5 TERRESTRIAL ECOLOGY

5.1 INTRODUCTION

This chapter assesses the likely significant effects of the Project on Terrestrial Ecology, namely habitats, flora and fauna (mammals, amphibians, reptiles) and sets out the mitigation and compensation measures proposed to avoid, reduce or offset any potential significant effects that are identified. The residual effects on terrestrial ecology are then assessed. The Project refers to all elements of the application for the Firlough Wind Farm and Hydrogen Plant Project (as described in detail in **Chapter 2: Project Description**). The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project

This chapter of the EIAR is supported by Figures provided in Volume III and by the following Appendix documents provided in Volume IV of this EIAR:

- **Appendix 5.1 Total plant species lists for habitats encountered within the Site for the proposed wind farm and the Site for the Hydrogen Plant.**
- **Appendix 5.2 Bat Survey Report, Firlough Proposed Wind Farm. Eire Ecology Environmental Consultants, December 2022.**
- **Appendix 5.3 Preliminary Bat Roost and Badger Survey for a Proposed Hydrogen Plant. Eire Ecology Environmental Consultants, May 2023.**
- **Appendix 5.4 Biodiversity Enhancement and Management Plan (BEMP).**

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in Technical **Appendix 2.1**. This document will be a key construction contract document, which will ensure that all mitigation measures, which are considered necessary to protect biodiversity and the environment, are implemented.

5.1.1 Chapter Structure

In line with current EPA Guidelines (2022) the structure of this Terrestrial Ecology chapter is as follows:

- Details of the assessment methodology utilised for desk and field studies, in the context of legal and planning frameworks.
- Description of baseline ecological conditions at the Site of the Project.

- Identification and assessment of impacts to ecological interests associated with the Project at all stages of the project life cycle i.e., construction, operation and decommissioning phases.
- Identification of alternatives to prevent/mitigate effects.
- Identification and assessment of residual impact of the Project considering mitigation measures.
- Identification and assessment of cumulative effects, if and where applicable.

5.1.2 Outline Project Description

A detailed description of the Project has been included in **Chapter 2: Project Description**.

5.1.3 Project Team

This Terrestrial Ecology chapter has been prepared by Dr Brian Madden (BioSphere Environmental Services) and is informed by ecological survey data and relevant reports from various ecologists as listed in **Table 5.1** below.

Table 5.1: Personnel involved in Terrestrial Ecological Assessment.

Project Team Member	Qualifications & Experience	Role
Dr Brian Madden, BioSphere Environmental Services	BA. Mod. (Hons), PhD, MCIEEM Brian graduated in Natural Sciences from the University of Dublin in 1984 and earned a Ph.D. degree in 1990 from the National University of Ireland for his research on ecosystem processes in raised bogs. Since 1994, Brian has been the principal ecologist with BioSphere Environmental Services. Brian has carried out botanical surveys and habitat assessments for most terrestrial habitats which occur on the island of Ireland. He is also an experienced ornithologist, with particular interests in birds of prey and wetland birds. He has published a range of peer-reviewed research papers. Examples of energy projects that Brian has been involved in include: Grousemount Wind Farm, Cos. Cork/Kerry, Oweninny Wind Farm Phases 1 & 2, Co. Mayo, Castlepook Wind Farm, Co. Cork, Letteragh Wind Farm, Co. Clare, Kiltumper Wind Farm Co. Clare, Eglish Wind Farm, Co Tyrone, Connemara 110kV Overhead Line Reinforcement Project (40 km from Barna to Screeb Bay in Connemara.	Preparation of EIAR Chapter 5; habitat assessment; terrestrial mammal survey
Dr John Conaghan, Enviroscope	BSc, PhD, MCIEEM John has over 25 years experience of working on botanical projects throughout Ireland. He is a habitat	Habitat and botanical

Project Team Member	Qualifications & Experience	Role
Environmental Consultancy	specialist, with particular expertise in peatland and wetland habitats, as well as rare plants. John has worked with Coillte on their LIFE funded habitat restoration programme - he regularly contributes this expertise to Species and Habitat Management Plans. Examples of energy projects that John has been involved in include: Oweninny Wind Farm Phases 1 & 2, Co. Mayo, The Galway Wind Park, Grousemount Wind Farm, Cos. Cork/Kerry, Castlepook Wind Farm, Co. Cork, BGE Corrib Gas Pipleline from Bellanaboy, Co. Mayo to Craughwell, Co. Galway,	surveys; Report input
John Curtin, Eire Ecology	BSc, Environmental Science (NUI Galway) John has been carrying out bat surveys at wind farm sites since 2012, and has completed all standard training for such work through Bat Conservation Ireland, Bat Detector Workshop and Bat Handling Workshop. John holds the relevant licences for handling and photographing bats. Examples of energy projects that John has provided bat assessments for include Yellow River Wind Farm, Co. Offaly, Boggeragh Wind Farm, Co. Cork, Cappawhite B Wind Farm, Co. Tipperary, Glenmore Wind Farm, Co. Clare.	Implementation of Bat Survey for project, badger survey Analysis of bat data and preparation of risk assessment and mitigation report

5.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

5.2.1 Purpose of the Report

The purpose of this report is to:

- Establish and evaluate the baseline ecological environment as relevant to the Project.
- Identify, describe and assess all potentially significant ecological effects associated with the Project.
- Set out the prevention and mitigation measures required to address any potentially significant ecological effects and ensure compliance with relevant nature conservation legislation.
- Provide an assessment of the significance of any residual ecological effects.
- Identify any appropriate enhancement and / or post-construction monitoring requirements.

5.2.2 Relevant Legislation and Policy

The main pieces of legislation relevant to this chapter are as follows:

- The Wildlife Acts 1976 – 2022 as amended
- The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) as amended
- European Communities (Birds and Natural Habitats) Regulations 2011 - 2021
- Flora (Protection) Order, 2022 (S.I. No. 235 of 2022)

In considering ecological survey and assessment of impacts of the Project, regard was made to the following guidance and information documents:

- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022).
- European Commission (2017) Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report. (Directive 2011/92/EU as amended.
- NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes.
- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.
- Fossitt (2000). A Guide to Habitats in Ireland. Heritage Council, Kilkenny.
- Smith *et al.* (2011). Best Practice Guidance for Habitat Survey and Mapping in Ireland.
- Northern Ireland Environment Agency, Natural Environment Division (2021) Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland. Belfast: Department of Agriculture, Environment and Rural Affairs (Northern Ireland).
- Scottish Natural Heritage (2019). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.
- EUROBATS 'Guidelines for consideration of bats in wind farm projects' Revision 2014.
- Bat Conservation Trust 'Bat Survey Good Practice Guidelines' 2012 (BCT Guidelines).
- Bat Conservation Ireland (2012). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8 December 2012 Bat Conservation Ireland, www.batconservationireland.org.
- Marnell, F., Kelleher, C. & Mullen, E. (2022). Bat Mitigation Guidelines for Ireland. V2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage. Dublin, Ireland.

- England, N. (2014). Bats and onshore wind turbines Interim guidance. Rodrigues, L., Bach, L., Dubourg-Savage, M., Karapandža, B., Kovač, D., Kervyn, T., Minderman, J. (2015).

5.2.3 The Study Area

For habitats and flora species, the main study area is all land within the Redline Boundary, as well as the site of the house and shed to be demolished and rebuilt. However, consideration is given to the potential for sensitive habitats, such as bogs, fens, springs etc., or protected or rare plant species (including bryophytes), to a distance of up to 1 km of the Redline Boundary as well as the house and sheds to be demolished, but more should ecological or hydrological connectivity exist. Such habitats may be part of designated sites at a national or international level (Department of Environment, Heritage and Local Government 2010).

For terrestrial mammal species, badger and otter are identified as the principal species likely to be affected by the construction of the Project. For badger, the main study area was a distance of approximately 100 m of the proposed infrastructure locations (after NRA 2006 & NRA 2009b). For otter, the main study area was a distance of at least 150 m upstream and downstream of the sections of river potentially affected by the proposed infrastructural works, including the margins of the river to a distance of 10 m width. Generally, the potential of watercourses to support otter was based on stream size and water quality.

For bats, the desk review study area extended to a distance of 10 km for roost sites and to 4 km for known caves. A habitat assessment for bat potential, including assessment of value of trees as bat roosts, was carried out to a distance of 200 m of the locations for the proposed turbines (following BCI Guidelines Ver. 2.8, 2012, NIEA 2021, NatureScot 2021).

Table 5.2: Summary of Study Areas for Main Ecological Receptors.

Receptor	Study Area Definition	References
Habitats & Flora	Redline Boundary of site for core baseline survey; Extending to 1 km or beyond Redline Boundary for sensitive habitats and plant species	Department of Environment, Heritage and Local Government 2010
Badger	100 m (minimum) from works area	NRA 2006; NRA 2009b
Otter	150 m (minimum) upstream and downstream of watercourse crossing points	NRA 2008; NRA 2009b

Receptor	Study Area Definition	References
Bats	200 m from works area; Up to 10 km for bat roost desk review	BCI 2012 Nature Scot 2021 NIEA 2021

5.2.4 Zone of Influence

The Zone of Influence (ZoI), or distance over which potentially significant effects may occur, will differ across the Key Ecological Receptors (KERs), depending on the potential impact pathway(s). The results of both the desk study and the suite of ecological field surveys undertaken have established the habitats and species present within, and in the vicinity of, the Proposed Development. The ZoI and study area was then informed and defined by the sensitivities of each of the KERs present, in conjunction with the nature and potential impacts associated with the Proposed Development.

The ZoI in relation to direct impacts on habitats and flora and fauna species as a result of the Project will be confined to the area within the Redline Boundary of the Proposed Development, including the Grid Connection and Interconnector routes, as well as the site of the house and sheds to be demolished and rebuilt.

The ZoI of general construction activities (i.e. risk of spreading/introducing non-native invasive species, dust deposition and disturbance due to increased noise, vibration, human presence and lighting) is not likely to extend more than several hundred metres from the proposed Redline Boundary but could be further for bats.

The ZoI of potential impacts on surface water quality in the receiving environment, and associated aquatic flora and fauna, could extend downstream for up to 15 km (following UK guidance, Scott Wilson *et al.* 2006) but possibly more. For the Turbine Delivery Routes, the ZoI is confined to the portions of the route where road upgrade works are required (all within the River Moy Catchment).

5.2.5 Desk Study

A comprehensive desktop review was carried out to identify features of ecological importance within the Project area and surrounding region. This comprised a review of available ecological data, including the following:

- Online web-mapper of National Parks and Wildlife Service (NPWS) for data on sites designated for nature conservation (European & National) and on protected flora species and protected bryophytes (see www.npws.ie/protected-sites),
- Online web-mapper of National Biodiversity Data Centre for protected species datasets (see http://maps.biodiversityireland.ie)

For bats, a data search of the Wind Farm Site location was conducted in May 2021 and again in September 2022 to revise existing information from the footprint of the proposed planning boundary. The following information sources were examined:

- Known bat records within a 10 km radius of the proposed Wind Farm Site from the Bat Conservation Ireland database. The Hydrogen Plant Site was included in the 10 km roost zone but is considered that collision issues are unlikely.
- Adhoc and observational bat records from the National Bat Database held by the National Biodiversity Data Centre (www.biodiversityireland.ie)
- Review of Ordnance Survey mapping and aerial photography of the proposed Redline Boundary and its environs (*i.e.* 200 m plus rotor radius of the Redline Boundary of the Proposed Development)
- Records of designated sites within a 15 km radius of the proposed Wind Farm Site where bats form part or all of the reason for designation (https://www.npws.ie/protected-sites)
- Collation of data on known caves within a 4 km radius of the proposed Wind Farm Site from the Cave Database for the Republic of Ireland, compiled by Trinity College (http://www.ubss.org.uk/search_irishcaves.php)
- Review of bat survey data from Ecological Impact Assessments from proposed and permitted developments within the wider environs of the Wind Farm Site.

5.2.6 Consultation

As part of the study, consultation was made with the following relevant ecological parties:

- National Parks and Wildlife Services of the Department of Housing, Local Government and Heritage (response received 25th February 2021 – see **Table 1.14, Chapter 1**)
- BirdWatch Ireland (no response received)
- An Taisce (no response received)
- Irish Peatland Conservation Council (no response received)

5.2.7 Field Surveys

5.2.7.1 Habitats, vegetation and flora

The Site of the proposed Wind Farm at Firlough was visited and walkover surveys of the habitats and flora were conducted on the following dates: 24th August 2020, 2nd February 2022 and 19th July 2022, 14th February and 1st March 2023. A survey of the site for the proposed Hydrogen Plant was carried out on 19th July 2022, with the Grid Connection Route and Interconnector Route being assessed on 14th February 2023. The field survey was mainly concentrated in areas in which it is proposed to locate wind farm infrastructure.

