

Turbine Delivery Route

Direct Impacts

The TDR crosses several watercourses. It crosses through the River Black (O' Briensbridge) catchment, the River Ardcloony, the River Ballyteige 25, Lough Derg, the Roolagh Stream, the River Kilmastulla and the River Ballyard 25.

Works proposed at TDR nodes near watercourses are limited to tree branch trimming at Node 20 (Killestry Bridge/Ballyteige 25), tree branch trimming, utility pole removal and installation of a load bearing surface in the western verge at Node 23 (Ardcloony Bridge).

Indirect

The most likely potential effects during the construction phase of the proposed TDR on receiving watercourses and aquatic habitats arises indirectly via impacts affecting water quality, such as accidental releases of silt laden runoff and vegetation removal resulting in erosion. These indirect effects would occur downstream from the source of the impact. There are sensitive ecological receptors downstream of TDR Nodes 20 and 23 including the River Shannon. Other potential impacts affecting aquatic ecology during the construction phase could also occur as a result of accidental spillage of hydrocarbons used by machines to fell trees and clear vegetation as well as for excavation works.

To facilitate the TDR, vegetation clearance and tree felling will occur. 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 effects on fish and fisheries, as well as aquatic invertebrate communities and habitats within the study area.

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. Aquatic species listed on Annex II of the EU Habitats Directive (92/43/EEC) occurring within the study area include brook lamprey, sea lamprey, river lamprey and salmon. Some of the salmon appeared to be stocked fish. Potential impacts affecting these species could occur as a result of water quality impacts arising through accidental pollution events including increased erosion which may give rise to elevated suspended solids and siltation effects. These species are located in the River Ardcloony, River Kilmastulla and the River Ballyteige 25.

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 *Slight Negative, Short-term* and in the *local context*. Mitigation is required to avoid potential effects.

8.5.1.8 Marsh Fritillary

There is a risk that construction works in areas with devil's bit scabious (*S. pratentis*) could disturb, injure or kill marsh fritillary larvae in the event of their presence. No larvae were recorded in the proposed footprint, however the presence of several potential larval webs and abundance of *S. pratentis* in areas overlapped by the proposed footprint means such effects cannot be ruled out.

Aside from direct effects to larvae, some potential larval habitat will be lost. Approximately 410m^2 of rough grassland containing marsh fritillary larval foodplant *S.pratentis* will be lost within the proposed footprint. This loss equates to c. 1.2% of the total area supporting *S.pratentis* at the site, which covers c. 32,600m^2.

As such the proposed effect of habitat loss is *Short-term Imperceptible* at the *Local Scale*; however, the potential injury or death of larvae could be a *Short-term Significant* effect.

8.5.1.9 Other Species

Cinnibar moths could be affected by construction of the proposed temporary compounds if their larval foodplant ragwort (*Jacobaea vulgaris*) is cleared form the footprint, resulting in either direct effects if larvae are present on plants, or indirect effects via loss of breeding habitat and larval food. Considering that *J. vulgaris* is a common ruderal species which is likely to be abundant in the bare and recolonising ground in the surrounding quarry, and that the cinnibar is of Least Concern (Allen et al. 2016), a *Short-term Slight Reversible effect* at the *Local scale* is predicted.

8.5.2 Potential effects during the operational phase of the Project

The operational phase will have lower potential for effects on the local ecology than the construction phase. The main potential operational effects 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. The assessment of operational effects considers all scenarios within the proposed range of turbine dimensions.

8.5.2.1 European Sites

A Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on 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 screening stage), likely significant effects on the qualifying interests of the Lower River Shannon SAC and Dane's Hole, Poulnalecka SAC during the operational phase cannot be excluded on the basis of objective scientific information.

A Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact on these two SACs was therefore required.

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 project will not adversely affect the integrity of any of the European sites concerned. No operational phase impacts to the Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA, Dane's Hole, Poulnalecka SAC and Curraghchase Woods SAC were identified following mitigation.

8.5.2.2 Natural Heritage Areas or Proposed Natural Heritage Areas

A total of nine pNHAs and one NHA within the potential ZoI of the wind farm are overlapped by European Sites, namely Glenomra Wood pNHA, Lough Derg pNHA, Castleconnell (Domestic Dwelling, Occupied) pNHA, Danes Hole, Poulnalecka pNHA, Knockalisheen Marsh pNHA, Clare Glen pNHA, Fergus Estuary and Inner Shannon, North Shore pNHA, Derrygareen Heath pNHA, Ayle Lower Bog NHA and Inner Shannon Estuary- South Shore pNHA.

As discussed in section 8.5.1.1 an NIS has been undertaken to identify any potential impacts to European sites (SACs and SPAs) as a result of the proposed development.

The NIS concluded that the proposed project will not adversely affect the integrity of any of the European sites concerned. No operational phase impacts to the Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA, Dane's Hole, Poulnalecka SAC and Curraghchase Woods SAC were identified following mitigation.

Potential impacts to Cloonlara House pNHA/Leisler's bat could occur. The bat assessment identified that prior to mitigation, potential impacts of the operational phase upon Leisler's bat are considered to be *Significant* at the *County* to *Regional* level. This could potentially translate into a *Long-term Significant Reversible* effect on Cloonlara House pNHA.

No operational phase impacts are predicted for the five remaining NHAs and three remaining pNHAs within the potential ZoI of the wind farm, namely Doon Lough NHA, Gortacullin Bog NHA, Cloonloum More Bog NHA, Woodcock Hill Bog NHA, Lough O'Grady pNHA, Loughanilloon Bog NHA, Castle Lake pNHA and Lough Cullaunyheeda pNHA.

It is not anticipated that operation of the TDR route will be required during the operational phase of the project, unless in the unlikely event a turbine component is required to be transported to the site for replacement or repair. In this case, there is potential for similar impacts to the construction phase but at a reduced scale.

8.5.2.3 Habitats and Flora

The habitats within turbine felling 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 short-sward actively managed grassland in an ongoing cycle.

8.5.2.4 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 wind farm 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 effects on terrestrial fauna as a general group during the operational phase of the windfarm is deemed to be a *Long-term Imperceptible Reversible effect* at the *local scale*.

One badger sett is located in an area potentially affected by fencing maintenance activities. As such, appropriate seasonal restrictions and non-invasive repair methods for this area has been detailed in the confidential appendix [Badger Report]. Prior to mitigation, a *Short-term Moderate effect* could arise at the *local scale* if setts were disturbed during the breeding season.

8.5.2.5 Bats

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

SNH (2021) provides guidelines for conducting risk assessment for bat species occurring on wind farms. The assessment of the Fahy Beg Wind Farm site draws on several sources to apply the SNH guidance in the Irish context, including Marnell et al. (2019) and Wray et al. (2010) for the bat population assessments (see Table 8-66). For collision risk of bat species to wind turbines (see Table 8-67) SNH et al. (2021) is used.

As shown in Table 8-67, Leisler's bats and Nathusius' pipistrelles are considered as high risk of direct effects from with wind turbines, as they regularly fly in the open and at heights, which may put them at risk of collision or barotrauma from turbines. The SNH et al. (2021) guidelines consider both common and soprano pipistrelles to be at high risk of direct impacts from wind turbines; based on a study investigating bat collisions at wind farm sites across the UK (Mathews et al, 2016), which found both these species to be amongst the most commonly recorded casualties during searches of turbines. *Myotis* species, brown long-eared bats and lesser horseshoe bats are considered as low risk based on behaviour and foraging techniques of these species.

Based on population status in Ireland and risk level in relation to adverse interactions with turbines, particular attention should be paid to Leisler's bats and Nathusius' pipistrelles, which are believed to be susceptible to impacts from wind turbines and have populations of high population vulnerability, in the context of wind turbine developments in Ireland. Leisler's bats are generally considered to forage habitually at height in more open landscapes and are less associated with habitat features than other bat species. Nathusius' pipistrelles are known to be migratory and may fly at height during migration. For this assessment we adhere to SNH et al. (2021) guidance, under which common and soprano pipistrelles are considered to have medium population vulnerability to wind farm developments in Ireland due to behaviour in relation to turbines. Whiskered bats are also classed as moderately vulnerable, due to the scarcity range in Ireland. Lesser horseshoe bats, brown long-eared bats and the two other Irish Myotis species (Daubenton's bat and Natterer's bat) are considered to have low vulnerability to wind farm developments in Ireland, being rarer species (populations of 10,000 to 100,000) exhibiting low collision risk with turbines.

Table 8-66: Conservation status of bat species in Ireland

Species	Rarity in Ireland Wray *et al*. (2010)	Irish status (Marnell *et al*., 2019)
Daubenton's bat *Myotis daubentonii*	Rarer (Frequent/widespread)	Least concern
Whiskered bat *Myotis mystacinus*	Rarest (Scarce/widespread)	Least concern
Natterer's bat *Myotis nattereri*	Rarer (Scarce/widespread)	Least concern
Leisler's bat *Nyctalus leisleri*	Rarer (Frequent/widespread)	Least concern
Common pipistrelle *Pipistrellus pipistrellus*	Common (Widespread)	Least concern
Soprano pipistrelle *Pipistrellus pygmaeus*	Common (Widespread)	Least concern
Nathusius'pipistrelle *Pipistrellus nathusii*	Rarer (Rare/restricted)	Least concern
Brown long-eared bat *Plecotus auritus*	Rarer (Frequent/widespread)	Least concern
Lesser horseshoe bat *Rhinolophus hipposideros*	Rarer (Rare/restricted)	Least concern

Table 8-67: Level of collision risk to individual bats from wind turbines

Collision Risk		
Low risk	**Medium risk**	**High risk**
Myotis species Brown long-eared bat Lesser horseshoe bat		Leisler's bat Nathusius' pipistrelle Common pipistrelle (SNH, 2021) Soprano pipistrelle (SNH, 2021)

Approaches to attributing nature conservation value to species have been developed for bats (see Wray et al. 2010). The approach to scoring foraging habitat and commuting features is detailed in Table 17 of the bat report (Appendix 8-4). Using the criteria set out in Table 17 (Appendix 8-4) and based on the baseline data collected during surveys, it is considered that the scores attributed to key factors on a site wide basis equates to species specific scores of:

- 31 for common pipistrelles and soprano pipistrelles. This ranks the wind farm site as holding foraging and commuting populations of these species that are of ***Regional Importance***.
- 34 for Leisler's bat. This ranks the wind farm site as holding foraging and commuting populations of this species of ***Regional Importance***
- 38 for *Myotis* species (whiskered bat if occurring*). This ranks the wind farm site as holding foraging and commuting populations of this species of ***Regional Importance***

- 24 for Lesser horseshoe bats, *Myotis* species (Daubenton's bat and Natterer's bat), and brown long-eared bats. This ranks the wind farm as holding foraging and commuting populations of ***County Importance***
- 19 for Nathusius' pipistrelle. This ranks the wind farm site as holding a foraging and commuting population of ***Local Importance***.

***Note**: Whiskered bats are considered to occur locally in small numbers across Ireland and it is acknowledged that it is a species that can go undetected during surveys (McAney, 2006). There are two potential records received from BCI within 10-km of the site. One record is a roost *c*.5.7km from the site while the second is a survey record *c*.6.7m. Neither record makes the distinction between whiskered bat or Brandt's bat, however, the presence of either species is a rare occurrence. There are no NBDC records of whiskered bats within 10km of the site. Based on habitat availability, the species could potentially occur on a site like Fahy Beg Wind Farm. However, since the risk of collision for Myotis species is considered low further consideration is only given to this species within its Genus (i.e. as Myotis species).

With the exception of Nathusius' pipistrelle (and whiskered bat if present), the bat species recorded utilising the wind farm site are generally considered common and widespread in an Irish context (Marnell et al., 2019 & Roche et al., 2014). Taking into account the EU Annex IV protected status of bats, the bat assemblage is considered to represent a feature of ***Regional Importance***.

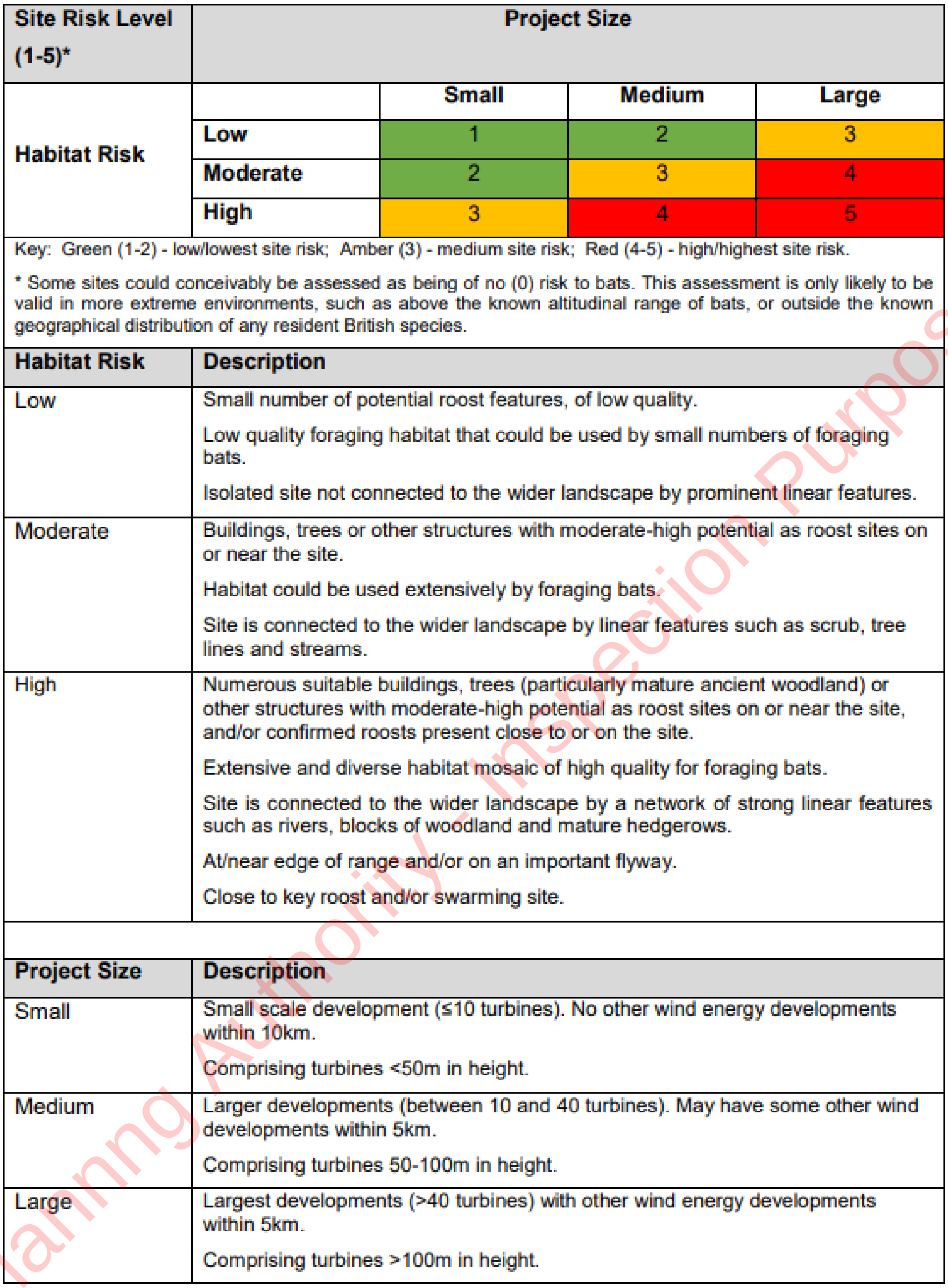
Site Risk Assessment

An initial (Stage 1) potential risk assessment for the Fahy Beg Wind Farm site was carried out using the risk assessment matrix provided in SNH *et al*. (2021) – see Table 8-68. For habitat risk, *High* was entered into the matrix as the wind farm site was assessed to have the following three conditions from the *High-risk* habitat section in SNH *et al* (2021):

- *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.*

For project size the *Medium* category was selected, as this is the best fits the proposed Fahy Beg Wind Farm as it features aspects from both the small and large project sizes (<10 turbines – small, turbines >100m – large). These two parameters returned a site risk score of **4**, which is considered a ***high site risk*** prior to the consideration of site specific data captured for the site.

Table 8-68: Stage 1 – Initial site risk assessment extracted from SNH (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 next of step of the risk assessment (Stage 2) uses a second matrix (Table 3b in SNH et al., 2021) to derive an overall risk assessment based on the activity level of high collision risk species, which in this instance are Leisler's bat, common pipistrelle, soprano pipistrelle, and Nathusius' pipistrelle. The Stage 2 - risk assessment matrix is reproduced in Table 8-69 and for each of the four high collision risk species the activity score is multiplied by the site risk score, which as stated above was determined to be 4 – high risk site. Active levels for each species are derived from Ecobat percentiles presented in the results section.

Table 8-69: Risk Assessment Matrix

	Ecobat activity percentile					
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)

Location and season specific risk assessment values generated using the matrix presented in Table 8-69 are presented in Table 8-70. Ecobat scores from 2021 were used during this risk assessment as it is considered the more robust dataset especially given that the Ecobat report produced in 2021 had the 2020 data incorporated into its reference dataset. This table highlights species at risk levels in specific locations and seasons.

Table 8-70: Risk assessment value for deployment locations

Applies matrix in Table 8-70, specific to species, location, and season using the 2021 Ecobat analysis results for high collision risk species

Collision risk species		Leisler's bat	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle
Spring	D.01	12	0	18	12
	D.02	15	0	15	4
	D.03	15	8	18	18
	D.04	12	0	12	8
	D.05	12	0	8	8
	D.06	12	0	15	15
	D.07a	12	0	12	12
	D.08	8	0	12	4
	D.09	15	0	18	12
	D.10	8	0	15	18

Collision risk species		Leisler's bat	Nathusius' pipistrelle	Common pipistrelle	Soprano pipistrelle
Summer	D.01	15	0	18	15
	D.02	15	0	15	12
	D.03	15	0	18	18
	D.04	18	0	15	12
	D.05	15	0	15	12
	D.06	15	0	18	15
	D.07a	15	0	15	15
	D.08	4	0	15	12
	D.09	15	0	15	15
	D.10	12	0	18	18
Autumn	D.01	15	0	18	18
	D.02	18	0	18	12
	D.03	18	0	15	12
	D.04	12	0	18	18
	D.05	12	0	15	15
	D.06	12	0	12	15
	D.07b	15	4	18	15
	D.08	12	0	15	18
	D.09	15	0	18	18
	D.10	12	0	18	18

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

Table 8-71 provides a summary of bat population vulnerability to wind farm impacts, species activity recorded at the Fahy Beg Wind Farm site and the regional importance attached to bat populations found to occur at the Fahy Beg Wind Farm site (locally to internationally important based on Wray *et al*, 2010).