Habitats within the study area were classified in accordance with 'A Guide to Habitats in Ireland' (Fossitt 2000). The dominant plant species present in each habitat type were recorded during the field surveys. This is considered sufficient to allow accurate classification of the habitats present. The extents and details of classified habitats were recorded and mapped using GIS. Where relevant, linkages with the EU Habitats Directive classification system are given.

During the various site surveys particular attention was paid to the possible occurrence of plant species listed in either the Flora (Protection) Order 2022 or the Irish Red Data Book (Curtis and McGough 1988). Vascular plant species nomenclature in this report follows Stace (2010) while that of mosses follows Smith (2004).

During the surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 – 2021 was conducted[1]. Invasive alien species which are widespread in Ireland include Japanese knotweed and Rhododendron.

The mapping of habitats was assisted by the use of aerial photography (OSI Geohive & BING online web-sites).

5.2.7.2 Terrestrial fauna

Multi-disciplinary walkover surveys of the Wind Farm Site were carried out on 24th and 25th August 2020, and 25th and 26th February 2021 in accordance with NRA guidelines on Ecological Surveying Techniques for Protected Flora and Fauna during the planning of National Road Schemes (NRA, 2009b). A survey of the Hydrogen Plant Site was carried out on 2nd February 2023.

[1] http://Invasives.biodiversityireland.ie/

The walkover surveys were designed to detect the presence, or likely presence, of a range of protected species, including badger and otter. Terrestrial mammal species were detected by direct observations and by search for signs, such as dwellings (*e.g.* setts), tracks or feeding signs

At the Wind Farm Site, survey for badger (*Meles meles*) was focused on the marginal areas of the conifer plantations along the western and south-western boundaries and within tracks or firebreaks through the forests. At the Hydrogen Plant Site, the field and associated hedgerows were surveyed, including along the access road. The areas were walked and checked for badger signs. Badger signs include setts, latrines, snuffle holes, prints, paths and tree scratching.

Stream courses within the Wind Farm Site, and leading from the Redline Boundary to a distance of approximately 100 m, were searched for otter signs, such as spraints, prints, slides, trails and holts along both banks of the stream. In addition to the width of the stream, a 10 m riparian buffer (both banks) was considered to comprise part of the otter habitat (NPWS 2009). The dedicated otter survey followed the guidance as set out in NRA (2008) *Guidelines for the Treatment of Otters Prior to the Construction of National Roads Schemes.* The otter survey was supplemented by survey information from the Aquatic Biodiversity study (**Chapter 6**).

Habitats within the Wind Farm Site and the Hydrogen Plant Site were evaluated for their potential to support breeding amphibians, namely the common frog *Rana temporaria* and the smooth newt *Lissotriton vulgaris,* as well as the common lizard *Zootoca vivipara,* with any sightings recorded whilst carrying out the habitat and mammal surveys.

5.2.7.3 Bats

In order to assess the presence and activity of bats associated with the Wind Farm Site, the following surveys were undertaken within and adjacent to the Redline Boundary for the Wind Farm Site:

- Bat activity (walked, driven transects and emergence surveys)
- Static detector (three survey periods); and.
- Preliminary roost assessment

All surveys adhered to SNH (2019) guidelines. It is noted that surveys were conducted prior to the release of (NIEA, 2021) and (SNH, 2021). Full details of the survey methods are contained in **Appendix 5.2.**

A preliminary bat roost survey was carried out at the Hydrogen Plant Site (details in **Appendix 5.3**).

Activity surveys

The night time activity surveys combined emergence surveys towards dusk and dawn and a combination of walked and driven transects of bat favourable habitats within and surrounding the survey area were conducted between June and August 2021. The transects targeted a range of foraging and commuting habitats present within and surrounding the survey area, those associated with linear features such as roadside margins, woodland plantation edges, hedgerows, treelines and waterbodies.

Where possible, a positive identification to species level was made. Information on the behaviour was also recorded where available.

All field surveys were undertaken within the active bat season and during recommended weather conditions (dry conditions and temperature at 8°C and greater). Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (Wildlife Acoustic's Kaleidoscope Pro; version 2.1.0).

Static detector surveys

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

The data was analysed with Wildlife Acoustic's Kaleidoscope Pro; version 2.1.0). This software identifies many of the calls made by Irish bats. All calls not labelled Soprano or Common Pipistrelle Bats were manually verified. Results presented below show some Myotis calls the surveyor is confident the bat is a Natterer's bat. Distinguishing between Myotis species recordings is difficult (unless distinctive social calls are recorded thus several calls are recorded to genus level only. These could be either Whiskered, Daubenton's or Natterer's bat. Similarly, several Pipistrelle calls were recorded with a peak frequency of around 40kHz. These calls are lower than expected for Common Pipistrelle but higher than typical for Nathusius's. Following the precautionary approach these calls

have been included in ECOBAT as Nathusius Pipistrelle although it is likely many were Common Pipistrelle. All detectors were set in open bog on a timber structure ensuring microphone height was set at 2.5 m.

Potential roost assessment

NEAI guidance recommends a search of trees within 200 m of each turbine. Trees were assessed with reference to the Bat Tree Habitat Key (Andrews, 2016) on the (give date). No trees with potential for hosting a bat roost is located within any of turbine buffer zones. Conifer plantation trees within the buffers have no potential to host bat roosts. In addition, all deciduous trees within the buffer zones were scrubby trees without cavities (the majority are willow) of no potential for bat roosts.

No buildings or built structures suitable for usage by bats was found within 200 m of any turbine location. Potential roost structures outside this zone were also examined. Several derelict sheds, dwellings and bridges were examined in the wider landscape of the Wind Farm Site. In situations where access was not possible the surveyor conducted night time surveys from the road examining bats and attempting to locate commuting routes and roosts.

At the Hydrogen Plant Site, a preliminary ground level roost assessment was conducted within the site on the 2nd February 2023 noting all trees and buildings (house and four agricultural sheds) with bat roost potential within the site and along the access route.

5.2.7.4 Survey Limitations

The information provided in this assessment accurately describes the baseline ecological environment within the area of the Project.

The specialist surveys, analysis and reporting have been undertaken in accordance with the appropriate guidelines and within the recommended seasonal time periods.

It is considered that the assessment as carried out on the baseline survey data provides an accurate prediction of the likely ecological effects of the proposed Project, prescribes best practice and mitigation as necessary (including monitoring), and describes accurately the residual ecological impacts. It is noted that should pre-construction surveys indicate a requirement for protection of relevant species, appropriate measures (as described in **Section 5.9**) will be taken to comply with all relevant legislation and best practice.

5.2.8 Assessment Approach

The ecological evaluation approach used in this report is based on "Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA 2009). The impact assessment approach is based on "Guidelines on the information to be contained in Environmental Impact Assessment Reports" (EPA 2022).

5.2.8.1 Key ecological receptors

Ecological receptors can be important for a variety of reasons and the rationale used to identify them is explained in the text. Importance may relate, for example, to the quality or extent of the Site or habitats therein; habitat and/ or species rarity; the extent to which such habitats and/ or species are threatened throughout their range, or to their rate of decline.

5.2.8.2 Determining importance of ecological receptors

The importance of an ecological receptor is considered within a defined geographical context. The following frame of reference has been used in this case (based on NRA Guidance 2009), relying on known/ published accounts of distribution and rarity where available, and professional experience:

- International and European
- National
- County
- Local Importance (higher value)
- Local Importance (lower value)

The above frame of reference is applied to the ecological receptors identified during the desk study and baseline surveys to inform this report.

The value of habitats and flora has been measured against published selection criteria where available. Examples of relevant criteria include habitats listed on Annex 1 of the Habitats Directive as amended and flora species listed on the Flora (Protection) Order 2022 or on the Irish Red List (Curtis & McGough).

In assigning a level of value to a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Reference has therefore been made to published lists and criteria where available. Examples of relevant lists and criteria include: species of European conservation importance (as listed on Annexes II, IV and V of the Habitats Directive (as amended) or Annex 1 of the Birds

Directive (as amended)), Birds of Conservation Concern in Ireland, species protected under the Wildlife Acts as amended etc.

For the purposes of this report ecological receptors of Local importance or greater, and/or subject to legal protection, have been subject to detailed assessment. Effects on ecological receptors rated Local Importance (lower value) are considered unlikely to be significant in legal or policy terms.

5.2.8.3 Characterisation of Impacts and Effects

The impact assessment process involves the following steps:

- identifying and characterising potential impacts;
- incorporating measures to avoid and mitigate (reduce) these impacts;
- assessing the significance of any residual effects after mitigation;
- identifying appropriate compensation measures to offset significant residual effects (if required); and
- identifying opportunities for ecological enhancement.

When describing impacts, reference has been made to the following characteristics, as appropriate (in accordance with EPA 2022):

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

The impact assessment process considers both direct and indirect impacts: direct ecological impacts are changes that are directly attributable to a defined action, e.g., the physical loss of habitat during the construction process. Indirect ecological impacts are attributable to an action but which affect ecological resources through effects on an intermediary habitat process or feature, *e.g.* the construction of a Site access track which causes local hydrological changes, which, in the absence of mitigation, could lead to the drying out of peat bog.

Consideration of conservation status is important for evaluating the effects of impacts on individual habitats and species and assessing their significance:

- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area.
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

5.2.8.4 Significant Effects

The concept of ecological significance is addressed in paragraphs 5.24 through to 5.28 of CIEEM guidelines. Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of ecological impact assessment, a 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific, *e.g.* for a designated site, or broad, *e.g.* national/local nature conservation policy, or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local and the scale of significance of an effect may or may not be the same as the geographic context in which the feature is considered important.

The EPA Guidelines on information to be included in Environmental Impact Assessment Reports (EPA 2022) were adhered to when determining significance and the present assessment is in accordance with those guidelines. Details of the EPA Guidelines, including the criteria used for determining the significance of effects, are presented in **Chapter 1: Introduction.**

5.2.8.5 Cumulative Effects

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

5.2.8.6 Avoidance, Mitigation, Compensation and Enhancement

When seeking mitigation or compensation solutions, efforts should be consistent with the geographical scale at which an effect is significant. For example, mitigation and compensation for effects on a species population significant at a county scale should ensure no net loss of the population at a county scale. The relative geographical scale at which

the effect is significant will have a bearing on the required outcome which must be achieved.

Where potentially significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the EPA (2022) and CIEEM (2022) Guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of impacts where possible, the application of mitigation measures to minimise unavoidable impacts and then compensation for any remaining impacts. Once avoidance and mitigation measures have been applied residual effects are then identified along with any necessary compensation measures, and incorporation of opportunities for enhancement.

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

- Avoidance is used where an impact has been avoided, *e.g.* through changes in scheme design;
- Mitigation is used to refer to measures to reduce or remedy a specific negative impact *in situ*;
- Compensation describes measures taken to offset residual effects, *i.e*. where mitigation *in situ* is not possible.
- Enhancement is improved management of ecological features or provision of new ecological features, resulting in a net benefit to biodiversity, which may be unrelated to a negative impact or is 'over and above' that required to mitigate/compensate for an impact.

5.3 BASELINE ECOLOGICAL CONDITIONS

5.3.1 Physical and General Ecological Description of Site

The Proposed Development is primarily located on two distinct sites which for the purposes of this EIAR are referred to as the Wind Farm Site and the Hydrogen Plant Site.

The Firlough Wind Farm Site is situated in the townland of Carrowleagh, northeast of the village of Bunnyconnellan, Co. Mayo, Irish Grid Reference (ITM): 536617, 821819 (see **Figure 1.2**). The site occupies an area of approximately 445 ha. The Hydrogen Plant Site is located in a rural setting and has an area of c. 6.5 ha, located in County Sligo in the townland of Carraun, adjacent to the Co. Mayo border. The site is situated approximately 6 km west of the proposed Wind Farm Site.