Table 8-71: Summary of collision risk impact assessment

Species	Population vulnerability wind farms impacts	Overall activity levels at Fahy Beg WF (Ecobat)	Site wide risk levels at Fahy Beg WF for high collision risk spp.	Population Importance at Fahy Beg WF (Scoring based on Wray *et al.*, 2010)
Leisler's bat	High	Moderate/High	15	Regional (34)
Nathusius' pipistrelle	High	Moderate/Low	8	Local (19)
Soprano pipistrelle	High	Moderate/High	15	Regional (31)
Common pipistrelle	High	High	18	Regional (31)
Myotis species	Low	Moderate	Low collision risk	County-Regional (24-39)
Brown long-eared bat	Low	Low	Low collision risk	County (24)
Lesser horseshoe bat	Low	Low	Low collision risk	County (24)

Potential Direct Impacts

It is noted that all scenarios within the range of proposed turbine dimensions have been assessed.

Both direct collision with rotor blades and barotrauma (injuries to internal air cavities and blood vessels caused by sudden change in air pressure behind a moving blade), have been found to directly effect bats (e.g. Cryan & Barclay, 2009, Rydell et al., 2010, Cryan et al. 2014, & Mathews et al., 2016). The evaluation of Irish bat species likely to be at risk from collision and barotrauma is detailed in Table 16 (Appendix 8-4); and is in part related to the likelihood of different species flying at rotor blade height in an open landscape. The SNH et al. (2021) guidance incorporates the 50m set-back distance between the rotor swept area and habitat features (such as forestry edge and treelines/ hedgerows). However, this guidance mainly applies to certain species, such as common and soprano pipistrelles, which are known to follow linear habitat features when foraging or commuting. It is not relevant to areas where linear features are absent or sites where Leisler's bat activity is high, since this species is just as likely to fly over open terrain as along habitat features.

Different bat species have different foraging behaviours and ecological requirements, infrastructure such as wind turbines may affect different species in different ways. Each bat species recorded at the wind farm site is considered in the following sections. It is important to note that the probability of impact is lower for those turbines located away from habitat features. In open habitat, the probability of such an impact is considered less likely. However, where turbines are located within close proximity to features such as hedgerows and treelines (notably T1, T3, T4, T5, T6, T7 and T8), there is potential for a greater occurrence of bats within the rotor-swept area, resulting in increased potential for impact.

The potential operational effects of the proposed development on bat populations in the area need to be considered in the context of proposed mitigation measures for bats. Mitigation will include minimum separation distances from likely (foraging and commuting) features of 50 m to the rotor swept areas for all turbines (and for all proposed combinations of turbine dimensions). This necessitates a requirement for vegetation clearance; and then re-planting appropriate areas to compensate for the habitat loss and ensure integrity of the wider area for foraging and commuting bats. As proposed felling will take place during the construction phase, any potential significant effects of felling operations on roosting and foraging bats are assessed under construction related impacts. The assessment of potential impacts associated with felling considers all scenarios within the range of proposed turbine dimensions.

Operational phase: Potential impacts on common and soprano pipistrelles

As listed in Table 8-67, both common pipistrelle and soprano pipistrelle are considered to be of high risk of injury or mortality from turbines, resulting from either barotrauma (injuries to internal air cavities and blood vessels caused by sudden change in air pressure behind a moving blade) or collision, based on the behaviour and foraging techniques of this species. Both species typically show an affinity to habitat features such as woodland/plantation edge, scrub, treelines and hedgerows; however, pipistrelles are also known to forage more regularly in open habitat. Some of the proposed infrastructure at the site is close to features that are used by these species for foraging/ commuting. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found that these two species of pipistrelle were amongst the casualties most commonly recorded during turbine searches. 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.

As summarised in Table 8-71, common and soprano pipistrelles are widespread and common throughout Ireland; however due to flight behaviour, population vulnerability to wind farm developments for both species is classed as *high risk.* Both species were classed as having an overall risk assessment of *high* on a site-wide basis (Table 8-71). As presented in Table 8-70**,** evaluation of location specific species risk levels found that common pipistrelles were only a medium risk at D.04, D.05, D.07a, and D08 during the spring and at D.06 during the autumn, while all other locations and seasons were classed as *high* risk. On a location and season specific basis they received a *medium* overall risk level at D.02 throughout all seasons. They were also received an overall *medium* risk evaluation at D.01, D.04, D.05, D.07a, D.08, and D.09 in spring, D.04, D.05, and D.08 in summer, and D.03 in autumn.

Without mitigation, the potential effects of the operational phase upon common pipistrelle and soprano pipistrelle are considered to be ***Long-term Significant*** at the ***Regional*** level.

Operational phase: Potential impacts on Nathusius' pipistrelle

As listed in Table 8-67, Nathusius' pipistrelles are considered as *high risk* of injury or mortality from wind turbines resulting from either barotrauma or collision; as this species regularly flies in the open and at heights. Nathusius' pipistrelles are strong flyers and known to be migratory in parts of their European range and may fly at height during migration. A review of turbine related bat fatalities in Europe (Rydell *et al*., 2010) found that 13% of the casualties were Nathusius' pipistrelles.

As summarised in Table 8-71, Nathusius' pipistrelles are classed as having high population vulnerability to wind farm developments due the assumed vulnerability of the population and flight behaviour. It is acknowledged that there is limited population assessment data available for this species in Ireland; however, indications are that the range and frequency with which this species are recorded is increasing. In an Irish context, the apparent range expansion could be an apparition caused by increased survey effort and improved survey techniques. Even when considering seasonal or localised risk the assessment remains medium. Even though this species was only recorded at low levels at two locations (D.03 spring and D.07b autumn) in 2021 the species was assessed to have an overall risk level of *medium* on both a site wide basis and at these locations (Table 8-70).

Without mitigation, the potential effects of the operational phase on Nathusius' pipistrelles are considered to be ***Long-term Significant*** at the ***County*** level.

Operational phase: Potential direct impacts on Leisler's bat

As listed in Table 8-67, Leisler's bats are considered as being at high risk of effects from wind turbines, based on species behaviour and foraging techniques, in terms of both the likelihood of barotrauma or collision. Leisler's bats are strong and fast in flight, regularly foraging over, or taking direct flights across, open habitats at heights within the collision risk zone for wind turbines. A study (Mathews et al., 2016) monitoring bat fatalities at wind farms around the UK found that common noctule bats (*Nyctalus noctula*), were amongst the casualties most commonly recorded during turbine searches (along with common and soprano pipistrelles). Common noctule bats are not known to occur in Ireland; however, it is a similar species to Leisler's bats (lesser noctule bats) in terms flight behaviour, and therefore similar levels of collision-risk would be predicated. Leisler's bats are very sparsely distributed in England and Wales, and only occasionally recorded in Scotland; and this explains why it was not encountered during turbine searches based in the UK. Leisler's bat is listed as Near Threatened on the Irish Red List of Terrestrial Mammals (Marnell et al. 2009).

On a site-wide basis Leisler's bats were assessed to have an overall risk level of high (Table 8-71). On a location and season specific basis, the only locations which were not assessed as high risk at least once were D.08 and D.10, assessed as medium risk throughout. The other locations assessed as medium were D.01, D.04, D.05, D.06, and D.07a in spring and D.04, D.05, and D.06 in autumn.

Without mitigation, the potential effects of the operational phase upon Leisler's bat are considered to be ***Long-term Significant*** at the ***County to Regional*** level.

Operational phase: Potential direct impacts on Myotis species

As listed in Table 8-67, bats of the genus *Myotis* are considered as being at low risk of effects from wind turbines based on species behaviour and foraging techniques. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found a single carcass of a *Myotis* bat during the searches (a Natterer's bat - *Myotis nattereri*). *Myotis* species are rarely recorded flying at heights above the canopy (20 to 30m) and tend to prefer a more cluttered habitat due to their short range, high frequency echolocation characteristics. Furthermore, their relatively slow flight speed allows them to manoeuvre well and therefore have the agility to avoid collision events (Mathews *et al*., 2016 & Rydell *et al*., 2010). Because of the behaviour exhibited by these species, the probability of direct operational effect is *Unlikely.*

Given the low collision risk for this species even without further mitigation, the potential direct effects of the operational phase upon *Myotis* species are considered to be ***Long-term Not Significant*** at the ***Local*** level***.***

Operational phase: Potential direct impacts on brown long-eared bat

As summarised in Table 8-67, brown long-eared bats are considered as being at low risk of effects from wind turbines. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK found a single brown long-eared bat carcass during the searches. The standard mode of flight behaviour exhibited by this species results in the probability of an effect from wind turbines to be *Unlikely*.

Given the low collisions risk of this species, even without further mitigation, the potential effects of the operational phase upon brown long-eared bat are considered to be ***Long-term Not Significant*** at the ***Local*** level***.***

Operational phase: Potential direct impacts on lesser horseshoe bat

As summarised in Table 8-67, lesser horseshoe bats are considered as being at low risk of effects from wind turbines. A study (Mathews *et al*., 2016) monitoring bat fatalities at wind farms around the UK did not find any lesser horseshoe bat carcasses during the searches. However, this study does note that only a limited number of sample wind farms were within the known range for lesser horseshoe bat. This species is known to forage within dense woodland and actively avoid open areas (Bontadina *et al.* 2002) further reducing the probability of collision events given the likely need for turbine to feature buffers. The standard mode of flight behaviour exhibited by this species results in the probability of an effect from wind turbines to be *Unlikely*.

Given the low collision risk of this species. even without further mitigation, the potential effects of the operational phase upon lesser horseshoe bat are considered to be ***Long-term Not Significant*** at the **County** level**.**

Potential Indirect/Secondary Impacts

As proposed felling operations will take place during the construction phase, any potential significant effects of vegetation removal on roosting and foraging bats should be assessed under construction related effects. Disturbance of roosting bats and disturbance of foraging bats though lighting impacts during the operational phase is unlikely for most species, as the installation of additional lighting proposed will be minimal. The notable exception are lesser horseshoe bats which are highly sensitive to light pollution. The species utilising the site the most – Leisler's bat, soprano pipistrelle and common pipistrelle – are less sensitive to light pollution than the less commonly recorded species – lesser horseshoe bat, brown long-eared bats, and Myotis species.

8.5.2.6 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, seed-eaters, gamebirds and skylark).

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

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

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

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

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance between turbines and slower rotation speeds (Krijgsveld *et al*., 2009). Appraisal of collision risk for the proposed development is based on 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 and CRM Report in Appendix 8-1).

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.

Collision Risk Model Analysis

The assessment of potential impacts considers all scenarios within the range of proposed turbine dimensions.

The Collision Risk Modelling (CRM) Report (See Appendix 8.1) presents the results of collision risk modelling for the proposed Fahybeg Wind Farm, Co. Clare. This modelling used data from vantage point surveys carried out in the winter of 2019-20, winter 2020-21, summers of 2020 and 2021. The modelling was carried out using the Scottish Natural Heritage Collision Risk Model (Scottish Natural Heritage, 2000; Band et al., 2007). The bird occupancy method (Scottish Natural Heritage, 2000) was used to calculate the number of bird transits through the rotors, and the spreadsheet accompanying the Scottish Natural Heritage report was used to calculate collision probabilities for birds transiting through the rotors.

The following raptor and waterfowl and wader species were recorded in the vantage point surveys:

Black-headed gull, buzzard, cormorant, greylag goose, hen harrier, kestrel, lesser black backed gull, merlin, peregrine falcon, sparrowhawk, swift, whimbrel and whooper swan.

A total of four species were selected for collision risk modelling as > 200 flight seconds (total aggregated flight time over the survey period) within the Collision Risk Zone (CRZ) inside the 500m turbine buffer was recorded for each during the VP surveys across 2019 - 2021. The CRZ was defined as 30-180m altitude on a precautionary basis and encompasses the lowest and highest altitude occupied by turbine blade tips (36 – 176.5m) for the range of proposed turbine dimensions.

Species with < 200 flight seconds in the CRZ/500m turbine buffer were not subject to CRM due to collision risk being negligible below this threshold. The four species selected for CRM were:

- Black-headed gull (506 flight seconds in CRZ)
- Buzzard (16,454 flight seconds in CRZ)

- Kestrel (4,680 flight seconds in CRZ)
- Whimbrel (420 flight seconds in CRZ)

These species have been selected because they were recorded flying for > 200 seconds within the 500 m buffers at rotor swept heights and are of conservation concern: i.e., they are red or amber-listed in Birds of Conservation Concern Ireland 2020-2026 (Gilbert et al., 2021), and/or are listed on Annex I of the Birds Directive (2009/147/EC) or green-listed and sensitive to wind farm developments (i.e. Buzzard). For all the other species recorded but not included for collision risk modelling, the effective collision risk can be assumed to be zero due to sub-threshold or no flight activity within the collision risk volume (within 500m buffer/rotor swept height band).

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 8-72.

Table 8-72: Potential collision risk to non-passerine target species

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Black-headed gull (Medium)	A published review of 46 European wind farms (Hoetker *et al*., 2006) found 87 fatalities across 46 wind farms. However, the published avoidance rate (SNH, 2018) is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions per year are: Option 1: **0.0052** Option 2: **0.0049** Option 3: **0.0049** Option 4: **0.0047** Option 5: **0.0041** The range of between 0.15 – 0.12 collisions predicted for this species over the lifetime of the wind farm represents less than 1% of the national population	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium,** overall effect significance is **very low** (Criteria: Percival, 2003). The proposed impact of collision risk will be a **long-term imperceptible effect** (at the ***national*** scale At the ***local*** scale, the proposed impact of collision risk remains a **long-term slight effect.** (Criteria: EPA, 2022)
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 pairs (Gensbol, 2008) and best available knowledge suggests	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	mortality due to wind farms is not sufficient to cause significant population declines of this green-listed species. Predicted number of collisions per year are: Option 1: **0.4613** Option 2: **0.4324** Option 3: **0.0049** Option 4: **0.4207** Option 5: **0.3593** (between 10.78 – 13.84 collisions over the lifetime of the wind farm)	The proposed impact of collision risk will be a **long-term imperceptible effect** (at the ***national*** scale At the ***local*** scale, the proposed impact of collision risk could increase to a **long-term imperceptible effect.** (Criteria: EPA, 2022)
Kestrel (High)	Twenty-nine fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European Context (Hoetker et al., 2006). The published avoidance rate is 95% (SNH, 2018). Predicted number of collisions per year are: Option 1: **0.2777** Option 2: **0.2592** Option 3: **0.2592** Option 4: **0.2516** Option 5: **0.2114** (between 6.34 – 8.33 collisions over the lifetime of the wind farm)	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **unlikely**, based on recorded flight activity, height of proposed turbine envelope (36-176.5m) and published best scientific knowledge. The proposed impact of collision risk will be a **long-term imperceptible effect** at the ***national*** scale. At the ***local*** scale, the proposed impact of collision risk increases to a **long-term moderate impact.** (Criteria: EPA, 2022).
Whimbrel (Low)	No whimbrel 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). Predicted number of collisions per year are: Option 1: **0.0086** Option 2: **0.0082** Option 3: **0.0082** Option 4: **0.0080** Option 5: **0.0072** (between 0.22 – 0.26 collisions over the lifetime of the wind farm)	**Collision:** Magnitude of effects is assessed as **negligible** (<1% population lost), species sensitivity is **low,** overall effect significance is **very low** (Criteria: Percival, 2003). The proposed impact of collision risk will be a **long-term imperceptible effect** (at the ***national*** scale At the ***local*** scale, the proposed impact of collision risk remains a **long-term imperceptible effect.** (Criteria: EPA, 2022)

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 wind farm are outlined in Table 8-73.

Table 8-73: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Barn Owl (High)	**Disturbance:** Possible disturbance would be noise or visual intrusion leading to effective habitat loss of e.g. foraging areas within the wind farm boundary. Barn owls breeding success has shown no declines in areas of high disturbance levels in the UK, such as near to military activity (Shawyer, 2011); it is unlikely that noise from turbines would significantly affect birds, if present. The barn owl breeding territory overlapping the quarries is located over 700m from the nearest proposed turbine. **Barrier Effect:** Given the low population levels within both the immediate area and the wider regional context (Balmer et al., 2016) avoidance of the proposed wind farm is unlikely to induce significant energetic expenditure on either daily patterns of birds or birds undertaking larger movements such as post fledging dispersal of juveniles. It is also noted the turbine layout features large gaps (minimum of c. 316m) between individual turbines, avoiding a 'wall' or barrier effect.	Disturbance: Magnitude of effects is assessed as **Low** (Guide: 1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude Not Significant; overall significance considered a ***Local Not Significant long-term*** effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as **Low** (Guide: 1-5% habitat lost), species sensitivity is **High**, overall effect significance 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 due to low population levels; overall significance considered a ***Local Imperceptible - slight long-term*** effect (Criteria: EPA, 2022).
Black-headed 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 % 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 ***County-level Imperceptible Long-term effect*** (Criteria: EPA 2022).

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 **Very 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 **Medium** (5-20% of habitat/population lost), 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 effect assessed as Imperceptible; overall significance considered ***Local Imperceptible Long-term*** effect (Criteria: EPA 2022).
Common Gull (Low)	**Disturbance:** Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on 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 **Low**, overall effect significance is **Very 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% habitat lost), species sensitivity is **Low**, 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 ***County-level Imperceptible Long-term*** Impact (Criteria: EPA 2022).
Cormorant (Medium)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Cormorant populations post-construction. The	Disturbance: Magnitude of effects is assessed as **Low**; Species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	limited number of Cormorants observed flying over site suggests any impacts will be low. **Barrier Effect:** Barrier effects on either migration or regular flights of Cormorant has been shown for 2 out of 6 studies to date (2004) in a European context (Hoetker et al., 2006), with the overall effect significance being non-significant. The limited number of Cormorants observed flying over site suggests any impacts will be low.	Magnitude Not Significant due to published habituation to wind farms; overall significance considered ***Local Long-term Not Significant*** effect (Criteria: EPA 2022). <u>Barrier Effect:</u> Magnitude effects is assessed as **Negligible** (<1% 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 ***County-level Imperceptible Long-term*** effect (Criteria: EPA 2022).
Curlew (High)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), none of the studies indicated habituation of curlew to wind farms. The absence of breeding or wintering curlew records at the proposed site suggests any impacts will be low. **Barrier Effect:** Barrier effects on either migration or regular flights of curlew has been shown for one study to date in a European context (Hoetker et al., 2006). The absence of curlew flight activity in the 500m turbine buffer site suggests any impacts will be low.	<u>Disturbance:</u> 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). <u>Barrier Effect:</u> Magnitude of effects is assessed as **Low**, species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Slight; magnitude of daily barrier effect assessed as Imperceptible due to low recorded flight activity; overall significance considered a ***County-level Imperceptible 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 one occasion. 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).	<u>Disturbance:</u> 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).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Barrier Effect: Low published avoidance rates of wind farms (Krijgsveld et al., 2009) and changes in densities within wind farms post construction (Pearce-Higgins et al., 2012), suggests wind farms 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.	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). 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 an ***County-level Imperceptible 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. **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. It is noted that grey heron activity at the site was focused on the quarry and as such the effects of disturbance and displacement arising from the operational wind farm are of minimal relevance to this species. 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.	Disturbance: Magnitude of effects is assessed as N**egligible**, 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). Barrier Effect: Magnitude of effects is assessed as N**egligible** (<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).
Greylag goose (Medium)	**Disturbance:** In a review of the published effects of wind farms on geese (Hotker et al. 2006), a 500m buffer for roosts is recommended. As there is no suitable habitat for this species at or within 500m of the proposed site, precludes impacts in this category.	Disturbance: Magnitude of effects is assessed as **Negligible**; Species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude Imperceptible due to absence of suitable habitat within 500m; overall significance considered a ***Local Long-term Imperceptible*** 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 greylag goose have been shown for two studies in a European context (Hotker et al. 2006). This species was recorded once during the two years of VP surveys; a group six birds was observed commuting through the study area.	Barrier Effect: Magnitude effects is assessed as **Low**, species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Slight; magnitude of daily barrier effect assessed as Imperceptible due to low level of recorded flight activity; overall significance considered a ***County-level Imperceptible 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 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. 316m) between individual turbines, avoiding a ‘wall’ or barrier effect.	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). 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	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

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	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 ***County-level Imperceptible Long-term*** effect (Criteria: EPA 2022).
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).
Kingfisher (Very High)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on Kingfisher populations post-construction. The species was not recorded on-site, so any effects are likely to be negligible. **Barrier Effect:** Barrier effects on either migration or regular flights of Kingfisher has not been shown to date (2004) in a European context (Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as **Negligible**; Species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival 2003). overall significance considered ***Local Long-term Imperceptible*** 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 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 a ***Local Imperceptible Long-term*** Effect (Criteria: EPA 2022).
Lapwing (High)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), negative effects on breeding lapwing were detected in 18 out of 29 studies; the effects were not statistically significant. For non-breeding lapwing, negative effects were detected in 29 of 40 studies, with the effects found to be statistically significant. Habituation of breeding lapwing to wind farms was detected in two of eight studies, while habituation of non-breeding lapwing was detected in three of five studies. The proposed site was not identified as providing potential breeding habitat by the ornithological assessment. It is considered unlikely the area would consistently support any significant numbers of wintering waders. As such the potential for disturbance to lapwing in very low. **Barrier Effect:** Barrier effects on either migration or regular flights of lapwing in a European context has been detected in five of six studies, with the effects found not to be statistically significant (Hoetker et al., 2006). This species was recorded once during the two years of VP surveys, when a flock of 12 was recorded flying east from VP1 towards the quarry – the flock did not enter the 500 m turbine buffer.	Disturbance: Magnitude of effects is assessed as **Negligible**; Species sensitivity is **High**, overall effect significance is **Very Low** (Criteria: Percival 2003). overall significance considered ***Local Long-term Imperceptible*** Impact (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as **Low**, species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Slight; magnitude of daily barrier effect assessed as Imperceptible due to low level of recorded flight activity; overall significance considered a ***County-level Imperceptible 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	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).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a ***County-level Imperceptible Long-term*** Impact (Criteria: EPA 2022).
Little Grebe (Low)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on little grebe populations post-construction. The species was not recorded on-site, so any effects are likely to be negligible. **Barrier Effect:** Barrier effects on either migration or regular flights of little grebe 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 **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude Imperceptible due to published habituation to wind farms; overall significance considered ***Local Long-term Imperceptible*** Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as **Negligible**, species sensitivity is **low**, 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).
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).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Merlin (Very High)	**Disturbance:** In a review of the published effects of wind farms on birds (Hotker et al. 2006), there was no information available on disturbance to merlin populations post-construction. Merlin activity was low at the proposed site (only one winter record over two years) with no breeding or roosting merlin present so any effects are likely to be negligible. **Barrier Effect:** Barrier effects on either migration or regular flights of Mallard have been shown for one study in a European context (Hotker et al. 2006). As for disturbance above, the low level of recorded merlin flight activity means any effects are likely to be negligible.	Disturbance: Magnitude of effects is assessed as **Negligible**, species sensitivity is **Very High**, 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 **Negligible** (1-5% of habitat/population lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival 2003). Overall significance considered a ***Local Imperceptible long-term*** Effect (Criteria: EPA 2022).
Moorhen (Low)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), one study found evidence of moorhen habituating to a wind farm. The species was not recorded on-site, so any effects are likely to be negligible. **Barrier Effect:** Barrier effects on either migration or regular flights of moorhen 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 **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude Imperceptible due to published habituation to wind farms; overall significance considered ***Local Long-term Imperceptible*** Effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as **Negligible**, species sensitivity is **low**, 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).
Mute Swan (Medium)	**Disturbance:** Possible disturbance of feeding areas during wintering period (Oct-March) dependant on availability of food resources (e.g. improved agricultural grassland/stubble). Literature suggests possible short-term displacement of 200- 400m (Fijn et al., 2012) (Rees, 2012) followed by habituation (Fijn et al., 2012) with little evidence of permanent post construction displacement (Rees, 2012). This	Disturbance: Magnitude of effects is assessed as **Negligible**, species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Overall significance considered a ***Local Imperceptible long-term*** effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	species was not recorded within the flight activity or transect surveys study area (only recorded feeding further afield during hinterland surveys). **Barrier Effect:** There are two types of barrier effect; those to migrating birds along migration routes and daily barrier effects due to placement of turbines between feeding and roosting sites. Barrier effect can be related to perceived collision risk (SNH, 2014). Barrier effects along migration routes of wildfowl have been shown to cause only small effects on total migration distance (Masden, 2009). Swans have been shown to exhibit horizontal avoidance as they fly past the outer edge of wind farms (Fijn et al., 2012) and distances of up to 200m have been noted for whooper swans (Rees, 2012). In the Netherlands, Bewicks Swans have been recorded adjusting their flight paths to the presence of turbines during both light and darkness, with no large deflections or panic reactions recorded and birds were recorded flying around and between rows of turbines (Fijn et al., 2012). Distances between turbines at the referenced site (300-400m) (Fijn et al., 2012) are comparable to those at Fahybeg (min. 316m). 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 macro-avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005).	Barrier Effect: Magnitude of effects is assessed as **Negligible**, species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). Some barrier is effect Probable; magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests swans safely commute through turbines, the distance between turbines allows for micro-avoidance, and height of rotor envelope in relation to recorded flight height diminishes perceived collision risk; overall significance considered a ***Local Slight long-term effect*** (Criteria: EPA, 2022).
Peregrine Falcon (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

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		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 ***County-level Imperceptible, 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. A sand martin colony is present north of a section of proposed access track traversing the quarry. This colony is at a great enough distance from the track and other wind farm infrastructure to exclude disturbance. **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).
Snipe (High)	**Disturbance:** Possible disturbance during winter months to feeding or roosting birds. Numbers recorded on site (3 separate individuals) are low in relation to National Threshold. 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 **Low**, species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). The proposed impact of disturbance will be a ***Local Long-term Not Significant*** 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 an ***Local Imperceptible Long-term Effect*** (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
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. Sparrowhawk do show habituation to the presence of wind farms (Hoetker et al., 2006). The species was observed to be breeding in close proximity to the proposed T2 hard standing. **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.	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 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).
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	**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 **Very High**, overall effect significance is **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). Swifts were observed foraging within the 500m turbine buffer six times during the 2021 breeding season, with foraging parties ranging from 2 to 6 birds. It is noted however that this activity was concentrated on the periphery of the 500m buffer, away from proposed turbine locations. The airspace over the Roadstone quarry also recorded some swift foraging activity and it is likely that birds were attracted to insects rising out of the sediment ponds and dense vegetation.	Magnitude Imperceptible; overall significance considered ***Local Long-term Imperceptible*** effect (Criteria: EPA 2022). Barrier Effect: Magnitude of effects is assessed as **Low**, species sensitivity is **Very 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).
Water Rail (Low)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on disturbance of water rail populations post-construction. The species was not recorded on-site, so any effects are likely to be negligible. **Barrier Effect:** Barrier effects on either migration or regular flights of water rail 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 **Low**, 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 **low**, 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).
Whimbrel (Low)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on disturbance of whimbrel populations post-construction. The species is a passage migrant in Ireland and was only recorded traversing the site, so any disturbance effects are likely to be negligible.	Disturbance: Magnitude of effects is assessed as **Negligible**, species sensitivity is **Low**, overall effect significance is **Very 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 on either migration or regular flights of whimbrel has not been shown to date in a European context (Hoetker et al., 2006).	Barrier Effect: Magnitude of effects is assessed as **Low**, species sensitivity is **low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; overall significance considered a ***County-level Imperceptible Long-term*** Effect (Criteria: EPA 2022).
Whooper Swan (Very High)	**Disturbance:** Possible disturbance from feeding areas during wintering period (Oct-March) dependant on availability of food resources (e.g. improved agricultural grassland/stubble). Literature suggests possible short-term displacement of 200- 400m (Fijn et al., 2012) (Rees, 2012) followed by habituation (Fijn et al., 2012) with little evidence of permanent post construction displacement (Rees, 2012). This species was not recorded feeding within the flight activity or transect surveys study area, or at any locations in the wider area (closest ground-level record was on Ardcloony Reservoir c. 3.8 km east of the wind farm; other records involved flying swans). **Barrier Effect:** There are two types of barrier effect; those to migrating birds along migration routes and daily barrier effects due to placement of turbines between feeding and roosting sites. Barrier effect can be related to perceived collision risk (SNH, 2014). Barrier effects along migration routes of wildfowl have been shown to cause only small effects on total migration distance (Masden, 2009). No migratory movements were observed during surveys; all recorded flights were commuting flights. Swans have been shown to exhibit horizontal avoidance as they fly past the outer edge of wind farms (Fijn et al., 2012) and distances of up to 200m have been noted for whooper swans (Rees, 2012). In the Netherlands, Bewicks Swans have been recorded adjusting their flight paths due to the presence of turbines during both light and darkness, with no large deflections or panic reactions recorded and birds were recorded flying around and between rows of turbines (Fijn et al., 2012).	Disturbance: Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Overall significance considered a ***Local Not Significant long-term*** 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). Some barrier effect is Probable; magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible as literature suggests swans safely commute through turbines, the distance between turbines allows for micro-avoidance, and height of rotor envelope in relation to recorded flight height diminishes perceived collision risk; overall significance considered a ***County-level Slight long-term effect*** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Distances between turbines at the referenced site (300-400m) (Fijn et al., 2012) are comparable to those at Fahybeg (min. 316m). 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 macro-avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005). There was one record of whooper swan traversing the study area during the two years of surveys. Three whooper swans were observed during winter VP surveys, commuting west through the buffer for 13 seconds at 100-150 m.	
Woodcock (Low)	**Disturbance:** In a review of the published impacts of wind farms on birds (Hoetker et al., 2006), there was no information available on disturbance of woodcock populations post-construction. As a nocturnal species, woodcock is unlikely to be affected by noise/visual intrusion. **Barrier Effect:** Home ranges are small with birds recorded flying up to 1 km from nest sites to forage (Hoodless and Hirons 2007). No published evidence of barrier effect to migrating birds is available (Hoetker et al., 2006).	Disturbance: Magnitude of effects is assessed as **Low**, species sensitivity is **Low**, overall effect significance is **Very 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 **Low**, species sensitivity is **Low**, 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 as literature suggests low published avoidance rates of wind farms; overall significance considered an ***County-level Imperceptible Long-term*** Effect (Criteria: EPA, 2022).

8.5.2.7 Aquatic Ecology

Wind Farm

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 effects considering the low numbers of vehicles involved.

Upgrading of the site track/road network could allow increased public access to the site. This could potentially result in illegal dumping of domestic rubbish which could impact the watercourses in the area by causing deterioration in water quality. The potential operational phase effects on aquatic ecology are assessed as being *imperceptible negative, temporary and in the local context.*

Grid Connection

Effects on aquatic ecology during the operational phase of the proposed development are unlikely. There is the potential for spills of any oil or fuels from site vehicles finding its way to the local stream network. In addition, if repairs need to be carried out and soil is excavated there is the potential for effects regarding suspended solids. However, this is unlikely to be a significant effect considering the low numbers of vehicles involved and the unlikelihood of maintenance. Potential operational phase effects on aquatic ecology are assessed as being *imperceptible negative, temporary and in the local context.*

Turbine Delivery Route

Effects on aquatic ecology during the operational phase of the proposed TDR 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.

8.5.2.8 Marsh Fritillary

As technical maintenance activities will be confined to the built infrastructure of the wind farm, and no turbine buffers overlapping grassland which potentially require maintenance (mowing) in the absence of regular grazing are located in areas with *S.pratensis*, there will be no operational stage impacts on marsh fritillary.

8.5.2.9 Other Species

No other species identified during desktop and baseline surveys will be affected during the operational phase of the wind farm.

8.5.3 Potential effects during the decommissioning of the Project

8.5.3.1 European Sites

A Natura Impact Statement (NIS) has been prepared for the proposed development. The NIS addresses potential impacts on 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 Lower River Shannon SAC at decommissioning stage cannot be excluded on the basis of objective scientific information. A Stage 2 Appropriate Assessment (Natura Impact Statement) of the potential impact on the Lower River Shannon SAC was therefore required.

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 project will not adversely affect the integrity of any of the European sites concerned. No decommissioning phase impacts to the Lower River Shannon SAC were identified following mitigation.

8.5.3.2 Natural Heritage or Proposed Natural Heritage Areas

On decommissioning, cranes will disassemble the above ground turbine components which will be removed off site for recycling. All the major component parts are bolted together, so this is a relatively straightforward process. The foundation pedestals will be covered over and allowed to re-vegetate naturally.

It is proposed that all the internal site access tracks and turbine hard standings will be left in place. These will continue to be used for forestry and agriculture. Turbine foundation pedestals and hard standings shall be covered over with topsoil previously stripped and used for landscaping purposes during the construction stage and left to revegetate naturally.

The temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be dismantled on site and removed using standard HGVs.

Grid connection infrastructure including the on-site substation and ancillary electrical equipment shall form part of the national grid and will be left in situ.

As such, no direct or indirect effects on pNHAs or NHAs within the potential ZoI of the wind farm or GCR/TDR are anticipated at decommissioning stage.

8.5.3.3 Habitats and Flora

The decommissioning of the wind farm 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. In addition it is likely that disturbance to habitats which established during the operational phase will arise from the relocation of topsoil from landscaping features to cover turbine foundations and hard standings.

Vegetation clearance and topsoil movement would result in a *Short-term Not Significant Reversible Effect* at the *Local scale*.

8.5.3.4 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. Direct effects on badger during the decommissioning process could occur if setts have become established in locations to be affected. Potential direct effects to badgers in the event of setts becoming established within areas which will be directly affected are *Significant, Short-term, Local* and *Reversible*.

The potential exists for indirect effects 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 effects could occur if setts have become established in locations to be affected. Potential indirect effects are *Moderate-Significant, Short-term, Local* and *Reversible*.

Otter

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 effects on prey availability; however, this will be minimal during the decommissioning process. Potential indirect effects are *Moderate, Temporary, Local* and *Reversible*

8.5.3.5 Bats

The possible direct effects on bats during the decommissioning phase of the wind farm are greatly reduced compared with the construction phase of the project; works will be limited to turbine removal, and reinstatement of hard standings, resulting in potential disturbance only.

Indirect effects 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 effects 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.

Potential effects are *Slight, Short-term, Local* and *Reversible*.

8.5.3.6 Avifauna

Potential Direct Effects

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

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

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

It is likely that the time period for decommissioning of the project would be ca. 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 effect to passerine species is a *Temporary Imperceptible Reversible Effect* at the *Local scale.*

Birds of Prey

Surveys conducted as part of the proposed development indicate that sparrowhawk and buzzard are breeding at the proposed site and in the surrounding area, with kestrel and barn owl breeding in the surrounding area.

There shall be no further woodland habitat loss during the decommissioning phase. Decommissioning during the breeding or wintering season shall result in some minimal disturbance to sparrowhawk, buzzard, and potentially kestrel or barn owl due to increased human activity and noise. The resultant effect to birds of prey is a *Temporary Imperceptible Reversible Effect* at the *Local scale.*

Waders and waterfowl

A number of gull species, wintering snipe and woodcock were noted as being present within the wind farm study area. The increase in human activity and noise may result in a minimal temporary disturbance to these species.

There will be no further habitat loss during the decommissioning phase. The resultant effect to waders and waterfowl is a *Temporary Imperceptible Reversible Effect.*

In the event that breeding snipe or woodcock are present at the time of decommissioning, a *Temporary Significant Reversible Effect* could occur at the *Local scale.*

Potential Indirect Effects

The decommissioning phase of the proposed wind farm poses similar risks of potential effects to the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ.

8.5.3.7 Aquatic Ecology

The decommissioning phase of the proposed wind farm site gives rise to similar potential effects as can occur during the construction phase; although the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in place on the site. Potential decommissioning effects on aquatic ecology, in the absence of mitigation, are assessed as being *slight negative, short-term* and in the local context.