The Wind Farm Site is within the lower north-western foothills of the Ox Mountains, adjacent to the county boundary between Mayo and Sligo. The Site is situated within a landscape dominated by blanket bog and heath (of varying intactness and quality), commercial forestry and agricultural land mainly used for stock grazing. There are a number of established wind farms in the vicinity, including Carrowleagh Wind Farm and Carrowleagh Wind Farm Extension directly to the east / north-east, Black Lough Wind Farm (1.3 km north-east) and Bunnyconnellan Wind Farm (3.6 km south).
The elevations within the Wind Farm Site range from 120 m O.D. in the north-west to up to c.170 m O.D. in the south-east. The topography of the site is generally flat.

The mapped geological formation underlying the both the Wind Farm Site and Hydrogen Plant Site is classified as the Ballina Limestone Formation (Lower), which is comprised of Dark fine-grained limestone and shale (for full details see **Chapter 8: Soils and Geology** of EIAR). The primary soil type across the Site for the wind farm is blanket peat, much of which has been subject to turbary. Peat depth is generally shallow though localised pockets of deeper peat (up to 4 m) occur in places. Land underling the proposed location for the Hydrogen Plant is comprised of Peat Bog, though the site itself has been converted to pastoral land. Directly south of the proposed Hydrogen Plant footprint, there is a remnant bog with peat depths ranging to a maximum of 1.9 m.

The site for the Wind Farm Development is situated within both the Moy Catchment (Catchment ID: 34_01), which has an area of 2,110.72 km^2, and the Easky-Dunneil-Coastal Catchment (Catchment ID: 35_03), with an area of 359.52 km^2.

Surface water runoff associated with the Wind Farm Site drains into two sub catchments and/or three river sub basins, or four no. rivers:

- Sub Catchment: Glenree_SC_010; River Sub Basins: Brusna (North Mayo)_020; Brusna (North Mayo)_010; and Glenree_020
- Sub Catchment: Easky_SC_010; River Sub Basin; Gowlan (Sligo)_010

Surface waters draining to the west of the Wind Farm Site eventually combine in the Moy River, from which waters eventually flow to Killala Bay and into the North Atlantic Ocean. Surface waters draining the east of the Site join the Easky River, which flows directly to the North Atlantic Ocean.

The Hydrogen Plant Site is situated within the Moy Catchment. Surface water runoff associated with this element of the Project drain into one sub catchment and/or one river sub-basin, or 1 no. river:

- Sub Catchment: Leaffony_SC_010;
- River Sub Basins: Dooyeaghny_010, Cloonloughan_010

Surface waters draining the Hydrogen Plant Site eventually combine in the Moy River Estuary north of Ballina,

Ecologically, the Wind Farm Site is dominated by Cutover blanket bog (PB4 of Fossitt 2000). Peat cutting is ongoing and there is a network of established gravel bog tracks throughout the site. There are areas of uncut high bog remaining throughout the site, which are classified as Lowland blanket bog (PB3). Wet heath (HH3) has developed in cutover bog which has not been disturbed in recent decades. Other habitats which occur over small areas are Scrub (WS1), Conifer plantation (WD4) and Wet grassland (GS4) (latter two habitats confined to the access area in the westernmost sector of site. The Hydrogen Plant Site comprises Improved agricultural grassland (GA1), Treelines (WL1) and Buildings and artificial surfaces (BL3). The Grid Connection and Interconnector Routes are almost entirely along public roads. The roads typically are lined with low hedgerows (WL1) and grassy verges (GS2). The location of the loop-in with the existing overhead line is within an improved grassland field.

The options for the Turbines Delivery Routes, from the port of Killybegs, Co. Donegal and from Galway Port, Co. Galway, are along existing public roads (BL3)

5.3.2 Designated Sites

The potential for the Project to impact on sites that are designated for nature conservation is considered in this Ecological Impact Assessment.

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are designated under the EU Habitats Directive as amended and EU Birds Directive as amended respectively and are collectively known as 'European Sites'. The potential for significant effects on the integrity of European Sites is fully assessed in the Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) that accompanies this application. As per EPA Guidance 2022, *"a biodiversity section of an EIAR, for example, should not repeat the detailed assessment of potential effects on European sites contained in documentation prepared as part of the Appropriate Assessment process, but it should*

refer to the findings of that separate assessment in the context of likely significant effects on the environment, as required by the EIA Directive". **Section 5.4.2** of this EIAR provides a summary of the key assessment findings with regard to European Designated Sites.

Natural Heritage Areas (NHAs) are designated under Section 18 the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. The potential for effects on these designated sites is fully considered in this Ecological Impact Assessment (EcIA).

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. However, the potential for effects on these sites is fully considered in this EcIA.

All designated sites that could potentially be affected were identified using a source-pathway – receptor model. To provide context for the assessment, European and national sites within a distance of 15 km surrounding the Wind Farm Site have been considered and are shown in **Figures 5.1 and 5.2** in Vol III respectively. The distance of 15 km follows guidance from the Department of Environment, Heritage and Local Government (2010). However, sites that were further away from the Proposed Development were also considered and especially where there is possible hydrological connectivity. Information on the identified sites according to the site-specific conservation objectives (as available) is provided in **Tables 5.3 and 5.4**.

It is noted that no part of the Proposed Development area is within a site with a nature conservation designation.

5.3.2.1 European designated sites

A total of six European designated sites occurs within a 15 km distance of the Wind Farm Site (see **Figure 5.1** in Vol III**).** These are listed in **Table 5.3**, along with the reasons for designation, the distance from the Proposed Development and whether any linkages or connectivity exist between the two locations.

The nearest designated European site to the Wind Farm Site is the Ox Mountains SAC (c.100 m distance from Redline Boundary), with ecological and hydrological connectivity between the two locations. The River Moy SAC receives drainage from the Wind Farm Site. The Killala Bay / Moy Estuary SAC and the Killala Bay / Moy Estuary SPA are hydrologically linked to both the Wind Farm Site and the Hydrogen Plant Site.

For the other two listed sites, there is no ecological or hydrological connectivity with the Sites for the proposed Wind Farm or Hydrogen Plant. The European sites are considered in detail in the AA Screening Report and NIS which accompany this application.

5.3.2.2 National designated sites

There are no Natural Heritage Areas (NHAs) within the 15 km radius of the Wind Farm Site (see **Figure 5.2** in Vol III).

5.3.2.3 Proposed designated sites

A total of nine proposed Natural Heritage Areas (pNHAs) occurs within a 15 km radius of the Wind Farm Site (see **Figure 5.2** in Vol III and **Table 5.4**). Proposed Natural Heritage Areas are sites of ecological interest though specific qualifying habitats or species have not as of yet been identified by NPWS.

Four of the pNHAs are also designated as SACs, namely Ox Mountains Bogs, Lough Hoe Bog, Lough Nabrickeagh Bog and Killala Bay/Moy Estuary. Potential impacts on these four sites are discussed in detail in the accompanying AA Screening Report and NIS.

For the remaining five listed pNHA sites, hydrological connectivity exists between one site, Easky River pNHA, and the Wind Farm Site.

Table 5.3: Relevant European sites, reasons for designation, distances from Project Area and summary of connectivity.

European Site	Reasons for designation (information correct as of 2nd May 2023) (*denotes a priority habitat)	Distance from Project Area and summary of connectivity
	SPECIAL AREAS OF CONSERVATION	
Ox Mountains SAC (site code 002006)	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3110] Natural dystrophic lakes and ponds [3160] Northern Atlantic wet heaths with Erica tetralix [4010] European dry heaths [4030] Blanket bogs (* if active bog) [7130] Transition mires and quaking bogs [7140] Depressions on peat substrates of the Rhynchosporion [7150] Vertigo geyeri (Geyer's Whorl Snail) [1013] Saxifraga hirculus (Marsh Saxifrage) [1528]	The southernmost boundary of the Wind Farm Site is approximately 100 m from the SAC (which extends to the southern bog track). Between the wind farm site boundary and the SAC there is cutover blanket bog, which provides ecological continuity

European Site	Reasons for designation (information correct as of 2nd May 2023) (*denotes a priority habitat)	Distance from Project Area and summary of connectivity
	According to this SAC's site Conservation Objectives document: NPWS (2013) Conservation Objectives: Ox Mountains SAC, Version 1.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, for each of the listed QIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.	between the two locations. A tributary of the Gowlan River rises in the northeast sector of the site and runs northwards. Approximately 2.5 km downstream of the wind farm site, the tributary enters the SAC and flows for a distance of c.3 km through the SAC. The Hydrogen Plant Site, which is connected to the Wind Farm Site by an Interconnector, is approximately 7.5 km westwards of the SAC. The Grid Connection Route drains to tributaries of the Brusna River. The Turbine Delivery Route has no connectivity with the SAC. It is concluded that (i) there is ecological and hydrological connectivity between the Wind Farm Site and the SAC, and (ii) there is no connectivity between the Hydrogen Plant Site and the SAC, or the Interconnector Route and Grid Connection Route and the SAC, or the TDR and the SAC.
Lough Hoe Bog SAC (site code: 00633)	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) [3110] Blanket bogs (* if active bog) [7130] Vertigo geyeri (Geyer's Whorl Snail) [1013] Austropotamobius pallipes (White-clawed Crayfish) [1092]	The Wind Farm Site is approximately 2.5 km northwards of the SAC. The two areas are separated by extensive forestry, agricultural lands and heath/bog of varying quality.

European Site	Reasons for designation (information correct as of 2nd May 2023) (*denotes a priority habitat)	Distance from Project Area and summary of connectivity
	According to this SAC's site Conservation Objectives document: NPWS (2017): Conservation Objectives: Lough Hoe SAC, Version 1. Department of Culture, Heritage & the Gaeltacht, for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	There are no ecological or hydrological linkages between the site of the Wind Farm and the SAC. The Hydrogen Plant Site is approximately 8 km northwest of the SAC. There are no ecological or hydrological linkages between the site of the Hydrogen Plant, and the Interconnector Route, and the SAC. The Grid Connection Route drains to tributaries of the Brusna River. The Turbine Delivery Route has no connectivity with the SAC. It is concluded that there is no ecological or hydrological connectivity between any component of the Project and the SAC.
Lough Nabrickleagh Bog SAC (site code: 00634)	Blanket bogs (* if active bog) [7130] According to this SAC's site Conservation Objectives document: NPWS (2019) Conservation Objectives: Lough Nabrickleagh Bog SAC, Version 1. Department of Culture, Heritage & the Gaeltacht, for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The Wind Farm Site is located approximately 7 km northwest of the SAC. The Hydrogen Plant Site, and the Interconnector Route, is approximately 13 km northwest of the SAC. The Turbine Delivery Route has no connectivity with the SAC. It is concluded that there is no ecological or hydrological connectivity between the any component of the Project and the SAC.

European Site	Reasons for designation (information correct as of 2nd May 2023) (*denotes a priority habitat)	Distance from Project Area and summary of connectivity
River Moy SAC (site code: 002298)	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) [6510] Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the Rhynchosporion [7150] Alkaline fens [7230] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] Austropotamobius pallipes (White-clawed Crayfish) [1092] Petromyzon marinus (Sea Lamprey) [1095] Lampetra planeri (Brook Lamprey) [1096] Salmo salar (Salmon) [1106] Lutra lutra (Otter) [1355] According to this SAC's site Conservation Objectives document: NPWS (2016): Conservation Objectives: River Moy SAC, Version 1. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The western sector of the Wind Farm Site is drained by tributary streams of the Owencam River and the Glenree River, both of which join the Brusna River. The lower reaches of the Glenree and Brusna system, to the confluence with the Moy Estuary, is within the River Moy SAC (for approximately 6 km). The Hydrogen Plant Site is approximately 3 km northeast of the SAC. There are no ecological or hydrological linkages between the site of the Hydrogen Plant and the SAC. The Interconnector Cable Route and the Grid Connection Route cross various tributaries of the Brusna River. The Turbine Delivery Route is hydrologically linked to the River Moy SAC. It is concluded that there is hydrological connectivity between (i) the Wind Farm Site and the SAC, (ii) the Interconnector and Grid Connection routes and the SAC, and (iii) the TDR, There is no connectivity between the Hydrogen Plant Site and the SAC.
Killala Bay / Moy Estuary SAC (site code: 00458)	Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210] Vegetated sea cliffs of the Atlantic and Baltic coasts [1230]	The Wind Farm Site is approximately 9.5 km east of the SAC, while the Hydrogen Plant Site is approximately 3.5 km eastwards of the SAC.