During the decommissioning phase, the grid connection will be left in place. 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 effects.

8.5.3.8 Marsh Fritillary

There is potential for *S. pratensis* to establish on landscaped features formed from excavated topsoil, and also potentially for marsh fritillary larvae to inhabit these areas. In the event that landscaped features supporting *S. pratensis* and marsh fritillary larvae were excavated to reinstate turbine hard standings, *A Significant Short-term* effect could occur at the *Local scale*.

8.5.3.9 Other Fauna

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

8.5.4 Potential cumulative effects on Biodiversity

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 cumulative impacts due to plans or projects 'that are currently under consideration together with the effects of any existing or proposed projects or plans.' For the purposes of the assessment the words in-combination and cumulative are interchangeable and have the same meaning.

According to the Scottish Natural Heritage, 'the cumulative effect of a set of developments is the combined effect of all the developments, taken together' (SNH, 2005). A cumulative impact arises from incremental changes caused by other past, present or reasonably foreseeable actions together with the proposed wind farm development.

The surrounding environment is dominated by agricultural land, with occasional woodlands and blocks of forestry. Upland areas covered by heath/blanket bog and conifer plantation are present to the west and north. The River Shannon and Lough Derg are present to the east and north. The Shannnon has been impacted by hydroelectric generation, with the presence of the Ardnacrusha Dam Headrace, Parteen Weir and riverbank modification works having created barriers to fish migration and homogenised riverine features. The main damaging operations and threats to the greater regions ecological resources are industrialised agriculture, forestry operations and hydroelectric power generation. Afforestation and agriculture have shaped the habitats within the study area. Forestry and agriculture can create habitat uniformity, negatively impact river catchments, and alter nesting and feeding habitats for animals. It is noted that the broadleaved forestry plantations onsite are more natural in character than conifer plantations. The forestry drainage onsite does not discharge directly into rivers, but the upland nature of the site means runoff from forestry is likely to enter the hydrological network. 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.

To inform the current appraisal, planning searches were carried using the resources listed below. The planing search was completed on 24th November, 2022.

The following sources were referred to:

- Clare County Council planning viewer https://www.clarecoco.ie/services/planning/applications/view/
- Limerick County Council planning viewer https://www.limerick.ie/council/services/planning-and-property/apply-or-search-planning-application/search-planning
- Tipperary County Council planning viewer https://www.tipperarycoco.ie/planning/category-search-planning-records
- An Bord Pleanála website (Strategic infrastructure development (SID) applications, Strategic Housing Development (SHD) applications and project applications including wind farms and planning appeals) https://www.pleanala.ie/en-ie/home;
- Irish Wind Energy Association (IWEA) https://www.iwea.com/

- Department of Department of Housing, Local Government and Heritage's EIA Portal https://www.gov.ie/en/publication/9f9e7-eia-portal/.

8.5.4.1 Developments

Existing or Proposed Wind Farms and Turbines

One operational wind energy installation exists within 20km of the wind farm site; this is a single turbine located at the Johnson & Johnson facility in Castletroy on the outskirts of Limerick City. A proposed 19-turbine wind farm located c.5.8 km north-west of the proposed site on the northern slopes of the Slieve Bearnagh Mountains has recently received planning permission. Projects along the GCR and TDR were also considered.

The following existing and planned wind farms within 20 km of the proposed development were examined for potential cumulative effects on Biodiversity with the proposed development.

Table 8-74: Existing and permitted/proposed wind farms within 20km of the proposed development

Wind Farm Name	Number of Turbines	Distance and Direction from Proposed Development Site	Status
Vistakon	1	11.4 km (south)	Existing turbine at manufacturing facility
Carrownagowan	19	5.8 km (north-west)	Consented

The construction phase of Fahybeg Wind Farm has the greatest potential to contribute suspended solids/pollutants to nearby watercourses due to excavation works and general construction works. The proposed Carrownagowan Wind Farm is located within the Owenogarney River catchment. The Broadford River which drains the section of Fahybeg where turbines T1 and T2 are located is a tributary of the Owenogarney, joining it via Doon Lough. The Owenogarney then continues south, draining to the Shannon Estuary at Bunratty.

As such, if both wind farms were constructed at the same time, there could be potential for cumulative effects on the aquatic receiving environment. The potential for cumulative effects on habitats, flora and less mobile species of fauna are considered negligible.

The potential for cumulative impacts to birds and bats from both existing and proposed turbines within 20 km is considered further below.

Large Scale/Infrastructure Projects

The following projects within c. 20 km of the proposed site are consented:

Restoration of 3.76 hectares of an extant sand and gravel quarry (Ballyquin Quarry which is partly overlapped by the proposed wind farm) to agricultural grassland. Required to comply with condition no. 4 of substitute consent 03.SU.0127 and will include importation inert material and all associated development works. This development straddles the Lower River Shannon and Shannon Estuary North catchments. The AA screening report for this project identified no likely significant effects.

Killaloe Bypass, Shannon Bridge Crossing and R494 Improvement Scheme: a western bypass around the town of Killaloe which will connect the R463 to the north of town with the proposed Shannon Bridge Crossing section and R463 to the south of the town. Shannon Bridge Crossing: This section of the scheme will cross the River Shannon approximately 1km south of the existing Killaloe Bridge and will connect the proposed Killaloe Bypass with the R494. R494 Upgrade: This section will involve widening, regrading and local realignment of the R494 from its junction with the R496 and proposed Shannon Bridge Crossing south of Ballina, as far as the junction with the R445 (previously known as N7) north of Birdhill. The NIS for this development concluded it will have no adverse effect on the integrity on any of the Natura 2000 sites listed and as such there is no potential for significant effects on Natura 2000 sites.

Quarrying an area consisting of 10 hectares located adjacent to the existing working quarry including extraction of rock by blasting down to 150mOD; extracted rock will be processed at the existing working quarry at Ballycar, Ardnacrusha, Co. Clare. An EIAR was submitted with this application. This development is in the Lower River Shannon catchment. The AA screening report for this project identified no likely significant effects. Consent was granted following provision of further information on management of onsite lagoons.

Site redevelopment comprising primarily offices, with residential and retail units also included, at a 2.35 Ha site in Limerick City. This development is in the Lower River Shannon catchment. An Bord Pleanála agreed with the findings of the NIS which stated that the proposed development would not adversely affect the integrity of European sites.

Change of use from a mental health day centre to a residential care dwelling in Limerick City. The dwelling house is intended for use as a community dwelling for rehabilitation residents. This development is in the Lower River Shannon catchment. The planner’s report concluded this project would not give rise to likely significant effects on Natura 2000 sites.

A new Irish Water National Laboratory in Limerick City. Part single and part two storey, with laboratory at ground floor and plant room and external plant at first floor/roof level. (total gfa 3,736sq.m approx.). This development is in the Lower River Shannon catchment. The NIS concluded this development would not have adverse effects on the integrity of any European site(s).

New 1000 pupil post-primary school circa 11,379sqm over 3 storey levels with rooftop plantroom and 450sqm photovoltaic panels located at Caheranardrish, Mungret, Co. Limerick. This development is in the Shannon Estuary South catchment. An AA Screening Report was requested by the planning authority prior to grant of consent. This report is not publicly available.

Alterations to an existing waste facility are consented at Galvone Industrial Estate, Roxboro, Limerick. This development is in the Lower River Shannon catchment. The planner’s report concluded the project would not give rise to likely significant effects on Natura 2000 sites.

A total of three retention applications for telecommunications masts are consented, in addition to one application to increase the height of an existing mast by 3m. These are located in Ballykelly, Broadford, Co. Clare, Woodcock Hill, Reaskcamoge, Co. Clare (Shannon Estuary South catchment), Aharinaghmore, Kilmore, Co. Clare and Drumline, Shannon, Co Clare (Lower River Shannon catchment). These projects do not have the potential to contribute to cumulative effects due to their limited scale and distance from the proposed Fahybeg wind farm.

An Urban Greenway (cycling & walking) providing connectivity between Castletroy College and Gaelscoil Chaladh an Treoigh. Main route is c. 820m in length. This development is in the Lower River Shannon catchment. The AA Screening Report concluded no likely significant effects on Natura 2000 sites would occur.

Extension of permission for a new public plaza at Colbert Station in Limerick City. This development is in the Shannon Estuary South catchment. information on mitigation was publicly available from the planning authority. In the absence of this, it is considered there is potential for cumulative effects on aquatic receptors from siltation and/or hydrocarbon pollution transported via the stormwater drainage network.

Upgrade works to power transmission infrastructure at Ardnacrusha hydroelectric station, including pylons and temporary structures. The planner's report concluded the project would not give rise to likely significant effects on Natura 2000 sites.

For projects which have been identified as having potential for effects, there is potential for these developments to contribute to cumulative effects on aquatic receptors including habitats, fauna and designated sites.

Housing Developments

A total of seven large housing projects are consented within the Lower River Shannon catchment within c. 20 km of the proposed site. These developments range from 41 – 99 units in volume and all are located Co. Limerick, in and around Limerick City and it's suburbs.

A total of four large housing projects are consented/proposed within the Shannon Estuary North catchment within c. 20 km of the proposed site. These developments range from 41 – 60 units in volume and all are located in Co. Clare, in or near towns and villages.

A total of ten large housing projects are consented within the Shannon Estuary South catchment within c. 20 km of the proposed site. These developments range from 48 – 384 units in volume and all are located in Co. Limerick, in and around the south-western suburbs of Limerick City.

Within these larger housing developments, a total of ten were considered not to have potential to give rise to likely significant effects, as indicated by planning reports and/or AA screening reports. A total of nine were accompanied by Natura Impact Statements which concluded the projects would not adversely affect the integrity of any European sites following mitigation.

There was no readily available AA or mitigation information from planning authorities for two of these developments (41 units in Quin, Co. Clare and 49 units in Patrickswell, Limerick. While it is unlikely these projects were consented without undergoing the AA process, in the absence of information to the contrary it is considered there is no evidence of the absence of effects, and no environmental/ecological mitigation is evident. They are therefore considered to have the potential for cumulative effects in-combination with the proposed Fahybeg wind farm.

A total of 43 one-off housing developments encompassing projects such as new builds, renovations, alterations and sheds are consented or pending within c. 2 km of the proposed site. Similar developments are also located along the proposed grid connection.

There is potential for these developments to contribute to cumulative effects on aquatic receptors including habitats, fauna and designated sites, prior to mitigation.

Renewable Energy Developments

Carrownagowan Wind Farm:

- Nineteen (19) No. Wind Turbines (blade tip height up to 169m).
- Nineteen (19) No. Wind Turbine foundations and associated Hardstand areas.
- One (1) No. Permanent Meteorological Mast (100m height) and associated foundation and hardstand area.
- One (1) No. Substation (110kV) including associated ancillary buildings (electrical building including control, switchgear and metering rooms, and the operational building Including welfare facilities, workshop and office), security fencing and all associated works.
- Upgraded Site Entrance.
- New and upgraded internal site service roads (8.4km of existing tracks to be upgraded and 11.4km of new service roads to be constructed)
- Provision of an on-site Visitor cabin and parking.
- Underground electrical collection and SCADA system linking each wind turbine to the proposed on-site substation.
- Construction of new roadways and localised widening along turbine delivery route.
- Two (2) No. Temporary construction site compounds.
- Three (3) No. Borrow Pits to be used as a source of stone material during construction.
- Three (3) No. Peat and Spoil deposition areas (at borrow pit locations).
- Associated surface water management systems.
- Tree felling for wind farm infrastructure.
- All associated site development works.

“A 10 year planning permission, and 30 year operational life from the date of commissioning is sought." Carrownagown wind farm has been granted planning permission.

110kV underground grid connection for Carrownagowan wind farm to Ardnacrusha is approximately 25km in length and runs in a northerly direction from the existing ESB Ardnacrusha 110kV substation to the proposed Carrownagowan Wind Farm substation location utilizing public local road networks, existing access tracks and private forestry access tracks.

The Carrownagowan NIS concluded that “provided the recommended mitigation measures are implemented in full the Carrownagowan Wind Farm project will not result in significant effects on the conservation objectives of the European sites considered in this NIS, either alone or in-combination with other plans and projects or affect integrity of these sites”.

The Carrownagowan EIAR Biodiversity chapter concluded that “provided that the proposed wind farm project is constructed and operated in accordance with the design, best practice and mitigation that is described within this application, significant effects on KERS are not anticipated at any geographical scale, or on any of the Key Ecological Receptors. The application of construction phase mitigation and protection measures will ensure that no significant residual ecological impacts either alone or in combination with other plans or projects will arise from the project.”

The Carrownagowan EIAR Ornithology chapter concluded that "With the avoidance measures (mitigation by design), and best practice in place (mitigation by management), and provided all mitigation measures are implemented in full, and remain effective throughout the construction phase, operational phase, and decommissioning phase of the project, significant residual effects on avian Key Ecological Receptors are not expected".

There is potential for cumulative effects to occur in conjunction the Carrownagowan project which identified potential for potential for significant effects (prior to mitigation).

Solar Farms:

A total of seven solar farms are consented in the surrounding region, located at distances ranging from 17 – 25 km from the proposed site.

Location	Size	EIAR/AA/NIS Conclusions	Catchment	Distance from Fahybeg
Clonloghan, Caherteige, Co. Clare	63,000 m^2 of solar panels	No significant effects on designated sites, habitats, flora or fauna identified. No potential for likely significant effects on European sites.	Shannon Estuary North	24 km
Cahershaughnessy near Spancil Hill, Co Clare	57,250 m^2 of solar panels	Overall positive effect on flora & fauna following implementation of mitigation. No potential for likely significant effects on European sites.	Shannon Estuary North	24 km
Knockanoura & Cranagher, Spancil Hill, Co. Clare	92,550 m^2 of solar panels	Overall positive effect on flora & fauna following implementation of mitigation. No potential for likely significant effects on European sites.	Shannon Estuary North	25 km
Manusmore, Clarecastle, Co Clare	Total site area 99.2 Ha	Overall positive effect on flora & fauna following enhancement measures. No potential for adverse effects on European sites.	Shannon Estuary North	24 km
Manusmore and Carrownanelly, Clarecastle, Ennis, Co Clare	Total site area 16.1 Ha	No residual impacts on key ecological receptors. No risk of significant adverse effects on any European site.	Shannon Estuary North	24 km
Tuogh, Cappamore,, Co.Limerick.	33,450 m^2 of solar panels	Neutral-imperceptible residual effects following mitigation. No likely significant effects on European sites.	Lower River Shannon	22 km
Islandduane, Mungret, Co. Limerick.	Total site area 12.1 Ha	Conclusions not available.	Shannon Estuary South	17 km

A solar farm at Ballyvalode, Garryduff, Gortnakistin, Gortyvahane, Keelogs, Kilmacogue, Moanoola and Moanroe, Co. Limerick (c. 22 km from Fahybeg) 141.8 hectares in extent was refused planning permission by Limerick Co. Council. This decision is under appeal. The reason for refusal was the site's location within the Yellow Option Corridor for the N24 Cahir to Limerick Junction road project. The NIS concluded that the integrity of European sites would not be adversely affected.

Considering that six of the above solar projects identified no significant residual significant effects, and the location of the Islandduane, Mungret, Co. Limerick solar farm on the southern side of the Shannon Estuary c. 17 km south of Fahybeg, no potential for significant cumulative effects in combination with these projects has been identified.

Another solar farm at Ballyvonnavaum, Coolshamroge, Cloonmore, Deerpark and Manusmore, Ennis, Co Clare (c. 22 km from Fahybeg) c. 27.34 hectares in extent is currently subject to further information. The FI request contains items pertinent to the NIS and EcIA.

8.5.4.2 Farming

Intensive grassland management is prevalent in parts of the wind farm site and is the dominant land use along the GCR and TDR. 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 wind farm to contribute to a cumulative effect 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 felling, construction activities in addition to ongoing farming operations.

The risk of such effects would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Due to the small sizes and/or 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 effects.

A total of five slatted livestock sheds are consented within c. 2 km of the proposed site, demonstrating the continued environmental pressure exerted by livestock farming.

8.5.4.3 Forestry

Forestry is one of the main land uses within the wind farm site and is relatively common within the greater area, particularly on hillsides at higher elevations. Conifer plantation common within the proposed site at surrounding area. Effects often associated with forestry on the local environment are habitat loss, habitat alteration and potential reduction in water quality. It is noted that the plantations onsite do not discharge directly to watercourses, reducing the potential for negative effects.

While forestry may have resulted in a reduction in water quality locally closer to the time of establishment, the water quality in the majority of the streams within the study area is more closely dependent on agricultural activities.

There is potential for felling and construction activities at the wind farm site to act cumulatively with other forestry activities in the same catchment, particularly harvesting operations. While it is difficult to quantify the level of resultant effects 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 potential indirect cumulative effects to the rivers draining the proposed site could occur further downstream and a *Medium-term Moderate Reversible Cumulative effect* is considered likely.

8.5.4.4 Hydroelectric Power

The existing Ardnacrusha hydroelectric dam includes a weir at Parteen where water is diverted from the Shannon main channel to a headrace flowing towards the dam. A deficient fish pass and brood stock trap is present at the weir; this is detrimental to migratory Atlantic salmon and does not function well as a fish pass. As there will be no barrier to fish migration caused by the proposed project, a cumulative effect is not predicted in this regard.

The following project within c. 20 km of the proposed site is proposed but not yet granted:

A temporary period of up to 5 years for the development of 3 no. hydrokinetic turbines, associated anchors and marker buoys upstream of Thomond Weir in the River Shannon in Limerick City. The project will be for 24 months. An EcIA and NIS were submitted with this application; however, the planning authority omitted the EcIA impact assessment and conclusion and NIS from their online planning portal. The NIS concluded that following mitigation, the integrity of the Lower River Shannon SAC would not be adversely affected.

A risk of cumulative effects to aquatic species exists, prior to mitigation.

8.5.4.5 Cumulative Impacts during Construction on Key Receptors

Designated Nature Conservation Sites

The wind farm site is not within the boundaries of any designated nature conservation site. The grid connection route does not traverse any designated nature conservation site. Therefore, there will be no direct effects to designated nature conservation sites for the wind farm site or the grid connection.

Prior to mitigation, there is potential for indirect cumulative effects on the Lower River Shannon SAC, River Fergus and River Shannon Estuaries SPA, Inner Shannon Estuary- South Shore pNHA and Inner Shannon, North Shore pNHA to arise from wind farm construction and grid cable installation in conjunction with consented large-scale housing developments, large-scale developments and one-off housing projects in the Lower River Shannon, Shannon Estuary North and Shannon Estuary South catchments where mitigation is not evident. Cumulative effects may also arise in conjunction with agricultural and forestry activities.

The proposed Carrownagowan grid connection runs for c. 25 km from Ardnacrusha hydroelectric station northwards to the Slieve Bearnagh Mountains via the road network, traversing the Lower River Shannon catchment. It overlaps the proposed Fahy beg grid connection for c. 1.8 km along the R471 and L3046. The aquatic ecology assessment identified no potential for cumulative impacts.

The TDR drains towards the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA. There is limited potential for siltation arising from TDR works to affect the Lower River Shannon SAC. Potential for the spread of invasive species to the Lower River Shannon SAC and Curraghchase Woods SAC arising from TDR accomodation works was also identified. As such there is potential for a cumulative effect in these categrories.

Cumulatively there is likely to be a *Long-term Moderate Reversible Cumulative Effect* at the *Catchment scale* without mitigation.

No effects are predicted to any other Nature Conservation sites during construction of the proposed wind farm project and no additive effects due to in combination direct effects 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. Where European sites overlapping with nationally designated sites were identified as being subject to likely significant effects, the conclusions from the NIS for said European sites is shown here.

The possibility of significant effects to these European sites were identified:

- Lower River Shannon SAC (002165)
- River Shannon and River Fergus Estuaries SPA (004077)
- Dane's Hole, Poulnalecka SAC (00030)
- Curraghchase Woods SAC (000174)

Relevant European sites in relation to the wind farm, GCR and TDR are as follows:

Three downstream pNHAs within the ZoI of the wind farm and/or the GCR/TDR overlap European sites which were considered as part of the NIS. The possibility of significant effects to these European sites (Lower River Shnnaon SAC and River Shannon and River Fergus Estuaries SPA) was identified:

- Knockalisheen Marsh pNHA
- Fergus Estuary and Inner Shannon, North Shore pNHA
- Inner Shannon Estuary- South Shore pNHA

Two pNHAs within the ZoI of the wind farm overlap a European sites which were considered as part of the NIS. The possibility of significant effects to these European sites (Lower River Shnnaon SAC and Danes Hole, Poulnalecka SAC) was identified:

- Castleconnell (Domestic Dwelling, Occupied) pNHA
- Danes Hole, Poulnalecka pNHA

One pNHA within the ZoI of the TDR overlaps a European site which was considered as part of the NIS. The possibility of significant effects to this European site (Curraghchase Woods SAC) was identified:

- Curraghchase Woods pNHA

The cumulative assessment in the NIS identified potential for cumulative impacts on the Lower River Shannon SAC (002165), River Shannon and River Fergus Estuaries SPA (004077), Curraghchase Woods SAC (000174) and Dane's Hole, Poulnalecka SAC (00030) arising from the proposed project in the absence of mitigation.

Habitats and Flora

Potential direct impacts during construction have been identified as land take during construction of the 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 wind farm may result in cumulative effects. The potential spread of invasive species recorded along the TDR, bordering the wind farm site and the along the grid connection could result in cumulative effects with other projects. Cumulatively there is likely to be a *Permanent Moderate Reversible Cumulative Effect* at the *County scale* without mitigation.

Mammals (Excluding Bats)

Mammal breeding or resting sites may be cumulatively affected by other developments which either remove potential breeding sites and foraging habitats (e.g. road construction) or farming and forestry activities which may for example remove badger setts, pine marten breeding sites, red squirrel dreys, etc.

Prior to the implementation of mitigation cumulative effects are likely to be *Short-term Moderate Cumulative Effects* at the *Local scale* which are potentially *Reversible*.

Bats

Potential cumulative impacts on bats during the construction phase would be as follows:

- Displacement of populations
- Abandonment of young
- Mortality

Bat surveys were completed for Carrownagowan Wind Farm recorded relatively low levels of bat activity throughout the site. Surveys results indicated the proposed Carrownagowan Wind Farm site is used by foraging bats in low numbers. No evidence of roosting bats was observed during surveys within the footprint of the proposed project. The impact assessment determined that habitat loss effects on bats as Permanent Slight Negative Effects, and any disturbance, and or displacement effects on bats site as Short-term Slight Negative Effects.

The consented solar farms in the surrounding region are not within close proximity (closest is c. 17 km away) and as such construction-stage cumulative effects on bats are highly unlikely. Similarly, the large-scale housing developments are not in close proximity (closest is c. 12 km away).

Considering the distance between the proposed site and consented large-scale housing developments and solar farms, and the low level of impacts identified for bats at Carrownagowan Wind Farm, a *Long-Term Slight Cumulative Effect* at the *County scale* is predicted for bats.

Avifauna

Potential cumulative construction effects - Carrownagowan Wind Farm:

The ornithological assessment for Carrownagowan Wind Farm identified hen harrier habitat loss during construction as a *Long-term Slight Negative* effect, and displacement/barrier effects during construction as *Short-term Significant Negative.* For peregrine, merlin and kestrel habitat loss during construction displacement/barrier effects during construction ranged from *imperceptible* to *slight*.

Considering the low amount of activity recorded at Fahybeg for hen harrier, peregrine and merlin, cumulative effects in terms of habitat loss are not predicted. Any cumulative effects on kestrel in terms of habitat loss are predicted to be Long-term *slight, reversible* at the *local level*.
Hen harrier, merlin and kestrel could experience *Temporary Slight* effects due to disturbance/displacement at the *local level*. No effects in this category are predicted for Peregrine.

Cumulative effects on buzzard and sparrowhawk are not predicted due to the small home ranges occupied by these species and the limited suitability of Carrownagowan for these species.

Temporary Not significant local level cumulative effects are predicted for Golden plover due to the absence of suitable habitat from the proposed site and low activity recorded.

The wintering woodcock population could experience *Temporary slight local level* effects due to construction-stage disturbance/displacement.

Potential cumulative effects - General

Direct effects 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.

Any cumulative effects to other birds not discussed above during the construction phase would be a *Short-Term Not Significant Cumulative effect* at the *Local scale*.

Aquatic Ecology

Wind Farm

The area of the proposed site is subject to additional pressures on water quality and aquatic ecology, particularly in relation to agricultural activities and drainage maintenance works. Where wind farm construction and agricultural activities occur at the same time there is the potential for cumulative effects on local watercourses. The risk of such effects would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Conifer forestry and peat extraction and associated operations could also have the potential to adversely affect water quality in the area; therefore, these could effect watercourses in-combination with the proposed Fahy Beg wind farm. There is a proposal for another wind farm in the area. This wind farm called Carrownagowan Wind Farm is located c. 5.5 km north of the current proposed wind farm. If both of these developments were constructed at the same time, there is the potential for cumulative effects. It is noted however that the Carrownagowan Wind Farm is located mostly in the upper reaches of the Owenogarney River catchment which drains to the Shannon Estuary North Catchment, while a small portion to the east in slocated in the Lower River Shannon catchment. Potential cumulative effects on aquatic ecology, in the absence of mitigation, are assessed as being *moderate negative, short-term and in the local context*.

Grid Connection

Upstream of the proposed grid connection route the River Blackwater [Clare] is under significant pressures and is at risk of not meeting its objectives as set out in the WFD by 2027. Along the route itself the river is not "At Risk" and downstream the river is "Under Review". The sites are subject to additional pressures on water quality and aquatic ecology, particularly in relation to agricultural activities. There are also impacts on fish passage due to in-stream obstructions. Where construction and agricultural activities occur at the same time there is the potential for in-combination or cumulative effects on local watercourses. The risk of such effects would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Conifer forestry and associated operations could also have the potential to adversely affect water quality in the area; therefore, these could effect watercourses in-combination with the proposed Fahy Beg wind farm. There is a proposal for another wind farm in the area. This wind farm called Carrownagowan Wind Farm is located c. 5.5km north of the current proposed wind farm. If both of these developments were constructed at the same time there is the potential for cumulative effects. It is noted however that the Carrownagowan Wind Farm is located mostly in the upper reaches of the Owenogarney River catchment which drains into the Shannon Estuary North Catchment. This is located in a different hydrometric area from all sites on the proposed grid connection. The potential cumulative effects on aquatic ecology, in the absence of mitigation, are assessed as being *moderate negative, short-term and in the local context*.

It is noted that the proposed Carrownagowan grid connection is in the same catchment as the proposed Fahy Beg grid connection. These grid connections overlap for a section along the R471 and a section of local road. This has been taken into account in the cumulative impact assessment and it is considered that that there will be no cumulative impacts.

TDR

Some of the watercourses present in the area of the proposed TDR are under significant pressures and at risk of not meeting their objectives as set out in the WFD by 2027. These include the River Ballyteige 25 and the River Roolagh. These waterways are under pressure from changes to hydromorphology and urban wastewater. During the aquatic ecology survey other pressures on the subject waterbodies were noted. The sites are subject to additional pressures on water quality and aquatic ecology, particularly in relation to agricultural activities. There are also impacts from recent river works including vegetation removal and potentially dredging on the River Kilmastulla. There are arterial drainage and historical mining impacts on this river. There are also fish migration issues. The River Ballyteige 25 has also been impacted by dredging and realignment.

Where construction and the above activities occur at the same time there is the potential for cumulative effects on local watercourses. The risk of such effects would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall. Conifer forestry and associated operations could also have the potential to adversely affect water quality in the area; therefore, could affect watercourses cumulatively along with the proposed TDR. It is noted that proposed TDR works in the vicinity of watercourses area limited to tree branch trimming, and placement of a load bearing surface in the road verge at one location Ardclooney Bridge).

Potential cumulative effects on aquatic ecology, in the absence of mitigation, are assessed as being *moderate negative, short-term* and in the *local context*.

Marsh fritillary

Cumulative effects on marsh fritillary could potentially occur in conjunction with forestry or agricultural activities. Potential cumulative effects are assessed as *slight short-term* and in the *local context*.

Other Species

Cumulative effects on other species are assessed as *imperceptible short-term* and in the *local context*.

8.5.4.6 Cumulative Impacts during Operation on Key Receptors

Designated Nature Conservation Sites

Potential operational phase effects to Cloonlara House pNHA/Leisler's bat were identified (prior to mitigation). It is unlikely that cumulative effects will occur in conjunction with Carrownagowan wind farm due to it's distance from Cloonlara House pNHA (c. 13 km) and low level of bat activity at Carrownagowan.

No significant operational effects were identified for any other sites designated for mobile species.

An accompanying Natura Impact Statement (NIS) has been prepared for the proposed development and accompanies this EIAR. The NIS addresses potential effects on European sites resulting from the proposed development.

Where European sites overlap with nationally designated sites, the conclusions from the NIS for said European sites is shown here.

Three downstream pNHAs within the ZoI of the wind farm and/or the GCR/TDR overlap European sites which were considered as part of the NIS. The possibility of significant effects to these European sites (Lower River Shnnaon SAC and River Shannon and River Fergus Estuaries SPA) was identified:

- Knockalisheen Marsh pNHA
- Fergus Estuary and Inner Shannon, North Shore pNHA
- Inner Shannon Estuary- South Shore pNHA

Two pNHAs within the ZoI of the wind farm overlap European sites which were considered as part of the NIS. The possibility of significant effects to this European site the possibility of significant effects to these European sites (Lower River Shnnaon SAC and Danes Hole, Poulnalecka SAC) was identified:

- Castleconnell (Domestic Dwelling, Occupied) pNHA
- Danes Hole, Poulnalecka pNHA

Whilst it has been acknowledged there could be potential for the wind farm site and grid connection to have significant effects on the Lower River Shnnaon SAC/River Shannon and River Fergus Estuaries SPA/ Knockalisheen Marsh pNHA/ Fergus Estuary and Inner Shannon, North Shore pNHA/ Inner Shannon Estuary- South Shore pNHA/ Castleconnell (Domestic Dwelling, Occupied) pNHA and Danes Hole, Poulnalecka SAC/pNHA, with the implementation of the detailed mitigation measures identified in the NIS it is concluded beyond reasonable scientific doubt that the integrity of the European sites listed above will not be adversely affected.

Habitats and Flora

No cumulative operational stage effects on terrestrial habitats are predicted. See Aquatic ecology below for details of possible effects on aquatic habitats.

Mammals (Excluding Bats)

Mammal breeding or resting sites may be cumulatively affected 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 etc.

Since no land take is predicted for the operational phase and potential effects are limited to occasional disturbance, a *Local Short-term Not Significant Reversible* cumulative effect is predicted.

Bats

Potential cumulative effects on bats during operation would be as follows:

- Mortality
- Reduction of local populations.

Static detector surveys were completed at Carrowagowan wind farm. The assessment identified low levels of bat activity at that location, with the resultant impact assessment identifying *long-term slight* effects from barotrauma and collision risk. Mitigation including bat felling buffers and post-construction monitoring reduced the impact on bats to *imperceptible*.

Indirect cumulative effects on Daubenton's bat via changes in water quality are not predicted due to the mitigation specified for Carrownagowan wind farm.

Considering the above, the distance between the two sites, and the higher levels of bat activity recorded at Fahybeg, operational cumulative effects on bats are of relatively low importance relative to effects identified for Fahybeg in isolation. Cumulative effects are identified as *Long-term Imperceptible* at the *Local scale*.

Avifauna

<u>Potential cumulative construction impacts - Carrownagowan Wind Farm:</u>

For hen harrier, merlin and peregrine, any cumulative operational effects in terms of displacement/barrier effect will be *long-term imperceptible* due to the low activity levels recorded at Fahybeg. For sparrowhawk these effects will also be *long-term imperceptible* due to the limited home range of this species. The effective collision risk for these species at Fahybeg is zero, and as such the potential for cumulative effects is *Imperceptible Long-term Local*.

The low sensitivity of buzzard results in *long-term imperceptible* effects in terms of both displacement/barrier effect and collision risk at Fahybeg. The Carrownagowan impact assessment identified these effects as *long-term imperceptible-slight.* Considering the small home range of buzzards and distance between the two sites in addition to the low-level impacts identified, a *long-term imperceptible local* cumulative effect for buzzard is predicted.

Kestrel were identified as being subject to *long-term not significant* to *slight* displacement/barrier effects at Fahybeg, and *long-term imperceptible* effects at Carrownagowan. As such any cumulative effect will not elevate the effect level above that already identified for Fahybeg in isolation. Similarly for collision risk, the predicted effect level of *imperceptible-slight* identified will not be elevated when considering the two sites cumulatively. For kestrel at Fahybeg, a *moderate long-term* collision risk effects could occur at the local scale. The cumulative effect would not raise this above the level identified for Fahybeg in isolation due to the *Imperceptible – Slight* effects identified for Carrownagowan.

Not significant cumulative effects are predicted for golden plover due to the absence of suitable habitat from the proposed site and low activity recorded. The effective collision risk for this species at Fahybeg is zero.

The wintering woodcock population could experience cumulative *Long-term Not significant Local* effects due to displacement/barrier effects. The effective collision risk for this species at Fahybeg is zero and as such the cumulative collision risk is *Imperceptible Long-term Local*.

Potential cumulative impacts – General Birds

Any cumulative effects to other bird species during the operational phase would be a *Local Long-Term Imperceptible Cumulative Effect*.

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 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 effects to aquatic ecology.

However, the likelihood of this occurring is very low and unlikely to be a significant effect considering the low volumes of vehicular traffic involved in typical wind farm operations.

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 effects on aquatic ecology are considered *Short-term Slight Cumulative Reversible Effects* and in the *Local Context*, in the absence of mitigation.

Marsh Fritillary

Operational phase effects are predicted to be *Long-term Imperceptible Local.*

Other Species

Operational phase effects are predicted to be *Long-term Imperceptible Local.*

8.5.4.7 Cumulative effects 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.

8.6 Mitigation Measures 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.

8.6.1 Mitigation by Avoidance and Design

The following measures are incorporated into the proposed wind farm design to reduce impacts on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the wind farm 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 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 wind farm (Drewitt and Langston, 2006).
- The grid connection routes have been selected to minimise land take of potentially sensitive habitats by following the site access tracks and public roads, and using existing crossings.
- Further mitigation measures for hedgerows/treelines that will be affected by the grid connection route are discussed further in Section 8.6.2.3.
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers and streams. Buffers of 50m from natural watercourses have been maintained, excepting where crossing points occur.
- Four new stream crossings shall be required within the wind farm site. A clear-span bridge design has been selected to avoid instream works and to minimise disturbance of banks and associated indirect effects such as siltation at the most sensitive location. Pre-cast concrete culverts will be installed at the remaining locations which are lower-value and do not support key ecological receptors; the use of precast structures will avoid the risk of concrete contamination.
- Directional drilling is the proposed installation method where the grid connection crosses EPA-mapped watercourses. As such, in-stream works will not be required and the potential for contaminant or pollutant input will be greatly reduced as a result.
- The design of the grid connection was also carried out with cognisance to ecological features. Cables are to be placed underneath public roads where possible to avoid impact to roadside hedgerows.

Further mitigation measures for hedgerows/treelines that will be affected by the grid connection route are discussed further in Section 8.6.2.3.

- The design of TDR Node 9 was carried out with cognisance of the adjacent Inner Shannon Estuary – South Shore pNHA. The route identified is constrained to the existing public road network and does not overlap or abut any habitats, supporting habitats or features of interest for this site.

8.6.2 Mitigation measures during the construction phase of the project

8.6.2.1 Introduction

Construction of this project is expected to cause temporary (disturbance) adverse effects on local ecological receptors. The mitigation measures described below will reduce these effects significantly.
It is noted that all measures requested by IFI during consultation have been included.

8.6.2.2 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.

8.6.2.3 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 stream 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 3.1). 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 wind farm and TDR Nodes. This will reinstate or replace linear habitat loss to ensure no net loss of these habitats occurs.

A total of 12 new hedgerows totalling c. 1.4 km in length will be planted at the proposed wind farm site to mitigate linear wooded habitat loss and enhance connectivity in the landscape. Details are included in the Biodiversity Enhancement & Management Plan (Appendix 3-4). The species proposed to be planted at these locations are detailed in Table 8-75.