European Site	Reasons for designation (information correct as of 2nd May 2023) (*denotes a priority habitat)	Distance from Project Area and summary of connectivity
	Salicornia and other annuals colonising mud and sand [1310] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Humid dune slacks [2190] Vertigo angustior (Narrow-mouthed Whorl Snail) [1014] Petromyzon marinus (Sea Lamprey) [1095] Phoca vitulina (Harbour Seal) [1365] According to this SAC's site Conservation Objectives document: NPWS (2012), Conservation Objectives for Killala Bay/Moy Estuary SAC [00458]. Version 1.0. Department of Arts, Heritage and the Gaeltacht, for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	Hydrological linkages exist between the Wind Farm Site and the SAC via the Brusna/Glenree River system which receives drainage from the wind farm site and enters the SAC at the northern outskirts of Ballina town. A hydrological link exists between the Hydrogen Plant Site and the SAC via the Dooyeaghny River, which enters the SAC at Castleconor. The Interconnector Cable Route and the Grid Connection Route cross various tributaries of the Brusna River, which enters the Moy Estuary just above Ballina town. The Turbine Delivery Route is hydrologically linked to the Killala Bay / Moy Estuary SAC. It is concluded that there is hydrological connectivity between (i) the Wind Farm Site, (ii) the Hydrogen Plant Site, (iii) the Interconnector and Grid Connection routes, and (iv) the TDR and the SAC.
	SPECIAL PROTECTION AREAS	
Killala Bay / Moy Estuary SPA (site code: 004036)	Ringed Plover (Charadrius hiaticula) [A137] Golden Plover (Pluvialis apricaria) [A140] Grey Plover (Pluvialis squatarola) [A141] Sanderling (Calidris alba) [A144] Dunlin (Calidris alpina) [A149] Bar-tailed Godwit (Limosa lapponica) [A157] Curlew (Numenius arquata) [A160] Redshank (Tringa totanus) [A162] Wetland and Waterbirds [A999]	The Wind Farm Site is approximately 9.5 km east of the SPA, while the Hydrogen Plant Site is approximately 3.5 km eastwards. Hydrological linkages exist between the Wind Farm Site and the SPA via the Brusna/Glenree River system which

European Site	Reasons for designation (information correct as of 2nd May 2023) (*denotes a priority habitat)	Distance from Project Area and summary of connectivity
	According to this SPA's site Conservation Objectives document: NPWS 2013, Conservation Objectives: Killala Bay/Moy Estuary SPA 004036. Version 1.0, Department of Arts, Heritage, and the Gaeltacht, for each of the listed SCIs, the Conservation Objective is to maintain the favourable conservation condition of the species for which the SPA has been selected.	receives drainage from the wind farm site and enters the Moy estuary approximately 2 km upstream of the SPA. A hydrological link exists between the Hydrogen Plant Site and SPA via the Dooyeaghny River, which enters the SPA at Castleconor. The Interconnector Cable Route and the Grid Connection Route cross various tributaries of the Brusna River, which enters the Moy Estuary on the northern outskirts of Ballina town and approximately 2 km upstream of the SPA. The Turbine Delivery Route is hydrologically linked to the Killala Bay / Moy Estuary SPA. The Wind Farm Site and the Hydrogen Plant Site do not provide suitable habitats to support the SCIs of the SPA. It is concluded that there is hydrological connectivity between (i) the Wind Farm Site, (ii) the Hydrogen Plant Site, (iii) the Interconnector and Grid Connection routes, and (iv) the TDR and the SPA.

Table 5.4: Relevant proposed Natural Heritage Areas, reasons for designation (if known), distances from Firlough Wind Farm Site and Hydrogen Plant Site and summary of connectivity.

Site	Reasons for designation (information correct as of 2nd May 2023)	Distance from Firlough Wind farm Site and Hydrogen Plant Site and summary of connectivity
	PROPOSED NATURAL HERITAGE AREAS	
Ox Mountains pNHA (site code 002006)	Not Stated but presumed similar to SAC (see Table 5.3)	As in Table 5.3 above.
Lough Hoe Bog pNHA (site code: 00633)	Not stated but presumed similar to SAC (see Table 5.3)	As in Table 5.3 above.
Lough Nabrickeagh Bog pNHA (site code: 00634)	Not stated but presumed similar to SAC (see Table 5.3)	As in Table 5.3 above.
Killala Bay/Moy Estuary pNHA (site code 00458)	Not stated but presumed similar to SAC & SPA (see Table 5.3)	As in Table 5.3 above.
Cloonagh Lough pNHA (site code: 001485)	Eutrophic lake (source: Areas of Scientific Interest in Ireland, 1991)	The pNHA is located approximately 14 km west of the Wind Farm Site and approximately 8 km west of the Hydrogen Plant Site. With the location of the pNHA west of the Moy River and Estuary, there is no ecological or hydrological connectivity with the area of the Project.
Moy Valley pNHA (site code: 002078)	Not stated	The pNHA is located approximately 14 km southwest of the Wind Farm Site and approximately 12 km south-southwest of the Hydrogen Plant Site. There is no ecological or hydrological connectivity between the pNHA and the area of the Project.
Cloongoonagh Bog pNHA (site code: 001657)	Not stated	The pNHA is located approximately 14 km southeast of the Wind Farm Site and approximately 22 km southeast of the Hydrogen Plant Site. There is no ecological or hydrological connectivity between the pNHA and the area of the Project.
Dunneil River pNHA (site code 001664)	Exposed limestone rock (source: Areas of Scientific Interest in Ireland, 1991)	The pNHA is located approximately 13 km north-northeast of the Wind Farm Site and approximately 19 km northeast of the Hydrogen Plant Site. There are no ecological or hydrological connectivity between the pNHA and the area of the Project.
Easky River pNHA (site code: 001665)	Marsh (source: Areas of Scientific Interest in Ireland, 1991); Also, the	While the Easky River receives drainage from the northwest sector of the Wind Farm

Site	Reasons for designation (information correct as of 2nd May 2023)	Distance from Firlough Wind farm Site and Hydrogen Plant Site and summary of connectivity
	Easky River is an important salmon and sea trout fishery and the main channel of the Easky River has a population of freshwater pearl mussel (though this is upstream of the pNHA) .	Site (via the Gowlan River tributary), the pNHA is an estimated 13 km downstream of the Wind Farm Site. The proposed Hydrogen Plant is located at a distance of 16 km from the pNHA and there is no ecological or hydrological connectivity between the two locations. It is concluded that hydrological connectivity exists between the Wind Farm Site and pNHA.

5.3.3 Habitats, Vegetation and Flora

The dominant habitat within the Wind Farm Site is cutover blanket bog (PB4), with smaller areas of lowland blanket bog (PB3), wet grassland (GS4), scrub (WS1), coniferous plantation (WD4), and gravel tracks (BL3). Improved agricultural grassland (GA1) is the dominant habitat within the site for the Hydrogen Plant.

In the following sections, the vegetation composition of these habitats is described, with a list of the plant species occurring presented in **Appendix** 5.1. Habitats which occur within the Wind Farm Site are mapped in **Figure 5.3** in Vol. III.

5.3.3.1 Cutover blanket bog (PB4)

Cutover blanket bog is the dominant habitat within the Wind Farm Site. Much of the rea has been subject to extensive peat-cutting for many decades and the practice still continues to the present day. This cutting has resulted in the presence of a shallow peat soil (typically <50 cm) which gives rise to a mosaic of vegetation cover. Many of the more intensively and recently cut areas are characterised by a high cover of bare peat, *i.e.* greater than 50%. Typically, the main plant species in the vegetation are many-flowered bog-cotton (*Eriophorum angustifolium*), purple moor-grass (*Molinia caerulea*), deer grass (*Trichophorum germanicum*), ling heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*) and carnation sedge (*Carex panicea*). Other locally frequent species may include bog asphodel (*Narthecium ossifragum*), soft rush (*Juncus effusus*) and, in actively cut/disturbed areas, bulbous rush (*Juncus bulbosus*).

Mosses and lichens generally have a low cover in the vegetation, with the most conspicuous species being *Cladonia portentosa, Hypnum jutlandicum, Sphagnum capillifolium, Rhytidiadelpus loreus* and *Campylopus introflexus*. The cover of Sphagnum moss is

typically less than 25% due to disturbance, however the cover may be higher in less disturbed areas of cutover where there is some waterlogging.

Plate 5.1: General view of a cutover bog surface with machine cut turf visible on the left.

Plate 5.2: A view of more recent turf cutting activity, with large areas of bare peat evident.

5.3.3.2 Lowland blanket bog (PB3)

Throughout the Wind Farm Site there are a number of relatively small uncut blanket bog areas, which are typically surrounded by cutover bog. The peat depth in these more intact areas generally exceeds 2.5 metres and this greater peat depth results in a wet peat surface which often contains areas of surface bog pools with standing water. The main plant species growing in these blanket bog areas are deer grass (*Trichophorum germanicum*), purple moor-grass (*Molinia caerulea*), bog asphodel (*Narthecium ossifragum*) and ling heather (*Calluna vulgaris*), with frequent cross-leaved heath (*Erica tetralix*), common bog-cotton (*Eriophorum angustifolium*) and hare's tail bog-cotton (*Eriophorum vaginatum*). The moss layer can be well-developed with *Sphagnum capillifolium, Sphagnum papillosum, Racomitrium lanuginosum* and *Hypnum jutlandicum* generally dominating with the liverwort species *Pleurozia purpurea* also locally common. The Sphagnum cover in these areas is generally greater than 30% and in the wetter central areas can be greater than 50%. In the bog pools *Sphagnum cuspidatum* is the main moss species present and it is usually accompanied by bog bean (*Menyanthes trifoliata*).

Equivalent EU Annex 1 Habitat – Blanket bog (7130)

Plate 5.3: View of remnant blanket bog area showing wet bog pool areas.

Plate 5.4: View of remnant blanket bog showing a wet bog pool system in the south-east of the Wind Farm Site.

5.3.3.3 Wet grassland (GS4)

A few small fields of wet grassland occur along the western margins of the Wind Farm Site. These fields are dominated by lightly grazed wet grassland habitat in which soft rush (*Juncus effusus*) is the dominant species, *i.e*. >50% cover. Other frequent species include Yorkshire Fog (*Holcus lanatus*), creeping bent (*Agrostis stolonifera*), marsh thistle (*Cirsium palustre*) and creeping buttercup (*Ranunculus repens*).

5.3.3.4 Eroding/upland rivers (FW1)

A number of narrow, First Order upland streams occur along the western margins of the survey area. The stream margins are generally dominated by soft rush (*Juncus effusus*), with wetland species such as bog pondweed (*Potamogetom polygonifolius*), bulbous rush (*Juncus bulbosus*) and lesser spearwort (*Ranunculus flammula*) growing in/along the water channel.

5.3.3.5 Scrub (WS1)

Occasional small areas of low-growing scrub dominated by Willow (*Salix* species) occur along tracks and drains within the Wind Farm Site. This scrub vegetation is generally between 2 and 4 metres tall. The main species are grey willow (*Salix cinerea oleifolia*) and eared willow (*Salix aurita*) with occasional rowan (*Sorbus aucuparia*), gorse (*Ulex*

europaeus) and downy birch (*Betula pubescens*) also noted. Bracken (*Pteridium aquilinum*) and briar (*Rubus fruticosus* agg.) are also frequent components of the habitat.

5.3.3.6 Coniferous plantation (WD4)

Relatively small areas of conifer plantation occur along the western margins of the Wind Farm Site. These trees were planted in 2001 and are generally between 6 and 8 metres tall. Sitka spruce is the main tree species and the species-poor ground layer is dominated by conifer needles along with occasional clumps of mosses such *Hypnum jutlandicum, Rhytidiadelphus loreus* and *Plagiothecium undulatum*.

5.3.3.7 Buildings and artificial surfaces (BL3)

A network of gravel tracks traverse the bog within the Wind Farm Site (see Plate 5.5). These are long established tracks which were constructed for peat extraction. The tracks generally have a low cover of vegetation however the margins and the centre ridges can support a grassland vegetation dominated by species such as Yorkshire fog (*Holcus lanatus*), *Molinia caerulea*, cock's foot (*Dactylis glomerata*), soft rush (*Juncus effusus*), and crested dog's tail (*Cynosurus cristatus*). Ribwort plantain (*Plantago lanceolata*), marsh thistle (*Cirsium palustre*) and self-heal (*Prunella vulgaris*) are also common. Patches of bracken *Pteridium aquilinum* and brambles *Rubus fruticosus* are also locally frequent along the track margins. An occupied residence and four agricultural sheds occur at the access entrance to the Hydrogen Plant Site.

Plate 5.5: View of a typical gravel bog track which occurs within the Wind Farm Site, looking eastwards across site.

5.3.3.8 *Improved agricultural grassland (GA1)*

The location of the Hydrogen Plant is on well-drained mineral soil dominated by improved agricultural grassland. The vegetation is characterized by a high cover of agricultural plant species such as Yorkshire fog (*Holcus lanatus*), white clover (*Trifolium repens*), perennial rye grass (*Lolium perenne),* Timothy (*Phleum pratense*) and ribwort plantain (*Plantago lanceolata*) (see Plate 5.6). These areas are currently grazed by livestock.

Plate 5.6: General view of improved grassland vegetation which dominates the proposed Hydrogen Plant site.

5.3.3.9 *Treelines (WL2)*

At the very western end of the Hydrogen Plant Site, *i.e.* at the access road entrance, there are a number of prominent treelines which enclose small fields/paddocks close to farm buildings. The main tree species is tall sycamore (*Acer pseudoplatanus*) with occasional tall ash (*Fraxinus excelsior*). Smaller tree and shrub species present in the treeline include elder (*Sambucus nigra*), and hawthorn (*Crataegus monogyna*). Common nettle (*Urtica dioica*), hogweed (*Heracleum sphondylium*) and broadleaved dock (*Rumex obtusifolius*) are commonly found along the treeline embankments.

5.3.3.10 Invasive species

During the field surveys, a search for Invasive Alien Plant Species (IAS) listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 – 2021 was conducted.

No species listed on this schedule were recorded during the surveys. The main regulations influencing Ireland's invasive species lists are:

- the Third Schedule list of the European Communities (Birds and Natural Habitats) Regulations 2011 [S.I.477/2011]
- the Invasive Alien Species of Union concern listed under the EU IAS Regulation [1143/2014]

5.3.3.11 Protected flora

No nationally rare or legally protected plant species listed in the 2022 Flora (Protection) Order were recorded from within the survey area.

There are no known previous records of legally protected plant species from within the survey area or from adjoining areas. The closest known site for such a species is the Lough Easky area located approximately 7 kilometres to the east of the Wind Farm Site, which has recent records for the legally protected species bog orchid (*Hammarbya paludosa*) (Conaghan and Fuller, 2005).

In recent years there have been recent discoveries of the protected plant species marsh saxifrage (*Saxifraga hirculus*) and the protected moss species *Paludella squarrosa* in blanket bog flush habitat to the north-east of the Wind Farm Site (National Parks and Wildlife Service personal communication with J. Conaghan, NPWS 2016). These populations lie within the Ox Mountains Special Area of Conservation (code: 002006). These species were not recorded from within the Wind Farm Site, and it is noted that areas of blanket bog flush habitat, to which the species are restricted, are not present.

5.3.3.12 Grid Connection Route corridor description

The route of the proposed Grid Connection between the Firlough Wind Farm Substation and the proposed loop-in grid connection on the Moy–Glenree 110kV overhead line just north of Bunnyconnellan village runs along minor roads which pass through land dominated by improved agricultural grassland (GA1), with smaller areas of recently felled conifer plantation (WD4) and cutover bog (PB4) also occurring. Roadside hedgerows are generally poorly developed along the route (see Plates 5.7 & 5.8) and any hedgerows which do occur

are mostly low-growing, *i.e.* 3 to 6 metres tall. Such low-growing, sporadic hedgerows are typical of the general region. The main tree/shrub species are willow species (*Salix* spp.), hawthorn (*Crataegus monogyna*) and common gorse (*Ulex europaeus*). Most of these hedgerows have been cut back/trimmed in recent years. Other less common tree/shrub species include downy birch (*Betula pubescens*), ash (*Fraxinus excelsior*) and blackthorn (*Prunus spinosa*). Along the road north of Bunnyconnellan village short stretches of taller hedgerow dominated by ash occur (see Plate 5.9), with most of the trees affected by ash dieback disease. Ivy (*Hedera helix*) is often frequent on the larger trees which occur.

Plate 5.7: View of route which runs just west of Firlough showing occasional groups of willow trees along the road. Grassy verges and banks dominated by briars occur along both sides of road.

Plate 5.8: In general, hedgerows are poorly developed along the local roads.

Plate 5.9: View of short stretch of hedge with heavily cut back ash trees, just north of Bunnyconnellan village.

The roadside verges are generally dominated by grassy vegetation with cock's-foot (*Dactylis glomerata*) and Yorkshire fog *(Holcus lanatus*) dominating. Other frequent species in the grassy vegetation include knapweed (*Centaurea nigra*), meadowsweet (*Filipendula ulmaria*), briar *(Rubus fruticosus*), wild angelica *(Angelica sylvestris*), creeping buttercup *(Ranunculus repens*), sweet vernal grass *(Anthoxanthum odoratum*) and common nettle *(Urtica dioica*).

Four main watercourses are crossed: Srafaungal River, Fiddaun Stream, Glenree Stream and Loughnagoire Stream.

5.3.3.13 Interconnector Route corridor description

The route of the interconnector underground cable which connects the Wind Farm Substation to the Hydrogen Plant Substation extends for a distance of 8.2 km and is largely along local roads. The first 2.7 km section from the Wind Farm Substation follows the route of the Grid Connection, while the final 955 m (approx.) utilises the access track into the Hydrogen Plant.

The local roads pass through land dominated by improved agricultural grassland (GA1), wet grassland (GS4), various conifer plantations (WD4) and remnant cutover bog (PB4).

Roadside hedgerows are mostly low-growing, *i.e.* less than 5-6 metres tall, and generally poorly developed. The hedgerows have signs of being regularly trimmed. The main tree/shrub species are *Crataegus monogyna* (hawthorn), *Salix* spp. (willow species) and *Ulex europaeus* (common gorse). Other tree/shrub species present include *Prunus spinosa* (blackthorn), *Fraxinus excelsior* (ash) and *Sambucus nigra* (elder). There are few tree standards, all being ash and with signs of ash dieback disease.

Bramble *(Rubus fruticosus)* is frequent within the base of the hedgerows, along with ivy (*Hedera helix*). The roads are generally edges by grassy verges (similar to as described for the Grid Connection Route).

The route crosses the main channel of the Brusna River.

5.3.3.14 Turbine Delivery Route description

As noted, the two options for the Turbine Delivery Route, from Killybegs Port and Galway Port, to the Wind Farm Site will use existing public roads (details in **Appendix 15.1**). These are mainly national routes, with the final stretches to the Wind Farm Site along local roads.

The portions of the routes where road upgrade works will be required are all within the River Moy Catchment.

The local roads to the Wind Farm are typically bounded by grass verges and ditches/banks, with associated low hedgerows and/or treelines (latter mostly near residences).

5.3.4 Mammals, Amphibians and Reptiles

The Irish hare *Lepus timidus hibernicus* is widespread within the Wind Farm Site and was often seen feeding or resting along the bog tracks. Signs of fox *Vulpes vulpes* were observed at several locations throughout the site. Deer species have a presence in the area, with sightings and feeding marks in the area of the conifer plantations along the western margin of the Wind Farm site. Any deer seen appeared to be fallow deer *Dama dama,* which reflects the known distribution of deer in Ireland (Lysaght & Marnell 2016).

Various widespread occurring small mammal species, including pygmy shrew *Sorex minutus,* field mouse *Apodemus sylvatica* and brown rat *Rattus norvegicus* would be expected within the Wind Farm Site and the Hydrogen Plant Site.

There was no evidence, such as feeding marks or latrines, of badger (*Meles meles)* activity within the Wind Farm Site area or within the site of the Hydrogen Plant. It is noted that peat habitats provide poor habitat for badger as they normally require well drained soils to excavate setts and in Ireland setts are particularly associated with clay banks within hedgerows, native woodland and scrub (Smal 1991).

No signs of otter presence were recorded during the terrestrial ecology field surveys or the aquatic surveys (see **Chapter 6: Aquatic Biodiversity).** It is considered that the watercourses within the Wind Farm Site, namely the Owencam River tributary, the Glenree River tributary and the Gowlan River tributary, are unsuitable for otter *Lutra lutra* due to their small size and limited fisheries or aquatic habitat value. However, downstream of the site these river systems increase in size and habitat diversity and do have potential to support otter.

At the Hydrogen Plant Site, the Dooyeaghny River is in a steep-sided canalised cut approx. 2 m below the surrounding land with a base of width of c.1.5 m and depth of c. 30-40 cm (see **Chapter 6, section 6.3.1.2**). The flow regime is gentle glide with a silty substrate and occasional pockets of gravel. The channel and bank are heavily vegetated and it is expected that stream has the potential to support small numbers of

Brown Trout, Stickleback, Minnow and European Eel in the vicinity of the site. From the N59 road downstream as far as the estuarine reaches at the confluence with the Moy, the river develops some riffle habitat which may offer potential spawning for salmonids. While there was no evidence of otter presence, it is likely that otters associated with the Moy Estuary may at times commute along the river.

The common frog *Rana temporaria* is widespread within the Wind Farm Site, including within bog drains and ponded areas associated with cutting activities. As permanent freshwater ponds are absent from the Wind Farm Site, the site does not provide suitable habitat for the smooth newt *Lissotriton vulgaris*. There is no suitable habitat for amphibian species within the site for the Hydrogen Plant.

The common lizard *Zootoco vivipara* was observed on dry bog and along a bog track on two occasions in August 2021 and in May 2022 – it is likely that this species is distributed throughout the Wind Farm Site. The habitats within the site for the Hydrogen Plant are not suitable for the common lizard.

5.3.5 Bats

5.3.5.1 Desk review results: historical records

The NBDC and Bat Conservation Ireland database were consulted for details on bat records held for the Wind Farm Site and the surrounding 10 km (which includes the Hydrogen Plant and the house and sheds to be demolished). Full details are present in Table 2.2 of **Appendix 5.2.** Five species of bat have been recorded within 10 km of the Wind Farm Site, namely pipistrelle species *Pipistrellus pipistrellus*, soprano pipistrelle *P. pygmaeus*, Leisler's bat *Nyctalus leisleri*, brown long-eared bat *Plecotus auritus*, and Daubenton's bat *Myotis daubentonii*.

The closest historical roost is located 6.5 km from the Wind Farm Site, recorded in 2008. Two soprano pipistrelle bats were observed here. The subject Site sits outside the core substance zone for this roost. Several ad hoc records are also recorded in the surrounds.

5.3.5.2 Bat landscape

The bat landscape association model (Lundy *et al.* 2011) suggests that all turbines are situated within a landscape of low bat importance, with a slight improvement in bat suitability from turbines 1 to 10. One species showed amber suitability (turbines 1 – 10): soprano pipistrelle.

5.3.5.3 Bat activity surveys

During activity surveys at the Wind Farm Site, a total of four species of bats were recorded: Soprano Pipistrelle, Common Pipistrelle, Leisler's bat and Brown Long-eared bat. The most commonly recorded species was Soprano and Common Pipistrelle, followed by Leisler's, with only a single Brown Long-eared bat noted.

5.3.5.4 Bat static detector surveys

The results of the static detector surveys deployed over three rounds (spring, summer and autumn) are summarised in **Table 5.5** below, with full details per season and per species in **Appendix 5.2** (section 3.2.4 Static detector results).

Eight species of bats were recorded on all detectors. Overall eight bat species were recorded (Common Pipistrelle, Soprano Pipistrelle, Nathusius' pipistrelle, Leisler's bat, Brown Long-eared bat, Natterer's bat, Whiskered bat and Daubenton's bat). Where the call could not be identified to species, the identification was determined to the highest level possible. Several registrations were recorded with a peak frequency of 40kHz. These bats will have been either common or Nathusius's Pipistrelle.

Overall, turbine locations within the site showed similar levels of bat activity, with highest bat passes recorded at turbines 1 and 2, at 2.39 and 2.01 bat passes per hour respectively. These turbines located to the south west of the site lie somewhat close to conifer plantation. All other turbines range from 1.66 to 1.0 bat passes per hour.

Table 5.5: Total recordings for all static detectors at Firlough Wind Farm Site for 2021 season.

Common Name	Species	No. of recordings 2021
Brown long-eared bat	*Plecotus auratus*	152
Common pipistrelle	*Pipistrellus pipistrellus*	1825
Daubenton's bat	*Myotis daubentoniid*	9
Leisler's bat	*Nyctalus leisleri*	3284
Nathusius' pipistrelle	*Pipistrellus nathusii*	51
Natterer's bat	*Myotis nattereri*	40
Soprano pipistrelle	*Pipistrellus pygmaeus*	2137
Whiskered bat	*Myotis mystacinus*	6
40 kHz Pipistrelle	-	314
Myotis sp	*Myotis sp*	262
Total registrations		8,080

5.3.5.5 Ecobat

Results from the static detector surveys were analysed using Ecobat (University of Exeter); a software package that standardizes and performs interpretation of bat activity data (Full details in **Appendix 5.2**). It compares static detector data with similar datasets set in similar habitats and ranks activity levels.