Hedgerows removed or lowered by TDR Node works will be reinstated using the same native species present in original hedgerows. The exception to this is that Ash is not proposed to be used, due to it’s vulnerability to ash dieback disease. Other large-growing native species such as Alder and Oak are proposed instead. Semi-mature specimens of native provenance will be included to accelerate rehabilitation of these areas. Native, semi-mature specimen trees will be planted where large trees are felled at TDR Nodes to offset the loss of existing trees. A proportion of smaller trees will also be planted with the semi-mature specimens.

The species proposed to be planted at these locations are detailed in Table 8-76:

Table 8-75: Hedgerow Planting at Wind Farm Site

Linear Feature	Plant
1	Oak, rowan, holly, birch, grey willow, alder
2	Oak, birch, grey willow, alder
3	Grey willow, hawthorn, elder
4	Grey willow, hawthorn, elder
5	Grey willow, hawthorn, blackthorn
6	Grey willow, hawthorn, blackthorn
7	Hawthorn, elder, birch, holly
8	Oak, rowan, holly, grey willow
9	Oak, hawthorn, blackthorn
10	Oak, rowan, birch, grey willow, blackthorn
11	Oak, rowan, birch, grey willow, blackthorn
12	Grey willow, hawthorn, alder, oak

Table 8-76: Hedgerow/Treeline Reinstatement at TDR Nodes

Node	Species
30	Hawthorn, Alder, Oak
31	Pedunculate oak, Alder, Hawthorn
32	Birch, Oak, Alder

8.6.2.4 Woodland Reinstatement

The oak-ash-hazel woodland (WN2) abutting the clear span bridge will be replanted following construction, to minimise habitat loss and repair connectivity for wildlife along the riparian corridor. An area of approximately 320m^2 across both sides of the bridge will be planted with the following mix: grey willow- 30%; hazel- 70%. Details are included in the Biodiversity Enhancement & management Plan (Appendix 3-4).

8.6.2.5 Management of the spread of non-native invasive species

Where invasive non-native species are present at TDR Nodes, measures will be implemented to ensure spread of these species is prevented and eradicated as described below and in the invasive species management plan (Appendix 8-8).

- 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 8-8) will be adhered to for works at TDR nodes

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.

Prevention

Wind Farm Site

No invasive species are present within the proposed wind farm footprint. As such, if baseline conditions remain unchanged, interaction with proposed works is avoidable for all invasive species recorded in the study area. Due to the possibility of spread of invasive species in the intervening period, a preconstruction invasive species survey is required as part of the invasive species management plan (ISMP) (Appendix 8-8). Containment and eradication measures are detailed in the ISMP which will be used as required in the event of changes to the invasive species baseline.

Grid Connection Route

Prior to trimming or vegetation removal along the grid connection an invasive species survey will be undertaken to reconfirm the findings of the EIAR. Containment and eradication measures are detailed in the ISMP which will be used as required where avoidance of invasive species is not possible.

Works along the Turbine Delivery Route

Prior to trimming or vegetation removal at turbine delivery work locations, an invasive species survey will be undertaken to reconfirm the findings of the EIAR. As interaction of proposed works with invasive species is likely based on surveys of the existing environment, containment measures are required in accordance with the invasive species management plan (ISMP) (Appendix 8-8). Options for eradication are also detailed.

Containment, Treatment, 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 where 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.

8.6.2.6 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 (e.g., an 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. 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 along the grid connection route and wind farm site 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. mature treelines).

Badgers

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.

A number of badger setts including active setts were present within the site boundary area during surveys, and there are records of badger in the local area. Badgers can move between setts regularly and may also excavate new setts within their territory. As such there is potential for the layout and status of the badger setts onsite to change in the intervening period between planning and construction stages.

A badger mitigation plan to ensure construction does not contravene the Wildlife Act will be required if planning is granted, and as such a confidential badger mitigation report has been prepared and submitted with this application. The plan will be updated as required prior to construction, and the NPWS scientific unit and local conservation ranger will be consulted prior to implementing the plan.

Setts in close proximity to the development will require temporary hard-blocking and exclusion for the duration of construction works to ensure that badgers potentially occupying these setts during construction works are not injured. Setts affected by proposed felling only will be hard blocked for the duration of felling operations, but will be unblocked after felling is completed, provided adequate buffers between construction areas and setts exist.

No hard-blocking or sett exclusions will be undertaken during the badger breeding season (December-June inclusive).

A report detailing evacuation procedures, sett excavation and destruction, and any other relevant issues will be submitted to the NPWS, as a formal record of compliance with the Wildlife Act.

Details on the location of setts and proposed mitigation are included in the confidential Appendix: ***Badger Mitigation Plan.***

Vegetation clearance

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 (50m during breeding season) 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.

Measures to prevent the injury of Badgers during proposed mitigation measures

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 wind farm site. The GCR otter survey recorded otter activity along the Blackwater (Clare) and Glenomra wood stream watercourses at or near GCR crossing points but no holts are present within 150m of GCR crossings.

A pre-construction mammal survey will be undertaken (no later 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 felling of trees in forestry areas 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. Suitable mitigation measures will be implemented and a derogation/disturbance licence will be sought if dreys are found within the felling footprint or adjacent areas.

Pine Marten

Where possible, felling of trees in forestry areas 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 Stoat

Since stoat dens are difficult to detect, mitigation measures should focus on avoiding impacts during the breeding season. Since stoats are born in April, and reach adult size by September, the implementation of mitigation measures for breeding birds (no vegetation removal between March-August inclusive) will avoid disturbance to stoat during the majority of their breeding season.

If vegetation clearance is unavoidable during this period, then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any stoat are present. A licence under the Wildlife Act will be sought as necessary.

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).

8.6.2.7 Bats

Buffer Zone

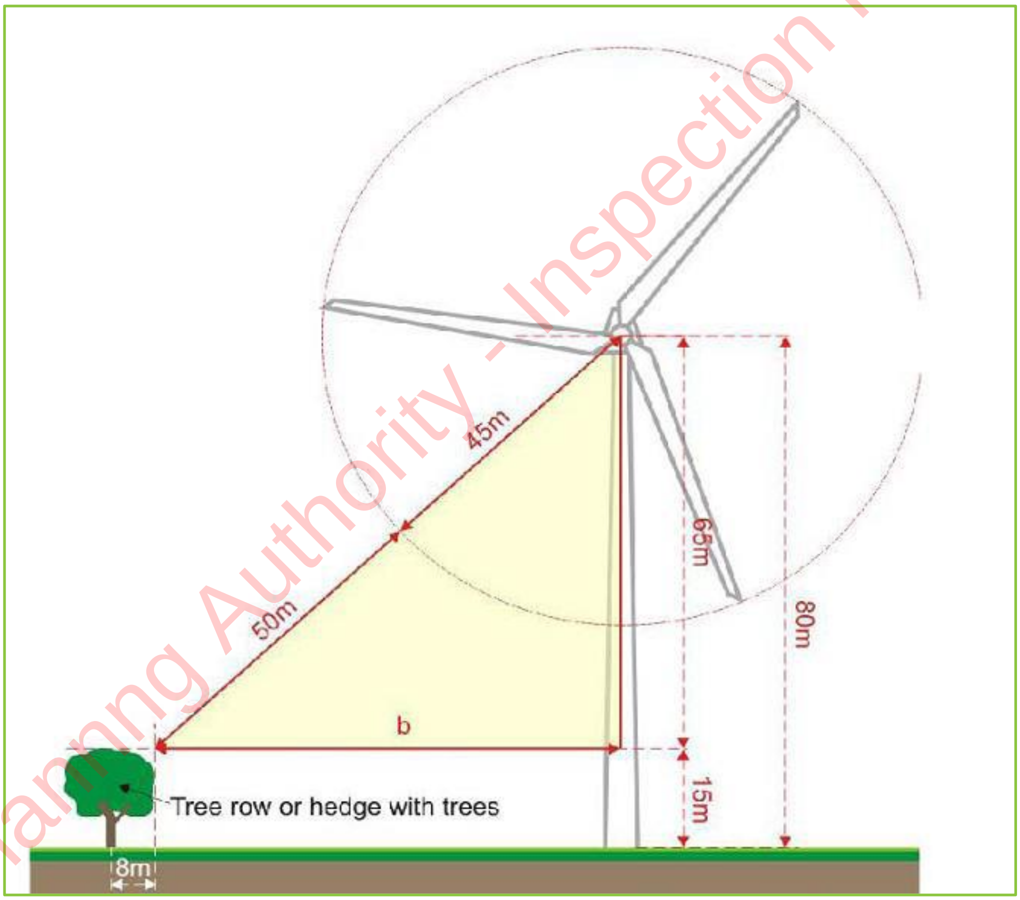
To minimize risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine intrudes.

According to SNH (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 Fahybeg Wind Farm Development.

The following formula was used to calculate the required felling buffer for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location). Calculations were run for each set of proposed optional turbine dimensions.



$$b = \surd\ \{(50 + bl)^2 - (hh - fh)^2\}$$

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)

Note: fh for each turbine location is given in column 3 of Table 8-77

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 eight proposed turbine locations.

Surrounding habitats, height of surrounding trees and felling buffer calculated using the above equation are included in Table 8-77 below. Note that the tree heights have been increased to allow for growth prior to felling, thereby expanding the buffers.

To minimise risk to bat populations, a buffer zone is required around any treeline, hedgerow, woodland feature, into which no part of the turbine will intrude. The buffers for each turbine location based on the five optional sets of turbine dimensions (see Section 3.3.2 in Chapter 3 Description of Proposed Development) are presented in Table 8-77.

Table 8-77: Assessment of potential turbine/bat conflict zones (based on proposed turbine dimension options 1-5)

Turbine number	Habitats Requiring Felling	Tree Height allowing for growth (m)	Felling Buffer Radius (m)				
			Option 1	Option 2	Option 3	Option 4	Option 5
1	Hedgerows; Scrub	10	64	71	60	70	68
2	None	0	N/A	N/A	N/A	N/A	N/A
3	Hedgerows	5	56	64	50	63	60
4	Hedgerows	10	64	71	60	70	68
5	Conifer Plantation	25	82	87	80	87	86
6	Conifer Plantation; Scrub; Mixed broadleaved woodland (immature ash plantation)	25	82	87	80	87	86
7	Conifer Plantation; Scrub	25	82	87	80	87	86
8	Hedgerows; Treelines	5	56	64	50	63	60

Existing trees will be cleared around all six turbines to provide a vegetation-free buffer zone around each turbine. All buffers will be maintained throughout the lifetime of the wind farm.This will be achieved through mechanical means only; the use of chemical substances is prohibited.

The following mitigation measures for bats are proposed:

Supervision of vegetation clearance

An ecologist/ECoW will supervise areas where 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. Treelines and mature trees within the wind farm site will be avoided and retained intact. Overall impacts on these areas will be minimised through modified design and sensitivity during construction. Any trees and treelines along approach roads and planned site access tracks will be retained unless felling is unavoidable.

Retained trees should 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

Pre-felling roost surveys are required for Ballymoloney Woods and the mature ash tree within the T5 felling buffer to reconfirm the finding of the EIAR. Emergence/re-entry surveys may also be required, pending results of PRF surveys. If required, derogation licences shall be sought from NPWS.

If three years lapse from between planning-stage surveys in 2020 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; SNH, 2019; 2021) and includes static detector, activity and roost inspection surveys.

Retention of tree PRFs

Potential roosting features occurring in mature trees proposed to be felled will be retained and strapped to suitable adjacent trees using durable fastening solutions to provide ensure they remain available to bats and that no net loss of PRFs occurs.

Tree Felling Measures (TDR)

Where mature trees with low bat roosting potential are proposed to be felled, these trees will be left in situ for 24 hours prior to disposal. This will allow any bats present to escape.

It is noted that only low potential trees were identified within the footprint of TDR Nodes; two ash trees with heavy Ivy growth (TDR Node 31). These trees may have potential for individual/small numbers of bats to roost opportunistically and are classified as having low suitability for roosting bats.

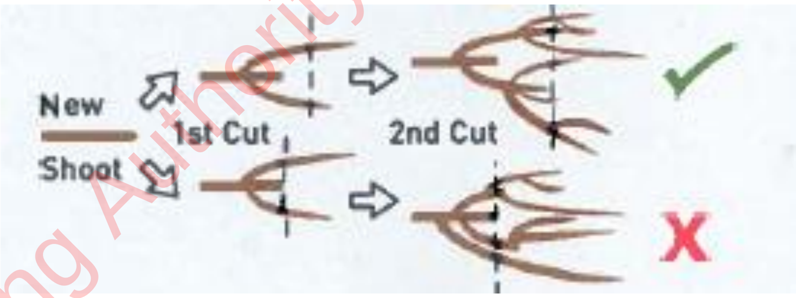
Compensation for loss of commuting routes/Diversion from felling buffers

Linear features such as hedgerows and treelines serve as commuting corridors for bats (and other wildlife). The magnitude of habitat loss is Imperceptible. Between 920m and 1,098m (10-12 %) of Hedgerows will be lost within the development footprint. Between 190m and 206m (4-5 %) of Treelines will be lost within the development footprint. Felling around turbines will alter commuting and foraging routes associated with existing hedgerows and woodland edges.

Where hedgerows and treelines are affected by turbine felling buffers, bats will be directed away from tree-free buffers along an alternative commuting route. This will be achieved by planting new pollinator-friendly hedgerows along Lines 2, 3, 4, 7, 10 & 11 (see Figure 8-19). 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 2, 3, 4, 7, 10 & 11, to help accelerate establishment. These will be supplemented with planting of whips.

The following fast-growing damp tolerant species will be planted along the inner edges of these hedgerows: grey willow *Salix cinerea* and alder *Alnus glutinosa.* The following native fruiting hedgerow species will be planted along the outer edges of these hedgerows: whitethorn *Crataegus monogyna*, blackthorn *Prunus spinosa,* elder *Sambucus nigra,* 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-8-42) 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-8-42: 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 wind farm site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Some works along the cable route and wind farm site 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. mature treelines). 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 will 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.

8.6.2.8 Avifauna

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

This 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, GCR and TDR nodes, including forestry plantation, 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 along Lines 1-12 (see Figure 8-19, Table 8-75). Willow will be included in these hedgerows due to it’s rapid growth rate which will accelerate establishment. This planting will ensure no net loss of linear wooded habitats used by barn owl and kestrel for hunting. Wildflower strips will be planted to provide habitat analogous to rough grassland for hunting barn owl and kestrel. These strips will be located along access tracks away from proposed turbine locations (see Figure 8-19).

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).

Kingfisher; Grey Wagtail; Dipper: Implement mitigation measures outlined in Chapter 10 - Hydrology and Water Quality of this EIAR, the CEMP and Aquatic Ecology Mitigation, section 8.6.2.9 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 Barn owl, Buzzard, Kestrel, Sparrowhawk, Snipe and Woodcock 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 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.

8.6.2.9 Aquatic Ecology

Proposed Mitigation Measures for the Construction Stage of the project

Construction phase mitigation for hydrology will follow that outlined in section 10.7 of Chapter 10, 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 Lower River Shannon SAC (002165).

Proposed Mitigation Measures for Tree Felling

Localised tree felling will be required in the vicinity of turbine T1, T3, T4. T5, T6, T7 and T8 hardstand areas, and along the access tracks running through wooded habitats. It is estimated that 11.1 Ha of existing wooded habitats will be felled to facilitate development of the proposed wind farm infrastructure (e.g., turbine hardstands, and associated access tracks), in addition to a further 3.1 Ha of conifer plantation to facilitate establishment of a new oak woodland (giving an overall felling areas o 14.2 Ha). There are potential source-receptor pathways from felling areas to the streams draining the proposed site.

Check dams/silt fences will be installed within any drainage channels within turbine felling buffers prior to commencement of felling. In addition, silt fencing will be installed along the western perimeter of the T6 buffer which abuts the riparian corridor of the River Black. Silt fencing will be installed along both sides of the un-named stream at T7. Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Brash mats will be used to support vehicles on soft ground and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place before they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall.

Where felling within the riparian corridor is required, this will be carried out by hand only to prevent disturbance of steep-sided stream valleys. 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 stream valleys.

To ensure tree 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 felling 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, kingfisher, otter), it is proposed to undertake felling 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 or in the 48-hour period following heavy rainfall (DAFM, 2018). Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of drainage channels will reduce nutrient seepage immediately post-felling and in the proceeding years after felling 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.

All infrastructure will have a setback distance of 50 m away from all streams within the site except for the watercourse crossings. Where site tracks are existing rather than a new site track, this buffer will not apply. There are also four stream crossings proposed within the wind farm 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. Stream crossings will be constructed during low flow conditions and within a 5-day weather window.

The internal access track crossings will be via a single span, pre-cast concrete bridge, and precast box culverts. 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. Potential releases of sediment-laden surface run-off as a result of bank clearance works to facilitate bridge installation/access will be mitigated against through the water quality mitigation measures applicable throughout the site (see section 10.7 of chapter 10 and the CEMP).

Silt fences will be placed downstream of all works and regularly maintained. Materials used to install culverts and stream crossings will be ore-cast.

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. Trench excavations will not be carried out during heavy rainfall (over 4mm per hour), or during 24-hour periods before heavy rainfall. Regular checks of weather forecasts will be carried out and construction schedules will be adjusted to avoid heavy rainfall. Trenches will be excavated 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, which details the required measures for the Contractor to implement in the event of a ‘worst case’ scenario on the site, such as a breakout of sediment-laden water from a silt pond. Timing of the proposed instream works will also take account of the fisheries constraints within the study area, where no works will be undertaken in the instream environment during the salmonid close season (October–March annually), which also avoids the lamprey spawning season.

Secure concrete washout areas are designated on site and detailed in the CEMP. These are located > 50m from the nearest watercourse. Washout of chutes only is permitted in these areas.

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 settlement 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. Design and installation of fuel tanks will be in accordance with best practice guidelines. Refuelling of plant during construction will be carried out in an appropriately designed designated area, no refuelling will be permitted within 50m of 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 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 wind farm site. All machinery shall be disinfected and visually inspected before leaving works areas where invasive species are present.

Crayfish plague is known from the Lower River Shannon 25C and Shannon Estuary South Catchments to the north and south but has not been detected to date in the Lower River Shannon 25D and Shannon Estuary North Catchments where the proposed wind farm and grid connection are located. The potential introduction of Crayfish plague is of particular concern at watercourse crossings given the potential for White-clawed Crayfish populations downstream.

To reduce the risk of invasive species and pathogen introduction (e.g. Crayfish plague), all equipment will be thoroughly checked, cleaned and dried in accordance with best practice as specified in the CIRIA C532, C648 and C741 guidelines below. Furthermore, plant machinery which has worked within riparian corridors or come in to contact with water will be steam-cleaned and dried in advance of works commencement in the Blackwater catchment.

Any operatives entering watercourses will be required to disinfect clothing and equipment coming in contact with water prior to and after entering the watercourse. The same disinfection measures shall apply (disinfection and wash down before and after works) to any machinery working in or 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 8-8.

Grid Connection

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. This includes areas of the grid connection route near waterways and at crossing points. Works on riverbanks can potentially lead to destabilisation, erosion and increased siltation downstream. The four river crossings will be carried out using horizontal directional drilling.

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. The maintenance and monitoring of such silt fences will be subject to an on-site quality management system which are set out in the CEMP.

Spoil heaps from any excavations will be covered with geotextile and surrounded by silt fences to filter sediment from the surface water run-off from excavated material. Spoil heaps will not be stored within the Lower River Shannon SAC and will be placed at least 10m from the river. 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. If cables will be installed in trenches, they will be located underneath and directly adjacent to access tracks as far as possible. Trench excavations will not be carried out during heavy rainfall (over 4mm per hour), or during 24-hour periods before heavy rainfall. Regular checks of weather forecasts will be carried out and construction schedules will be adjusted to avoid heavy rainfall. Trenches will be excavated 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 have been included as a contingency in the CEMP, which details the required measures for the Contractor to implement in the event of a ‘worst case’ scenario on the site.

Timing of the proposed works will also take account of the fisheries constraints within the study area, where no works will be undertaken in the instream environment during the salmonid close season (October–March annually), which also avoids the lamprey spawning season.

An Ecological Clerk of Works (ECoW) will monitor both turbidity and observe the riverbed during the horizontal directional drilling process to detect any leakage (frac-out) of drilling fluid. Should this leakage be observed, works will cease immediately. If drilling fluids are required, a biodegradable fluid such as CLEARBORE shall be used rather than Bentonite. HDD methodology is detailed in the CEMP (Section 3.4.7.3).

These works as a precautionary measure will be undertaken within the salmonid open season for instream works (June 1st -September 30th). In addition, a silt fence will be placed downstream and regularly maintained.

Machinery will be stored in the site compound. Wheel washing facilities will be provided at the site entrance draining to silt traps. 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. Fuels and oils will be stored at the temporary construction compound, which is located c.320m from the nearest watercourse. Design and installation of fuel tanks will be in accordance with best practice guidelines (BPGCS005, detailed below). Refuelling of plant during construction will be carried out on a designated and appropriately managed area, at minimum 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 to ensure that non-native aquatic/riparian species are not introduced into the site. These measures should follow as relevant 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 wind farm site. All machinery shall be disinfected and visually inspected before leaving works areas where invasive species are present.

Crayfish plague is known from the Lower River Shannon 25C and Shannon Estuary South Catchments to the north and south but has not been detected to date in the Lower River Shannon 25D and Shannon Estuary North Catchments where the proposed wind farm and grid connection are located. The potential introduction of Crayfish plague is of particular concern at watercourse crossings given the potential for White-clawed Crayfish populations downstream.

To reduce the risk of invasive species and pathogen introduction (e.g. Crayfish plague), all equipment will be thoroughly checked, cleaned and dried in accordance with best practice as specified in the CIRIA C532, C648 and C741 guidelines below. Furthermore, plant machinery which has worked within riparian corridors or come in to contact with water will be steam-cleaned and dried in advance of works commencement in the Blackwater catchment.

Any operatives entering watercourses will be required to disinfect clothing and equipment coming in contact with water prior to and after entering the watercourse. The same disinfection measures shall apply (disinfection and wash down before and after works) to any machinery working in or 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 8-8.

Works within and adjacent to watercourses, as part of HDD and new excess track crossing construction, will adhere to the guidelines set out in the best practice documents as listed below:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.
- CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019b). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

Turbine Delivery

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.

Where excavation is required 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. The maintenance and monitoring of such silt fences will be subject to an on-site quality management system which will be set out in the CEMP.

The load bearing surface installed at Node 23 adjacent the Ardclooney River will use clean aggregate made of hard rock which contains no fine material to prevent sediment washout. Any disturbed ground will be reseeded with native grass species *Holcus lanatus* and *Agrostris capilaris* following removal of the temporary load bearing surface after use.

An Emergency Erosion and Silt Control Response Plan is included in the CEMP, which details the required measures for the Contractor to implement in the event of a 'worst case' scenario on the site. Timing of the proposed works will also take account of the fisheries constraints within the study area, where no works will be undertaken in the instream environment during the salmonid close season (October–March annually), which also avoids the lamprey spawning season.

Machinery will be stored in the site compound. Wheel washing facilities will be provided at the site entrance draining to silt traps. 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 (fuels and oils will be stored at the temporary construction compound, located c. 320m from the nearest watercourse). The design and installation of fuel tanks will be in accordance with best practice guidelines. Refuelling of plant during construction will be carried out in a designated and appropriately managed area 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 will be detailed in the ISMP to ensure that non-native aquatic/riparian species are not introduced into the site. These measures should follow as relevant the manual *'The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads*' by NRA (2010).

An invasive species management plan which details management measures for each invasive plant species is included in Appendix 8-8.

8.6.2.10 Marsh Fritillary

A preconstruction survey of the proposed footprint and adjacent areas will be completed during August/September prior to construction to reconfirm the finding of the EIAR. If marsh fritillary larvae are present in the proposed footprint or zone of influence, translocation to suitable habitat outside the infrastructure footprint will be carried out. This will be achieved by marking the location of pupae/larvae, and carefully excavating the surrounding sod under ecological supervision. Translocated sods will be placed in receptor sites which have been excavated to receive the sods. Receptor sites will be located nearby in similar habitat with abundant *S. pratensis*.

If required, translocation will be carried out immediately following the survey during September to ensure pupae/larvae can be relocated.

8.6.3 Mitigation measures during the operational phase

8.6.3.1 *Designated nature conservation sites*

Mtigation measures outlined in section 8.6.3.6 and Chapter 10 - Hydrology and Water Quality of this EIAR, will be implemented, in addition to those described in the NIS to minimise and prevent the identified indirect effects on water quality as outlined previously.

Measures to protect bats detailed in section 8.6.3.4 will mitigate potential effects to foraging Leisler's bat which could potentially be associated with Cloonlara House pNHA, or lesser horseshoe bats potentially associated with Dane's Hole, Poulanlecka pNHA.

8.6.3.2 *Habitats and flora*

Mtigation measures outlined in section 8.6.3.6 and Chapter 10 - Hydrology and Water Quality of this EIAR, will be implemented, in addition to those described in the NIS, 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.

8.6.3.3 *Mammals*

Maintenance of woodland fencing will use manual means only within 30m of badger setts during non-breeding (July-November inclusive) and 50m during breeding season (December – June inclusive). No fence posts will be driven into the ground within 30m of a sett (alternative means such as self-supporting fencing will be used).

Provision for the passage of small and medium-sized mammals shall be made in deer fencing around woodland enhancement aresa, with Gaps measuring 300mm x 300mm inserted at the bottom of the fence at 50m intervals. The gaps should be formed in a way which does not compromise the integrity of the wire mesh. Alternatively, 300mm diameter pipes may be dug into the ground at 50m intervals to provide passage under the fence.

Information on sett locations and implementation of buffer zones is contained in the confidential Appendix: Badger Report.

8.6.3.4 *Bats*

Feathering of Blades

Turbines will operate in a manner which restricts the rotation of the blades as far as is practically possible below the manufacturer's specified cut-in speed (SNH, 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% (SNH 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 locations had moderate-high or high activity for common pipistrelle at some point during the activity season (with higher activity focused on summer and autumn), while the majority of locations had activity levels for soprano pipistrelle and Leisler's bat ranging from moderate to high (again with higher activity focused on summer and autumn). Therefore, increased cut-in speeds will be implemented for all turbines from commencement of operation. 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 10 to 11°C at nacelle height.
2. Generally, bat activity peaks at a wind speed range of 5.0 to 6.5m/s (at nacelle height).

Due to the considerable unnecessary down time resulting from the proposed "blanket curtailment" (above) and the advances in smart curtailment, a focused curtailment regime is proposed as described below from year four of operation. This will focus on times and dates, corresponding with periods when the highest level of bat activity occur within the Site. This includes the use of the SCADA (Supervisory Control and Data Acquisitions) operating system (or equivalent) to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods.

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.

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., 2009). 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 high 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, 20, 25 and 30 with further review after each monitoring period.

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 Clare 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[9] 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. This mitigation measure is compatible with all of the proposed turbine dimension options.

An assessment of static data gathered during operational surveillance will be completed using the online analysis tool Ecobat as recommended by SNH (2021) as a minimum, or other equivalent guidance as dictated by up-to date standards and practices.

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[9] Used to supplement ground-based equipment designed to replicate the survey effort undertaken at the pre-application stage (see Roemer et al., 2017). They are particularly useful at woodland key-holed sites.

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.

The radii (determined by five optional sets of turbine dimensions) of each buffer zone as determined by the height of surrounding vegetation is listed below in Table 8-78 below. It is noted that no trees are present around T2 and as such felling is not required at that location. However, 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 T3, 4 and 8 which are located in agricultural land, management in of surrounding grassland within buffers (in addition to felling for hedgerows) will be required in the event of cessation of grazing.

Hedgerow planting to maintain connectivity and divert bats around felling buffers

Where hedgerows or treelines are affected by turbine felling buffers, bats will be directed away from tree-free buffers along an alternative commuting route. This will be achieved by planting new pollinator-friendly hedgerows along Lines 2, 3, 4, 7, 10 & 11 (see Figure 8-19, Table 8-75). Willow will be included in these hedgerows due to it’s rapid growth rate which will accelerate establishment.

Table 8-78: Vegetation Management Buffer Zones for Bats (based on proposed turbine dimension Options 1-5)

Turbine number	Vegetation Management Buffer Radius (m)				
	Option 1	Option 2	Option 3	Option 4	Option 5
1	64	71	60	70	68
2	46	55	38	54	51
3	56	64	50	63	60

Turbine number	Vegetation Management Buffer Radius (m)				
	Option 1	Option 2	Option 3	Option 4	Option 5
4	64	71	60	70	68
5	82	87	80	87	86
6	82	87	80	87	86
7	82	87	80	87	86
8	56	64	50	63	60

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, 20, 25 and 30 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 described in Section 8.6.3.5 are outlined below, and an assessment of bat mortality will essentially follow the same methodology:

a) 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.

b) Turbine searches for fatalities will be undertaken following best practice in terms of search area (focusing on the hard standing) (SNH, 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.

c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

d) Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 8-79: Monitoring schedule proposed for bat mitigation measures

Mitigation measure	Monitoring 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, 20, 30, 34
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, 20, 25 and 30 post construction.

Table 8-80: Summary of Operational-phase Mitigation Measures for Bats

Moderate-High Level Bat Mitigation Applies to all turbines	**Category**
A buffer zone free of woodland/trees within 50m of turbine blade tips will be created.	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 blanket curtailment during year 1-3 while post construction surveys are undertaken. 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 5.5 m/s during specified weather conditions and during the active bat season (April to October).	Blanket curtailment
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.	Post construction monitoring
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, 20, 25 and 30 with further review after each monitoring period. 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 Clare 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.	Smart curtailment

Moderate-High Level Bat Mitigation Applies to all turbines	**Category**
Undertake a carcass search during years 1-3, and subsequently in years 5, 7, 10, 15, 20, 25 and 30 as part of the additional curtailment monitoring schedule.	Carcass monitoring
Maintain immediate area around the wind turbines in a manner that does not attract insects.	Maintain vegetation free buffer

8.6.3.5 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 years 1, 2, 3, 5, 10 and 15 post construction)- A comprehensive fatality monitoring programme is to be undertaken following published best practice; the primary components are as follows:

   a. 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.

   b. Turbine searches for fatalities are to be undertaken following best practice (Fijn *et al*., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height = 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 years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.

   c. A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

   d. Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the 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:

    a. Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species and all wader species.
    b. Record changes in flight heights of key receptors post construction.

Reports will be submitted to the 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:

    a. Assess displacement levels (if any) of wildfowl such as swans post construction
    b. Assess overall habitat usage changes within the vicinity of the Fahybeg 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:

    a. Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

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

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

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 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.

Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

8.6.3.6 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. However, this will not be associated with the TDR and any potential TDR works during the operational phase will be limited to temporary accommodation works in the event that turbine replacement is required.

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 turbine felling buffers shall be maintained and replaced as required throughout the lifespan of the wind farm.

8.6.4 Mitigation measures during the decommissioning of the project

The same mitigation measures for the wind farm and GCR 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. This will include general mammal, badger and otter surveys to check whether any mammal breeding/resting places have become established during operation. In the event of decommissioning of the Fahybeg wind farm, the access tracks will 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 connection 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.

8.6.5 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 3-4). A summary is provided below.

8.6.5.1 Quarry Biodiversity Area

An area of c. 4.6 Ha of mixed broadleaved woodland will be retained within the quarry. The woodland will be allowed to mature naturally. The area will be demarcated and signage will be erected to prevent interference with the area but the area will remain accessible to animals using the woodland.

8.6.5.2 Nest Boxes

One barn owl nest box and one kestrel nest box will be installed on suitable trees in the quarry biodiversity area under ecological supervision. These can be installed on poles if suitable trees are not available.

8.6.5.3 New Oak Woodland Establishment

An area of c. 3.1 Ha of immature conifer plantation north of T5 will be felled in order to establish an area of new oak woodland abutting the long-established Ballymoloney Woodland. The woodland will be established through a mix of planting and natural recolonisation. Acorns from the adjacent Ballymoloney Wood will be collected during mast years, grown on in a nursery and planted as saplings, in addition to birch of local provenance which will act as a nursery tree, and holly of local provenance. Unplanted areas will be allowed to recolonise naturally. Periodic grazing under strict supervision may be used for brief periods to control brambles and other dense scrubby vegetation, and pigs may be used to disturb ground and disperse seeds, also under strict supervision for brief periods.

The woodland will be fenced off to prevent deer and other large herbivores entering, but fencing will include gaps at the bottom to allow other mammals to continue traversing the area. Gaps measuring 300mm x 300mm will be placed at the bottom of the fence at 50m intervals to allow continued access for mammals. See Figure 8-19 for the location of this measure.

8.6.5.4 Protection of Ballymoloney Wood

An area of c. 3.8 Ha of Ballymoloney Woods will be fenced off to prevent deer and other large herbivores entering. This will give this area of the woodland a chance to regenerate naturally. The woodland is currently open and is accessed by fallow deer and cattle. The absence of natural regeneration is notable, and is considered to be attributable in large part to overgrazing by large herbivores.

The woodland will be fenced off to prevent large herbivores entering, but fencing will include gaps at the bottom to allow other mammals to continue traversing the area. Gaps measuring 300mm x 300mm will be placed at the bottom of the fence at 50m intervals. See Figure 8-19 for the location of this measure.

8.6.5.5 Bee Banks

Banks made up of well-drained soil will be created along access tracks in the vicinity of T6 and T8, located near the wildflower strips (Figure 8-19). There will be 3 banks. c. 20m length each. These can be created by scraping vegetation away from an existing bank if available, or by constructing a bank from excess spoil generated onsite.

It is important to avoid heavily compacting it with machinery. The road-facing sections of banks will be required to be kept clear of vegetation using mechanical means only. This can be carried out in winter as required (frequency depends on rate of re-vegetation) by scraping away vegetation.

8.6.5.6 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 8-19. 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.

8.6.5.7 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 8-19.

8.6.5.8 Wildflower Strips

Planting will consist of seeding linear areas along proposed access tracks in the eastern part of the Site with a native wildflower meadow seed mixture. There will be 2m width wildflower strips planted adjacent to access tracks, totalling c. 1750 m^2 in area. Fencing is required for strips bounding agricultural land. See Figure 8-19 for the location of this measure.

Wildflower seed mixes are required to be of native provenance; mainstream commercially available mixes are not acceptable. Ecoseeds https://www.ecoseeds.co.uk/ (Northern Ireland) or another reputable and experienced supplier capable of supplying seed mixes that meet the required criteria shall be used.

A typical wildflower meadow plant assemblage includes the following species: Birdsfoot Trefoil, Black Medick, Cowslip, Devil's Bit Scabious, Meadow Buttercup, Field Scabious, Hemp Agrimony, Kidney Vetch, Lady's Bedstraw, Lesser Knapweed, Meadowsweet, Mullein, Ox-eye Daisy, Purple Loosestrife, Ragged Robin, Red Campion, Red Clover, Ribwort Plantain, Rough Hawksbit, Sorrel, St Johnswort, Wild Angelica, Wild Carrot, Yarrow, Yellow Agrimony, Yellow Rattle, Teasel, Corn Marigold, Corn Poppy, Cornflower and Scented Mayweed. In particular, the clover species will provide habitat for Large Red Tailed Bumble Bee (Carvell et al., 2011). It is also recommended to include fine leaved grasses such as Red Fescue, Smooth Meadow-Grass and Crested Dog's Tail for conservation of this bee, which was noted in the desk study.

Flowering species recorded within the wet grassland habitats onsite will also be incorporated into the planting mix.

8.6.6 Vulnerability to major accidents and disasters

Should a major accident or natural disaster occur, the potential sources of pollution onsite during the construction and operational phases of the Fahy Beg Wind Farm are limited. The primary sources with the potential to cause significant environmental pollution and associated negative impacts on human health and the environment include the bulk storage of hydrocarbons, chemicals and wastes. In the case of the proposed Fahy Beg Wind Farm development site, the storage of chemicals of this kind are strictly limited. For biodiversity, the main possible impacts are considered to be the release of sediment and pollutants into watercourses, which could negatively impact upon aquatic habitats and species.

Potential vulnerabilities relevant to the proposed project are limited to:

- Flooding
- Fire
- Major incidents involving dangerous substances;
- Catastrophic events
- Landslides.

The risk of flooding is addressed in Chapter 10: Hydrology and Water Quality, which concludes that the wind farm site will have a negligible impact on flood risk in the surrounding area, as a result of the proposed development. Furthermore, there is no expected increase to flood risk along the grid route or TDR.