In order to ensure quality, all calls not auto identified as Common or Soprano Pipistrelle were manually verified. The data was then entered into Ecobat and a report was subsequently generated. Specifically, a median bat activity level is calculated which corresponds to a bat activity category (**Table 5.6**).

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

BAI (Bat Activity Index) = Total number of bat records / number of hours of record.

The reference range datasets were stratified to include:

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

Table 5.6: Media percentile range and corresponding bat activity.

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

Table 5.7 provides a summary of bat activity from all survey periods combined and bat activity category based on median percentile. No static location was deemed to have a High bat activity (for specific bat species) level based on the Percentile Median value. Highest activity level based on the percentile was from Leisler's bat, with Moderate-High activity.

Table 5.7: Summary showing the number of nights recorded bat activity fell into each activity band for each species across all detectors for all survey periods combined.

Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Median Percentile	Bat Activity Category
Myotis	0	6	37	32	67	24.7	Low to Moderate
Myotis daubentoniid	0	0	0	5	5	19.8	Low
Myotis nattereri	0	0	0	8	24	12.8	Low
Myotis mystacinus	0	0	0	0	2	2	Low
Nyctalus leisleri	74	154	69	44	47	64.2	Moderate to High
Pipistrellus nathusii	5	5	15	22	57	24.0	Low to Moderate
Pipistrellus pipistrellus	28	66	67	45	60	46.7	Moderate
Pipistrellus pygmaeus	47	68	59	36	69	51.8	Moderate
Plecotus auritus	0	2	9	19	69	13.5	Low

5.3.5.6 Roost surveys

Wind Farm Site

Trees were assessed with reference to the Bat Tree Habitat Key (Andrews 2016). No trees with potential for hosting a bat roost is located within any of turbine buffer zones (*i.e.* to 200 m radius). Conifer plantation trees within the buffers have no potential to host bat roosts. In addition, all deciduous trees within the buffer zones were scrubby trees without cavities (the majority are willow) of no potential for bat roosts.

No buildings or built structures suitable for usage by bats was found within 200 m of any turbine location. Potential roost structures outside this zone were also examined. Several derelict sheds, dwellings and bridges were examined in the wider landscape.

During the daylight search no evidence of bats were noted from any of the structures listed in **Table 5.8**. All of these were revisited during night time surveys baring structure 4 and 7 which had no potential and 5. This building was set 130 m off the road too far to observe bat behaviour. The night time surveys did not reveal the presence of bat roosts from these structures or anywhere else.

Table 5.8: Potential roost structures examined during daylight preliminary searches.

No	Lat	Long	Potential level	Distance to closest turbine	Details
1	54.13933	-8.99052	High	660 m W of T4.	Derelict dwelling
2	54.15770	-8.995185	High	1.11 km NW of T6	Derelict house with good bat roosting potential. Treeline to rear.
3	54.13580	-8.991780	Moderate	730 m W of T3	Private occupied farmstead.
4	54.14266	-8.99484	Low	635 m to W of T5	Bridge on road to north of derelict house 1. Constructed of concrete with minimal crevices. No signs of bats.
5	54.15468	-8.99420	Unknown	780 m NW of T6	Private occupied house set off the road. No access possible.
6	54.14350	-8.992074	Medium	440 m W of T5	Low potential bridge / culvert constructed of concrete
7	54.120783	-8.97851516	Low	930 m SW of T1	Nice bridge to south of site. Crevices has been pointed thus minimal potential.

Hydrogen Plant Site

In total, 60 trees were assessed, 25 of which were categories 1 and 2 (*i.e.,* trees having features capable of supporting larger roosts or use by single bats respectively). All category 1 and 2 trees were found close to the western entrance by the road. No trees with potential to host a bat roost was found within the site where the Hydrogen Plant is proposed.

The buildings surveyed, which are found by the western entrance to the site, consist of an occupied dwelling and four sheds. The house and sheds were examined both inside and outside. The dwelling has good potential to host a bat roost with potential entrances into the roof space by gaps in fascia. An internal search of the attic however showed a lot of cobwebs (an indicator that bats are not flying around in the roof space) and no bats. No bat droppings or other evidence of bats were found.

All sheds were also examined. Three sheds had some potential to host a void dwelling bat such as Brown Long-eared where timber sits on timber. No bats were found.

There are no features within the site, which is essentially a grassland field, suitable for use as a roost by bats.

5.3.6 Summary of Ecological Receptors and Conservation Value of Project Area

5.3.6.1 Habitats, vegetation and flora

The Wind Farm Site is dominated by an extensive lowland blanket bog landscape, which has been subject to peat-cutting for decades and this practice continues to the present day. This ongoing peat cutting has lowered the ecological value of the blanket bog habitat and has resulted in the dominance of cutover bog with a relatively species-poor flora, a locally high cover of bare peat and a low cover of Sphagnum mosses. In some cutover areas, however, there has been relatively low levels of recent disturbance from cutting and here extensive re-vegetation by bog species has occurred. In addition to peat cutting there is also some grazing by sheep on site, though the intensity does not appear to be high. The cutover bog on the Site is rated as Local Importance (higher value).

Scattered throughout the site are a number of remnant areas of relatively intact blanket bog, *i.e*. uncut high bog. Although the margins of these remnant bog areas are generally subject to drying out due to peripheral drainage caused by adjoining turf cutting, some of these uncut high bog areas contain wet central zones which support quaking areas with a high Sphagnum cover and bog pools present. Most of these wetter central areas correspond to the priority EU Annex I habitat Blanket bogs (7130). The remnant high bog, which covers an estimated area of 72.5 ha (within Redline Boundary), is rated as County Importance.

In addition to the dominant blanket bog habitats, there are smaller areas of willow scrub, wet grassland and coniferous plantation present, however these cover a relatively small portion of the wind farm site and are rated as Local Importance (lower value). The watercourses on site, which are typical of a peatland dominated landscape, have been assessed in the **Chapter 6: Aquatic Biodiversity**.

The Hydrogen Plant Site is dominated by agricultural improved grassland which at the time of survey was grazed by livestock. Improved grassland is a habitat of low botanical interest - rated as Local Importance (lower value). The treelines (dominated by non-native sycamore) and buildings on site are also rated Local Importance (lower value).

The terrestrial habitats along the routes of the Grid Connection and Interconnector comprise roads edged with grassy verges and intermittent low hedgerows - all rated Local Importance (lower value).

No nationally rare or legally protected plant species listed in the 2022 Flora (Protection) Order were recorded from within the Wind Farm Site and Hydrogen Plant Site during the surveys nor are there any past records of such species from the study area.

5.3.6.2 Terrestrial mammals, amphibians and reptiles

The Wind Farm Site supports a typical mammalian fauna of blanket bog with adjoining conifer plantation.

The Irish hare and all deer species are protected under the Wildlife Acts, as is the pygmy shrew (not recorded but expected within the Project area).

While the watercourses within the Wind Farm Site on site are not considered suitable for otter, the rivers downstream of the site support this species. Also, the Dooyeaghny River, which flows close to the Hydrogen Plant Site, has some potential to support otter. Otter is listed on Annex II of the EU Habitats Directive as amended.

All mammal species recorded within the Project Area, or expected to occur, are listed as 'Least Concern' on the Irish Red List (Marnell *et al*. 2019).

The common frog and the common lizard are protected under the Wildlife Acts, though both are listed as 'Least Concern' on the Irish Red List (King *et al*. 2011).

5.3.6.3 Bats

The bat landscape association model suggests that the Wind Farm Site is situated within a landscape of low bat importance.

During bat activity surveys, a total of four species were recorded: soprano pipistrelle, common pipistrelle, brown long-eared and Leisler's bat.

During static surveys, a total of eight species of bats were recorded: Soprano Pipistrelle, Common Pipistrelle, Leisler's bat, Nathusius's Pipistrelle, Brown Long-eared bat, Natterer's bat, Whiskered bat, and Daubenton's bat. The most commonly recorded species were Leisler's bat, followed by Soprano and Common Pipistrelle, with lower levels from other species.

All bats recorded are classified as 'Least Concern' on the Irish Red List (2019) and protected under the EU Habitats Directive as amended Annex IV and Wildlife Acts as amended.

5.4 ASSESSMENT OF POTENTIAL EFFECTS

5.4.1 The 'Do-Nothing' Impact

Without the proposed Wind Farm proceeding, it is expected that the present main land use on the Wind Farm Site, namely peat cutting, will continue. Any of the remaining areas of uncut high bog could be subject to future turbary.

Without the proposed Hydrogen Plant proceeding, it is expected that the present main land use on Site, namely intensive agriculture, will continue.

Overall, in the absence of the Proposed Development, the ecology of the Wind Farm and Hydrogen Plant Sites would be expected to remain fairly similar as at present.

5.4.2 Potential Impacts on European Conservation Sites

The AA Screening report that accompanies this planning application has shown objectively that for two of the European sites identified (as in **Table 5.3** above) there are no realistic Source-Pathway-Receptor linkages and hence there is no potential for effects on the Qualifying Interests as a result of the Project. These sites are:

- Lough Hoe Bog SAC (code 00633)
- Lough Nabrickleagh Bog SAC (code 00634)

It is considered that these two European sites can be excluded from further assessment. However, in the absence of mitigation, likely or possible significant effects on four of the European sites listed in **Table 5.3** could not be excluded during the construction, operational and/or decommissioning stages of the Project:

- Ox Mountains SAC (code 000365)
- River Moy SAC (code 002315)
- Killala Bay/Moy Estuary SAC (code 000364)
- Killala Bay/Moy Estuary SPA (code 002041)

As it is considered that, in the absence of mitigation, the risk of likely or possible significant effects on these European sites cannot be ruled out, and that there is potential for effects on their Qualifying Interests or Special Conservation Interests as a result of the Project, they are subject to further consideration and an Natura Impact Statement (NIS) has been prepared. Full details on the potential for adverse effects on these four European sites are given in the accompanying NIS. A synopsis of the likely adverse effects, in absence of mitigation, follows:

While the southeast sector of the Wind Farm Site is in proximity to the Ox Mountains SAC (distance of c.270 m between nearest work area and SAC), it is not considered likely that construction works could have hydrological effects on the blanket bog within the SAC.

As noted in **Table 5.3,** a tributary of the Gowlan River rises in the northeast sector of the Wind Farm Site and runs northwards towards the Ox Mountains SAC where if flows for a distance of c.3 km within an area dominated by blanket bog. Should the tributary stream carry contaminants from the Wind Farm Site (in absence of mitigation) during construction, operational and/or decommissioning phases, there is a theoretical possibility that the blanket bog Attribute: 'Ecosystem function: soil nutrients' could be affected adversely were the stream to be in flood and affect the pH and nutrient status of adjoining bog.

It is noted that there is no ecological connectivity between the Ox Mountains SAC and the Hydrogen Plant and Interconnector Route, as well as the Grid Connection Route and the Turbine Delivery Route.

The Wind Farm Site has connectivity with the River Moy SAC as drainage from part of the site is to the Brusna River system. Hydrological connectivity also exists between the River Moy SAC and the Interconnector Route and Grid Connection Route, as well as the Turbine Delivery Route, as tributaries of the Brusna River are crossed by these routes. The Hydrogen Plant Site drains direct to the River Moy Estuary and does not have connectivity with the River Moy SAC.

Potential construction phase effects, and to a lesser extent the operational and decommissioning phase effects, relate to the release of suspended solids/nutrients, cementitious materials and hydrocarbons into the drainage network arising from the works. As the conservation objectives of the identified European site could potentially be affected adversely, measures are required to avoid or reduce harmful effects of the proposed project, *i.e*. mitigation measures.

The Wind Farm Site has connectivity with the Killala Bay / Moy Estuary SAC and the Killala Bay / Moy Estuary SPA as drainage from part of the site is to the Brusna River system, which enters the SAC just north of Ballina town and approximately 2 km upstream of the SPA. The Interconnector Route and the Grid Connection Route, also drain to the Brusna River system. Also, the Hydrogen Plant Site has connectivity with the SAC and SPA as drainage is to the Moy Estuary via the Dooyeaghny River. The Turbine Delivery Route has hydrological connectivity with the SAC and SPA.