In the event of extreme weather conditions, the proposed surface water drainage will manage storm water avoiding significant negative impact on the project's infrastructure. Therefore, it is unlikely that the proposed development will result in increased flood risk, and it is unlikely that flood risk would result in effects on human safety (including traffic), water quality, biodiversity, soil stability, material assets and archaeological or architectural heritage, as the increased flood risk is considered negligible.

Mitigation measures are set out in Chapter 10: Hydrology and Water Quality to avoid potential negative impacts during the construction stage with respect to flood risk.

The potential for fire at the proposed Fahy Beg Wind Farm is mitigated against by design. Furthermore, the wind farm will be remotely monitored, and potential accidents will be quickly identified and reported.

In line with IWEA Health and Safety Guidelines for the Onshore Wind Industry (2011), Emergency Response Plans will include emergency response procedures for initial actions in the event of a fire. Records will be kept for testing of fire alarms and drills and maintenance/inspection of fixed and portable firefighting equipment. Information will be provided to employees on fire safety and fire prevention, including risks of and control measures to prevent fire outbreak, evacuation procedures and those responsible for their implementation, and the use of firefighting equipment, in line with HSA guidance.

During the construction phase of the proposed development, an emergency response plan will be in place as set out in Section 6 of the CEMP, included in Appendix 3.1 of Volume 3 of this EIAR.

Given the nature of the proposed development, coupled with the lack of proximity to established Seveso sites, there is a negligible potential risk of negative impact to the proposed development and its receiving environment, as set out throughout this EIAR, arising from the occurrence of major incidents involving dangerous substances.

Potential catastrophic events associated with operational wind turbines include:

- Wind turbine toppling (due to foundation or tower failure)
- Wind turbine rotational failure in extreme wind conditions (due to control system or rotor break failure)
- Fire.

The primary mitigation against a catastrophic event that may endanger biodiversity has been implemented at design stage through adequate siting of wind turbines which provide sufficient set back distances from occupied buildings and other infrastructure to avoid the risk of negative impact in the event of wind turbine collapse.

The proposed tip height for wind turbines at the Fahy Beg Wind Farm is between 169 – 176.5m. No wind turbine is located within 500m of a residential dwelling. No turbines have been located within 1.5 x tip height of the proposed on-site substation.

Turbines have been sited with consideration for existing ground conditions to minimise the risk of turbine foundation failure, toppling and landslide. Intrusive site investigations have been carried out to confirm ground conditions at turbine locations as well as slope stability analysis throughout the wind farm site. Other design mitigation measures employed for the siting of wind turbines include the following:

- Areas mapped by GSI as having a high susceptibility to landslides have been avoided
- Turbine locations have been assessed by site investigation and visually by geotechnical engineers prior to confirmation of final siting
- Care has been taken in design of road and hard standing alignments, cutting and filling and drainage;
- Peat probing has been carried out at turbine locations. No peat was identified within the wind farm site.

See Chapter 9: Land, Soil and Geology for more information on ground conditions.

As detailed in Chapter 9: Land, Soils and Geology, a slope stability assessment was carried out at the Fahybeg Wind Farm site to investigate the lands for potential slope failure. No evidence of slope instability was observed at the site and there are no historical records of landslide activity within 1km of the site on the GSI database. Site investigation was conducted which revealed no peat on the site. As such, potential peat stability issues were ruled out at the proposed infrastructure locations.

Mitigation by design has been incorporated into the project to avoid potential effects from landslides. Mitigation for potential landslide/slope failure is set out in Chapter 9: Land, Soils and Geology. Mitigation measures relating to flood risk which could have a bearing on potential landslides are detailed in Chapter 10: Hydrology and Water Quality.

Wind turbines are fitted with sophisticated remote monitoring and control systems to manage rotational speed. Turbines also have the capability to shut down in storm conditions through adjustment of blade pitch. Turbines are also fitted with emergency power supply (EPS) units to provide backup power in the event of a loss of mains power supply that could impact the control system.

Wind turbines shall be fitted with fire suppression systems and will have emergency escape procedures in place for operational staff in the event of fire in a wind turbine. An emergency response plan is contained in the CEMP included in Appendix 3.1 of Volume 3 of this EIAR.

During the construction phase of the proposed development, an emergency response plan will be in place as set out in Section 6 of the CEMP in the unlikely event of a landslide/slope failure.

In relation to potential vulnerability of the project to major accidents and natural disasters it is concluded that the potential susceptibility to natural disaster of the proposed Fahy Beg Wind Farm is negligible. Therefore the potential for any related effects on biodiversity and the environment arising from fire or pollution are also negligible.

Path: R:\Map Production\2020\P20-003\Workspace\EIAR\Ecology\Biodiversity Enhancement Plan\P20-003_GIS_Fig2_Landscape_Management_Measures_A3.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
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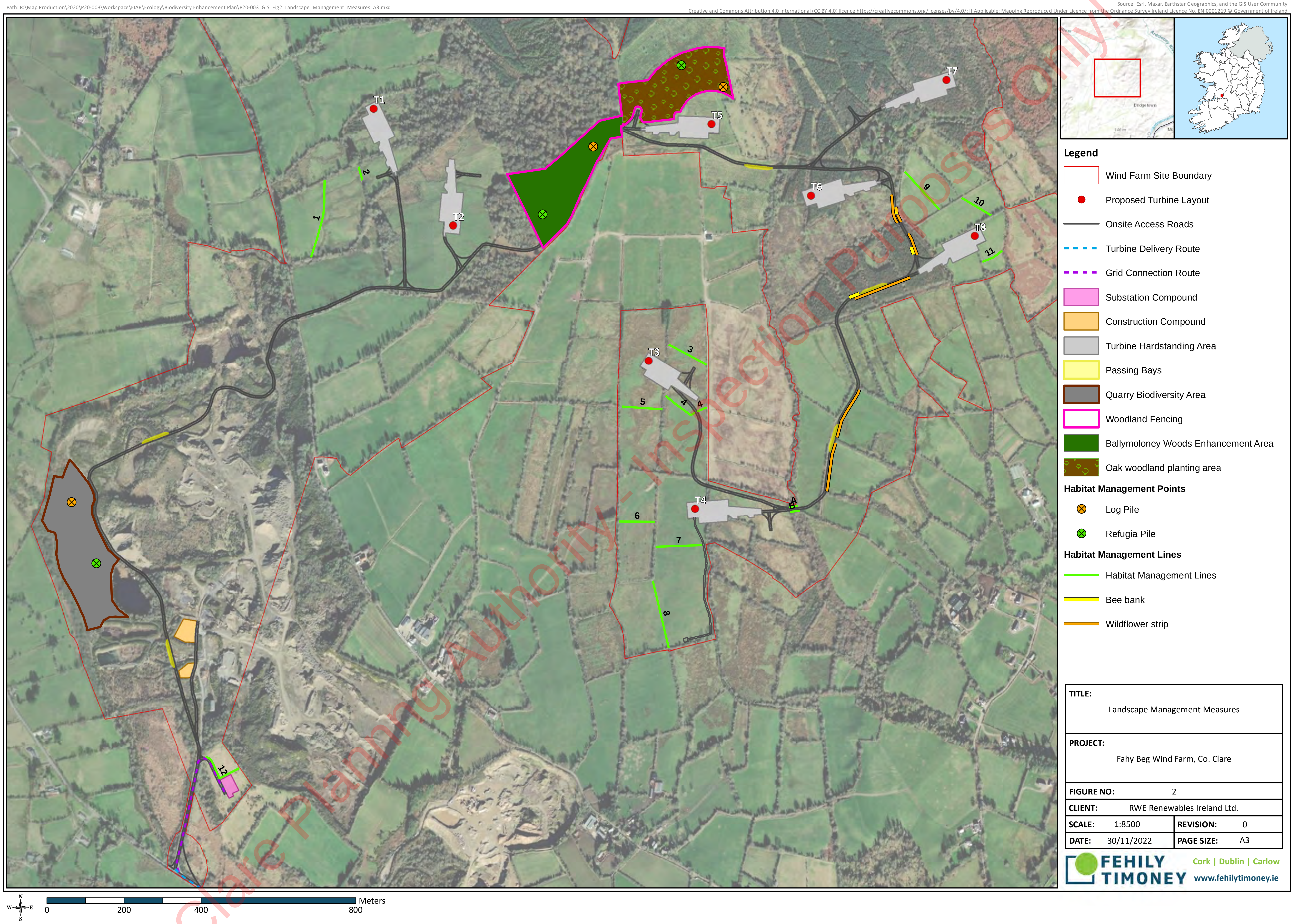

Legend

- 🟥 Wind Farm Site Boundary
- ● Proposed Turbine Layout
- — Onsite Access Roads
- - - Turbine Delivery Route
- - - Grid Connection Route
- ▨ Substation Compound
- ▨ Construction Compound
- ▨ Turbine Hardstanding Area
- ▨ Passing Bays
- ▨ Quarry Biodiversity Area
- ▭ Woodland Fencing
- 🟩 Ballymoloney Woods Enhancement Area
- ▨ Oak woodland planting area

Habitat Management Points

- ⊗ Log Pile
- ⊗ Refugia Pile

Habitat Management Lines

- — Habitat Management Lines
- — Bee bank
- — Wildflower strip

TITLE:
Landscape Management Measures

PROJECT:
Fahy Beg Wind Farm, Co. Clare

FIGURE NO:	2		
CLIENT:	RWE Renewables Ireland Ltd.		
SCALE:	1:8500	**REVISION:**	0
DATE:	30/11/2022	**PAGE SIZE:**	A3

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8.7 Residual Ecological Impacts

8.7.1 European sites

The Natura Impact statement concluded that, on the basis of objective scientific information, the wind farm site, turbine delivery route and grid connection will not, either alone or in combination with other plans or projects, adversely affect any of the constitutive interests of the Lower River Shannon SAC or Dane's Hole, Poulnalecka SAC (or any other European site), in light of the sites' conservation objectives.

8.7.2 Natural Heritage Areas or Proposed Natural Heritage Areas

While additional works are proposed at TDR Node 9, located at Dock Road west roundabout which is within the existing road network where it traverses the Inner Shannon Estuary – South Shore pNHA (000435), there is no potential for direct effects or significant indirect effects to the Inner Shannon Estuary – South Shore pNHA in terms of it's features of interest or any supporting habitats due to these works.

Three downstream pNHAs within the ZoI of the wind farm and/or the GCR/TDR overlap European sites which were considered as part of the NIS. The possibility of significant effects to these European sites (Lower River Shnnaon SAC and River Shannon and River Fergus Estuaries SPA) was identified:

- Knockalisheen Marsh pNHA
- Fergus Estuary and Inner Shannon, North Shore pNHA
- Inner Shannon Estuary- South Shore pNHA

Two pNHAs within the ZoI of the wind farm overlap European sites which were considered as part of the NIS. The possibility of significant effects to these European sites (Lower River Shnnaon SAC and Danes Hole, Poulnalecka SAC) was identified:

- Castleconnell (Domestic Dwelling, Occupied) pNHA
- Danes Hole, Poulnalecka pNHA

One pNHA within the ZoI of the TDR overlaps a European site which was considered as part of the NIS. The possibility of significant effects to this European site (Curraghchase Woods SAC) was identified:

- Curraghchase Woods pNHA

Whilst it has been acknowledged there could be potential for the wind farm site and grid connection to have significant effects on the Lower River Shannon SAC/River Shannon and River Fergus Estuaries SPA/ Knockalisheen Marsh pNHA/ Fergus Estuary and Inner Shannon, North Shore pNHA/ Inner Shannon Estuary-South Shore pNHA/ Castleconnell (Domestic Dwelling, Occupied) pNHA, Danes Hole, Poulnalecka SAC/pNHA and Curraghchase Woods SAC/pNHA, with the implementation of the detailed mitigation measures identified in the NIS it is concluded beyond reasonable scientific doubt that the integrity of the European sites listed above will not be adversely affected. The implementation of detailed mitigation measures specified in this EIAR will ensure the integrity of the associated pNHAs listed above will not be adversely affected.

The NIS report has assessed the potential effects on the integrity of the Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA, Danes Hole, Poulnalecka SAC and Curraghchase Woods SAC and their associated pNHAs in light of the sites' conservation objectives and mitigation measures have been developed to prevent such potential effects occurring.

In the light of the conclusions of the assessment which it shall conduct on the implications for the Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA and Danes Hole, Poulnalecka SAC, the competent authority is enabled to ascertain that the proposed project will not adversely affect the integrity of any of the Lower River Shannon SAC, River Shannon and River Fergus Estuaries SPA or Danes Hole, Poulnalecka SAC).

No significant residual impacts have been identified for the pNHAs overlapping the European sites listed above.

Residual effects to Cloonlara House pNHA are considered *Long-term Slight* at the *Regional scale*.

No significant effects or residual effects are predicted for the remaining national sites within 15 km and potential ZoI of the proposed wind farm and within 500m of the GCR and TDR Nodes which are not overlapped by European sites:

- Doon Lough NHA (000337)
- Gortacullin Bog NHA (002401)
- Castleconnell (Domestic Dwelling, Occupied) pNHA (000433)
- Cloonloum More Bog NHA (002307)
- Woodcock Hill Bog NHA (002402)
- Lough O'Grady pNHA (001019)
- Loughanilloon Bog NHA (001020)
- Castle Lake pNHA (000239)
- Lough Cullaunyheeda pNHA (001017)
- Derrygareen Heath pNHA (000931)
- Ayle Lower Bog NHA (000993)

As such no significant residual impacts to designated sites will occur.

8.7.3 Habitats and flora

Construction of the wind farm 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 felling buffers. For clarity, associated infrastructure includes the construction compounds and a substation. Land take at junctions along the proposed turbine delivery route will be minimal.

Not all land take is permanent as modifications along the turbine delivery route will be reinstated and felling 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 Recolonising bare ground will be allowed to recolonise naturally following construction.

Mitigation measures as outlined in the current chapter and Chapter 10 - Hydrology and Water Quality' as well as the use of HDD at grid connection watercourse crossings shall ensure no significant loss of aquatic habitat of higher value.

The implementation of the invasive species management plan (Appendix 8-8) will avoid the spread of invasive species as a result of the proposed project 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.*

8.7.4 Mammals (excluding bats)

Measures to protect Red Squirrel, Pine Marten and Irish Stoat include restricting felling operations 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.
Badgers will be protected through a suite of measures including pre-construction surveys, temporary hard-blocking of setts in close proximity to proposed infrastructure and felling areas, and the implementation of buffer zones as required. Operation-stage measures have been specified to prevent impacts to badger setts during maintenance operations. No actions to exclude Badgers from active setts will be undertaken during the breeding season (December - June inclusive).

Some permanent loss of areas of grassland and woodland 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 tree-free turbulence/bat mitigation buffers around turbines. The implementation of mitigation measures will reduce residual effects to *Long-term Imperceptible Negative Reversible Effects* in the local context.

For otters, by implementing the mitigation measures outlined in section 8.6.2.6 and accompanying Chapter 10 Water Quality and Hydrology, residual effects 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.

8.7.5 Bats

Based on Lundy *et al*., (2011) habitat suitability index, the overall suitability for the two 5x5 km squares which the wind farm site is spread between have been scored as holding moderate/high suitability for all bat species combined. For individual species it was ranked as having moderate/high suitability for common pipistrelle, brown long-eared bats, natterer's bat, Leisler's bat, soprano pipistrelle and Daubenton's bat. Whiskered bats scored moderate/low on the index. Suitability for Nathusius' pipistrelle and lesser horseshoe bats was ranked as low for both species.

A total of six bat species, in addition to genus -level records of *Myotis* Spp. have been recorded as present within the study area during the 2020/2021 bat surveys. All bat species occurring in Ireland are listed as 'Least Concern' on the Irish Red List (2019), and Annex IV of the EU Habitats Directive.

This assessment identifies that the bat activity levels with the Site are high for common pipistrelle, moderate/high for Leisler's bat and soprano pipistrelle, moderate for Myotis Spp., moderate/low for Nathusius' pipstrelle and low for brown long-eared bat and lesser horseshoe bat.

With the implementation of extensive mitigation outlined above (sections 8.6.2.7 and 8.6.3.4) potential risk of fatality from collision and/or barotrauma events to foraging and/or commuting high risk species such as pipistrelle and Leisler's have been 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 windfarms and/or have direct evidence supporting there efficacy at reducing / avoiding impacts.

The resulting effect of the proposed development on local bat populations, with implemented mitigation measures, is considered to be a *Not Significant-Slight Residual Negative Reversible Effect* and in the *Local* to *Regional* 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.

8.7.6 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 Barn Owl, Buzzard, Kestrel, Sparrowhawk, Snipe and Woodcock activity or taking up new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

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

It is considered that with the implementation of mitigation, the proposed wind farm development will have a *Slight-Imperceptible* Reversible Residual Effect on birds.

Residual effects on Kestrel are *Imperceptible* at the national scale, but at the local level are predicted to be *Moderate.*

8.7.7 Aquatic Ecology

The proposed wind farm 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 Wind Farm site are all small streams without sensitive ecological receptors. The grid connection route would also have a slight negative effect on aquatic ecology and fisheries in the absence of mitigation. The GCR traverses sensitive ecological areas near salmonid and lamprey nursery and spawning habitat. Effects will be effectively reduced to an *imperceptible* negative effect with the mitigation measures proposed. The limitation through mitigation of effects 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.

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 any instream works 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 (particularly Annex II Species recorded during the current surveys and in the Lower River Shannon SAC) 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.

8.7.8 Marsh Fritillary

Marsh fritillary larval webs were recorded outside the proposed development footprint; there is potentially suitable larval habitat (rough grassland with abundant *S.pratensis*) which is partly overlapped by the proposed development. With the implementation of mitigation detailed in section 8.6.2.10, residual effects will be reduced to *Imperceptible* levels.

8.7.9 Other Species

Residual effects for other species are identified as *Short-term Slight*.

8.7.10 Overall residual impact

With the implementation of the detailed mitigation measures (outlined in the Natura Impact Statement, this chapter, Chapter 9 Lands, Soils and Geology, Chapter 10 Hydrology and Water Quality and the CEMP) there will be no significant residual impacts from the wind farm site, turbine delivery route and grid connection on biodiversity.

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