Potential construction phase, and to a lesser extent decommissioning phase, effects relate to the release of suspended solids/nutrients, cementitious materials and hydrocarbons into the drainage network arising from the works. As the conservation objectives of the identified European sites could potentially be affected adversely, measures are required to avoid or reduce harmful effects of the proposed project, i.e. *mitigation measures*.

5.4.3 Potential Impacts on National Conservation Sites

5.4.3.1 Natural Heritage Areas

As noted, there are no Natural Heritage Areas (NHAs) within the zone of influence of the Project.

5.4.3.2 Proposed Natural Heritage Areas

There is a total of nine proposed Natural Heritage Areas (pNHAs) within the zone of influence of the Proposed Development (see **Figure 5.2** in Vol III and **Table 5.4**).

Four of the pNHAs are also designated as SACs or SPAs, namely Ox Mountains Bogs, Lough Hoe Bog, Lough Nabrickeagh Bog and Killala Bay/Moy Estuary. Potential impacts on these four sites are referred to in **Section 5.4.2** above and are discussed in detail in the accompanying AA Screening Report and NIS.

Of the remaining five listed pNHA sites, there is no ecological or hydrological connectivity between the Wind Farm Site, Hydrogen Plant Site, the Interconnector Route and the Grid Connection Route and the following four pNHAs:

- Cloonagh Lough pNHA
- Moy Valley pNHA
- Cloongoonagh Bog pNHA
- Dunneil River pNHA

As there is no potential for impacts on these four sites as a result of the Project, further consideration of these sites is not required.

For the Easky River pNHA, hydrological connectivity exists with the Wind Farm Site via the Easkey River system and specifically the Gowlan River tributary. While there is potential for contaminants from the Wind Farm Site to reach the pNHA, it is noted that the channel length between the two locations is considerable (c.13 km). Nevertheless, in the absence of appropriate mitigation, the interests of the pNHA (marsh, fish) could be affected.

5.4.4 Impacts on Habitats, Vegetation and Flora

The construction of the Project will result in the following impacts on terrestrial habitats and flora:

- permanent loss of habitat
- temporary loss of cutover bog
- disturbance to habitats

In addition, some tree removal and tree pruning works will be required along parts of the Turbine Delivery Route(s) to facilitate large transport vehicles.

5.4.4.1 Permanent loss of habitat

The permanent loss of habitat at the Wind Farm Site, *i.e.* habitat which will be replaced by wind farm infrastructure, is estimated at 18.1 ha. This will result from the following:

- Turbines foundations and hardstand areas 11.12 ha
- Wind Farm Substation (inc. potential extension) 2.20 ha
- New roads and road upgrades 2.59 ha
- Construction compound 0.18 ha
- Material storage area 1.99 ha

The on-site substation and the construction compound are situated on conifer plantation and wet grassland respectively, habitats which are widespread throughout the island of Ireland (and non-native in case of conifer plantation). The effect by the loss of these habitats is rated as Not Significant.

The majority of the affected habitat, approximately 15.23 ha, is cutover bog, with 0.49 ha of high bog.

The effect of the loss of 0.49 ha of high bog, which is mostly at T3 and a small amount at T9, is rated as an adverse effect of Moderate Significance, taking into account the relatively small area involved in the context of the frequency of high bog at the site (estimated 72.46 ha). Also, it is noted that all of the high bog areas within the site are remnants which are surrounded by cutover bog and hence subject to marginal drying.

The loss of 15.23 ha of cutover bog, which varies in quality depending on when cutting last occurred, is rated as an adverse effect of Moderate Significance. This loss represents 4.1% of the total area of cutover bog (approx. 368 ha) within the Redline boundary of the Wind Farm Site. The loss of cutover bog will be offset through a Biodiversity Enhancement and Management Plan (BEMP) (see **Section 5.8** and **Appendix 5.4**).

The proposed Hydrogen Plant is located within a field of improved agricultural grassland. As improved grassland is an abundant habitat throughout Ireland and of low ecological interest, the permanent loss of this habitat is rated as Not Significant.

A new entrance and access road from the N59 to the Hydrogen Plant will require breaching of a treeline to the east of the farm yard and the removal of some trees at the entrance. These are mostly sycamore (non-native species), with some ash. The significance of this Adverse effect is rated as Slight and of Permanent Duration. The effect by the loss of an existing dwelling and four sheds is rated as Not Significant.

5.4.4.2 Temporary loss of cutover bog

To facilitate the construction of the Project, there is a requirement to store excavated peat and soil on-site. Three Spoil Deposition Areas have been identified on cutover bog within the Wind Farm Site (see Drawing No. 6129-PL-100), at the following locations:

Turbine T2 (41,566 m^2): this plot has been extensively cut, with an existing peat depth of between 20 cm and 50 cm. The main species are *Calluna vulgaris* and *Molinia caerulea* with frequent *Tricophorum germanicum, Eriophorum angustifolium, Carex panicea* and *Narthecium ossifragum*. Sphagnum cover is generally in the range of 10 to 30% and the eastern half of the area shows more signs of recent peat cutting activity with 5 to 20% bare peat evident.

Turbine T12 (35,780 m^2): this plot is heavily disturbed cutover bog with active cutting taking place. The existing vegetation is generally dominated by *Tricophorum germanicum, Juncus effusus, Molinia caerulea* and the invasive moss *Campylopus introflexus*. Occasional uncut high bog strips occur however they have been dried out by the adjoining cutting. Sphagnum cover is generally less than 10% and bare peat cover is between 20 and 40% in places.

East of turbine T4 (11,961 m^2): this relatively narrow cutover strip has a shallow depth of peat remaining and runs alongside a bog track. There are indications that the area was used as a turf spread-field until relatively recently. The species-poor vegetation is dominated by *Molinia* and *Eriophorum angustifolium,* with frequent *Tricophorum germanicum* and *Narthecium ossifragum* in places. The Sphagnum cover is very low*, i.e.* <10%, with bare peat generally in the range of 10 to 30%.

Assuming all the above will be used for spoil deposition, a total of 8.93 ha of cutover bog will be covered with peat/sub-soil. The proposed depth of the deposited material is 2.0 m at the

T2 and T12 locations and 1.0 m at the T4 location. When complete, the surface will be capped with a peat layer and saved surface vegetation (which had been removed initially prior to the depositing of material) will be spread on the surface to promote the re-establishment of bog vegetation (see details in **Section 5.5.2.3**). With time, a vegetation similar to the adjoining areas of cutover bog is expected to become established.

The effect by this temporary loss of existing cutover bog vegetation at the three deposition areas (as described above) is rated as an Adverse Effect of Slight Significance of Medium-term duration. In the long-term, this effect is likely to become Neutral.

5.4.4.3 Disturbance to habitats

Areas of bog adjoining the infrastructure at the Wind Farm Site will be disturbed by the construction works, including the construction of an on-site drainage system. This will result in areas and strips of bare peat, which would be prone to erosion.

Disturbance to cutover bog adjoining the work sites will result in direct physical disturbance of the bog. As the hydrology of the cutover bog has already been compromised by drainage and cutting, indirect drying effects on adjoining cutover bog as a result of the works is not likely to be a significant issue. The significance of disturbance to adjoining cutover bog is rated as a Slight Adverse effect of Short-term duration.

The construction of turbines T3 and T9 will have physical disturbance effects on adjoining areas of high bog, as well as causing a likely drying effect due to the drawdown of water from the high bog. At T3 location, the area of high bog to the west of the turbine will be truncated and the remaining remnant will be particularly prone to a drying effect. Areas of bog that may become drier would be expected to support more vigorous growth of ling heather *Calluna vulgaris* and less development of bog mosses. The extent of a drying effect would vary according to local conditions but from observations at various blanket bog sites the cut edge drying effect is unlikely to extend more than 10 m into the high bog (personal observations, Dr John Conaghan). It is noted that at Firlough all of the bog remnants are already drier along their perimeters due to the adjoining cutting. The significance of disturbance to adjoining high bog is rated as a Moderate Adverse effect of Medium-term duration.

Mitigation to minimise disturbance of both cutover bog and high bog, and to minimise the potential for peat erosion of bare surfaces, as a result of construction works will be implemented (see **Section 5.5.2.2**).

The laying of the Grid Connection and Interconnector Route cables will cause localised disturbance to marginal vegetation alongside the roads due to trenching works and use of plant machinery. The amount of disturbance would vary depending on the exact line of the trench, but may affect grassy verges and roadside banks or ditches. However, hedging or trees are not expected to be removed to facilitate the works. Generally, there are no habitats of significant ecological interest alongside the roads of the Grid Connection Route or the Interconnector route. After trenching and the works are complete, full recovery of the marginal vegetation is likely to take place within 1-2 years. The effect of disturbance to roadside habitats is rated as Not Significant.

5.4.4.4 Works along Turbine Delivery Route

Some trees along sections of the Turbine Delivery Route options will need to be removed, and pruning back of branches and trimming back of marginal vegetation will be required along both the route options (see details of locations in **Appendix 15.1**).

The effect of the removal of any mature tree is rated as an Adverse effect of Slight Significance. The effect of pruning back of branches is generally Not Significant.

5.4.5 Potential Impacts on terrestrial mammals, amphibians and reptiles

The effect on terrestrial mammal species by the loss and disturbance of cutover bog and some conifer plantation and wet grassland at the Wind Farm Site is considered to be Not significant on the basis that the species involved are all widespread species of the countryside which will still occur within the Redline Boundary of Site as well as in the wider environs.

The local otter populations downstream of the Wind Farm Site, associated with the Brusna, Glenree and Gowlan river systems, could be affected adversely if contaminants generated during the construction phase, such as suspended solids, hydrocarbons and cementitious materials, were to enter the local watercourses and affect the prey items (fish etc.) of the otter. In the absence of mitigation, the effect on the otter population could be Significant. Similarly, otters utilising the Dooyeaghny River could be affected adversely by the construction and operation of the Hydrogen Plant. Mitigation to maintain water quality during the construction and operational phases of the Project will minimise the risk to the otter population.

Construction activity would be expected to cause larger mammals such as deer to remain in cover whilst the works are on-going. However, this will be a localised and temporary effect (and not generally relevant to nocturnal mammal activity) and the effect is considered to be Not significant.

The common frog and common lizard populations would be affected by loss of cutover bog habitat during the construction works and therefore direct impacts on some individuals can be anticipated. Mitigation will be implemented for the common frog to minimise destruction of spawn, tadpoles and adult frogs during construction (see **Section 5.5.4**). Mitigation will also be implemented for the common lizard. As viable breeding populations of these species are expected to remain on the Wind Farm Site, the significance of the effect on amphibian and reptile species within the Wind Farm Site is rated as a Slight Adverse effect.

The effect on terrestrial mammal species by the loss of improved grassland and some trees at the Hydrogen Plant Site due to the Proposed Development is considered to be Not significant on the basis that the site does not support any mammal species of conservation importance and is not suitable for amphibian or reptile species.

5.4.6 Impact on bats

Common, Nathusius's and Soprano Pipistrelle alongside Leisler's bats are high risk species for wind farm collisions (SNH 2019, Fiona Mathews 2015, BCI, 2012) (see **Figure 5.4** below). NIEA (2021) states that peaks of bat activity should be accounted for in addition to median levels to appropriately quantify risk. The report also noted the Leisler's bats, while fairly rare in Britain, are one of the commonest species found in Ireland. However, given their rarity in the rest of the UK, and indeed Europe, the Irish population is considered a global stronghold for the species and therefore we have an international responsibility for its protection.

Table 2: *Level of potential vulnerability of populations of British bat species. (Adapted from Wray et al., 2010)*

Yellow = low population vulnerability

Beige = medium population vulnerability

Red = high population vulnerability

Relative abundance	England	Collision risk		
		Low collision risk	Medium collision risk	High collision risk
	Common species	Brown long eared bat		Common pipistrelle Soprano pipistrelle
	Rarer species	Daubenton's bat Natterer's bat Whiskered bat Brandt's bat Lesser horseshoe	Serotine bat	Nathusius' pipistrelle Noctule bat Leisler's bat
	Rarest species	Alcathoe bat Bechstein's bat Greater horseshoe Grey long eared bat	Barbastelle bat	

Figure 5.4: Level of potential vulnerability of populations of British bats.

5.4.6.1 *Initial site risk assessment*

A risk assessment has been completed with reference to Table 3a and b; bats and onshore wind turbine report (SNH 2021, SNH 2019).

An initial risk assessment is based on an assessment of habitats and the size of the development. Habitat suitability is ranked either low, moderate and high while project size is ranked from small, medium and large. Habitats surrounding the subject turbines for the Proposed Development are ranked as Moderate. The majority of the site consists of open bog with little connective features. However, to the west conifer plantation edge habitat can be found and streams to the east and north.

The project size is ranked as large given proposed turbines are over 100 m in height. The proposed Firlough Wind Farm thus derives an Initial Site Risk Assessment Value of 4; *High site risk*.

5.4.6.2 *Overall risk assessment*

The output from the initial Site risk assessment is used in the below matrix to derive an overall risk assessment based on the activity level of high collision risk species. Common pipistrelle, Soprano pipistrelle and Leisler's bat are considered high collision species.

Site risk level (from Table 3a)	Ecobat activity category (or equivalent justified categorisation)					
	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
Med (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Figure 5.5: Risk assessment matrix (after SNH 2019).

Table 5.9: Summary of overall risk assessment based on activity level of high collision risk species

Turbine No.	Risk Assessment based on Ecobat Results								Is location of static at turbine location?	Bat Habitat within 200 m of turbine	If no mitigation is applied, what is the potential impact level?
	Leisler's bat		Common pipistrelle		Soprano pipistrelle		Nathusius's pipistrelle				
	Maximum Percentile	Median Percentile	Maximum Percentile	Median Percentile	Maximum Percentile	Median Percentile	Maximum Percentile	Median Percentile			
1	**20**	12	20	12	**20**	16	**16**	12	Yes	Yes. Conifers located at 200 m edge	High
2	**20**	16	20	12	**20**	12	**20**	4		Yes. Conifers and stream located at 200 m edge	High
3	**20**	16	20	12	**20**	12	**12**	8		Yes. Conifers and stream located at 200 m edge	High
4	**20**	12	20	12	**20**	12	**8**	4		Yes. Stream located 110 m, conifers at 150 m.	Medium
5	**20**	16	16	12	**20**	12	**12**	4		Yes. Conifers located c. 140 m	High
6	**20**	16	16	12	**20**	12	**8**	4		No. Conifers and stream located just outside 200 m buffer	High
7	**16**	16	20	8	**20**	12	**12**	12		No.	High
8	**20**	16	20	8	**20**	12	**8**	8		No.	High
9	**20**	16	20	8	**20**	12	**12**	8		No.	High
10	**20**	12	20	12	**20**	12	**16**	8		No.	Medium
11	**20**	16	20	12	**20**	16	**16**	4		No.	High
12	**20**	16	20	8	**20**	12	**12**	8		No.	High
13	**20**	16	20	12	**20**	12	**12**	8		Yes. Stream located 85 m.	High

5.4.6.3 Discussion of impacts on bats

Due to the levels of nightly bat activity (with regard to median values as determined by Ecobat analysis) at each of the static locations, turbines 4 and 10 are the only turbines considered medium risk for all at risk bat species. All other turbines, baring turbine 1, are high risk for Leisler's bats. Turbines 1 and 11 are high risk for Soprano Pipistrelle.

As outlined by Scottish Natural Heritage (2021), wind farms can affect bats in the following ways:

- Collision mortality, barotrauma and other injuries
- Loss or damage to commuting and foraging habitat
- Loss of, or damage to roosts
- Displacement of individuals or populations.

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. 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 bats remains the same. We cannot distinguish between these possibilities using acoustic data. However, either way, higher levels of activity around turbines is likely to increase fatality risks and help to explain why fatality rates are often not predicted by acoustic surveys for bat activity conducted prior to facility construction.

5.4.7 Potential Impact on Terrestrial Ecology from Hazardous Materials during Operational Phase of the Hydrogen Plant

Full details of the operation of the Hydrogen Plant are given in **Chapter 2: Project Description**. There will be a relatively large volume of various chemicals stored on the Hydrogen Plant Site, including hydrogen itself but also hydrocarbons and chemicals such as potassium hydroxide (KOH), Sodium bisulphite and glycol.

As with all fuels, the production and handling of hydrogen has an inherent degree of risk. Health and Safety has therefore been a key consideration in design of the hydrogen production facility. Through the adoption of best practice principles, the mitigation of hazards through design, and the following of relevant guidance and regulations, the Hydrogen Plant will be designed and operated to reduce the risk of industrial accidents. It is noted that preparation of a Major Accident Prevention Policy has begun for the Hydrogen Plant Site. **Chapter 16: Major Accidents and Natural Disasters** identifies, classifies and evaluates the risks associated with the operation of the Hydrogen Plant.

The release of the above-mentioned chemicals due to a fire or explosion, or any other major accident or natural disaster, could have significant environmental impacts and cause contamination or impact air quality and potentially local habitats and watercourses.

While sensitive terrestrial ecological receptors have not been identified within the site of the Hydrogen Plant, in the absence of mitigation there is a risk that contaminants released in the event of an industrial accident could enter the local watercourse (Dooyeaghny River) and ultimately the Killala Bay/Moy Estuary SAC and the Killala Bay/Moy Estuary SPA. In such a scenario, some of the Qualifying Interests of the SAC and the Special Conservation Interests of the SPA could be affected adversely. The significance of any effect would be dependent on the concentration and type of pollutant, as well as the magnitude and duration of a pollution event. This potential Significant Adverse effect on European sites is discussed in detail in the accompanying NIS.

Chapter 6: Aquatic Ecology (Section 6.3.1.8), notes that the Dooyeaghny River rises a short distance upstream of the Hydrogen Plant Site and has limited fisheries value in the vicinity of the Hydrogen Plant Site, being rated of local importance higher value. However, in its lower reaches it has some salmonid spawning habitat. Whilst not recorded, otter associated with the Moy Estuary is likely at times to utilise the river and could be affected adversely if contaminants associated with the construction and/or operation of the Hydrogen Plant were to enter the river.

5.4.8 Decommissioning Phase Impacts

A Decommissioning Plan accompanies the EIAR (**Appendix 2.1**). There follows an overview of the decommissioning process.

The Developer is applying for a consent for an operational period of 40 years for the Wind Farm. It is intended that all above ground components and underground cabling (ducting left in-situ) will be removed from the Wind Farm Site as part of the decommissioning of the Firlough Wind Farm. The following elements are included in the decommissioning phase:

- Wind turbines dismantling and removal off the Wind Farm Site
- Underground cabling removal (ducting left in-situ)
- Turbine Foundation backfilling following dismantling and removal of wind turbines (any excavated material, will be re-instated / foundations that protrude above ground level will be backfilled with soil)
- Transport Route Accommodation Works

Prior to wind turbine removal, due consideration will be given to any potential impacts arising from these operations. Potential impacts are likely to be similar to that of the construction phase, to an equal or lesser extent. Some of the potential issues could include:

- Potential disturbance by the presence of cranes, HGVs, and personnel on-site
- Time of year and timescale (to be outside sensitive periods).

Prior to the decommissioning work, a comprehensive plan will be drawn up and submitted to An Bord Pleanála for written agreement. The plan will take account of the findings of the EIAR for the present project and the contemporary best practice at that time, to manage and control the component removal and ground reinstatement.

It is the intention that the Hydrogen Plant will continue operations indefinitely. The source of electricity for the Hydrogen Plant would change upon the decommissioning of the Wind Farm (see **Management Plan 6** in **Appendix 2.1**)

The key targets of the Decommissioning and Restoration Plan are as follows:

- Ensure decommissioning works and activities are completed in accordance with mitigation and best practice approach presented in the accompanying Environmental Impact Assessment Report (EIAR) and associated planning documentation.
- Ensure decommissioning works and activities have minimal impact/disturbance to local landowners and the local community. This will relate to transport, particularly of material off site with noise and dust also impacting on receptors at time of decommissioning to a lesser extent.
- Ensure decommissioning works and activities have minimal impact on the natural environment. Disturbance to habitats will be avoided and the use of existing infrastructure and drainage will ensure silt does not enter waterways.
- Adopt a sustainable approach to decommissioning. This means comparing alternative methods for turbine disassembly and taking the approach with the least impact on the natural environment; and,
- Provide toolbox talks, environmental training and awareness of sensitive receptors and waste management within the Site for all project personnel.

From the perspective of terrestrial ecology, the anticipated potential impacts would be:

- disturbance to cutover bog and high bog at the turbine locations,
- disturbance to breeding birds and protected mammal species which may be on Site at the time,

- potential pollution of local waterways and ultimately the River Moy (designated) system,
- creation of new habitats on Site

5.4.8.1 Disturbance of bog

The cutover bog, and particularly the remaining high bog, on the Wind Farm Site is of significant ecological importance and any disturbance to the bog during the works to dismantle the turbines would be an adverse impact of potential significance. The Decommissioning and Restoration Plan has a target of minimal impact on the natural environment and it is not anticipated that personnel will need to traverse out onto the high bog surface for any reason. The Plan also highlights a target of providing training on sensitive receptors on the Wind Farm Site to all involved personnel.

With work carried out in accordance with the Plan, it is not likely that the Decommissioning works will have adverse effects on the bog habitat on Site.

5.4.8.2 Disturbance of fauna species

Particular care will be taken to ensure that the Decommissioning works do not cause disturbance to animal species occurring on the Wind Farm Site at the time (as well as at the Hydrogen Plant Site should it be dismantled). Pre-construction baseline surveys will be carried out for species identified of conservation importance during the 2020-22 baseline surveys, as well as for further species of importance which may be present at the time of the works. Relevant legislation relating to flora and fauna in force at the time will be strictly adhered to.

Mitigation measures described in the present report to avoid or minimise disturbance to protected fauna species will be implemented as necessary.

With the above approach followed, it is not likely that the Decommissioning works will cause significance disturbance to fauna species associated with the Wind Farm Site or the Hydrogen Plant Site.

5.4.8.3 Maintenance of water quality

The issue of potential impacts on hydrology is reviewed in **Chapter 9: Hydrology and Hydrogeology (Section 9.4.7)**. The assessment notes the following:

There will not be a requirement for additional drainage measures to be implemented during the Decommissioning phase and with the passage of time, the Wind Farm Site is expected to revert to a more natural drainage regime. All anticipated impacts are similar in nature to those already highlighted during the Construction Phase of the Project, *i.e.* release of hydrocarbons, waste water / sanitation and suspended soils through the excavation of material in order to remove cabling from joint bay locations. The works to be completed during the Decommissioning phase are likely to be an imperceptible to slight, neutral, permanent impact on the hydrological and hydrogeological setting surrounding the Site.

On this basis, it is likely that the Decommissioning works will not result in adverse effects on local watercourses.

5.4.8.4 Creation of new habitat

The Plan specifies that the turbine hard stands will be allowed to naturally revegetate. At the time of Decommissioning, parts of the hardcore surface will likely already support a sparse flora of annual and perennial species (this is normal to see at operational wind farms after a few years and indeed often attracts sheep to graze the tender shoots). The amount of vegetation that will eventually colonise will depend on the chemical character of the gravel surface, *e.g.* a calcareous substrate would support a higher diversity of plants than an acidic substrate. Such recolonising surfaces, which retain warmth in sunshine compared to surrounding areas of bog, tend to attract insects (butterflies *etc*.) as well as passerine bird species such as skylark and various finches, with the birds feeding on seeds from plants. The habitat that would be expected to develop is likely to fall into a mosaic of semi-natural grassland (GS) and artificial stone surfaces (BL3).

The natural re-vegetation of the above-mentioned surfaces is rated as a Positive effect of Moderate significance.

5.5 MITIGATION MEASURES

5.5.1 Designated sites

The present report has identified likely pathways between the area of the Project and four European sites (both also pNHAs) and one proposed Natural Heritage Area. The pathways are via the local drainage system and particularly the Gowlan River, the Glenree/Brusna River system and the Dooyeaghny River.

In the absence of mitigation, there is a risk that contaminants generated on the Wind Farm Site and Hydrogen Plant Site during the construction, operation and decommissioning phases

could enter local watercourses and ultimately flow to the designated sites where there could be resultant adverse effects on water quality and aquatic life and relevant qualifying interests within the sites. Mitigation is therefore required to minimise this risk (see **Section 5.5.2** for mitigation for a major hazard event).

The mitigation proposed to maintain water quality in the drainage channels and watercourses which drain the area of the Project are detailed in **Chapter 6: Aquatic Biodiversity** and **Chapter 9: Hydrology and Hydrogeology**. The mitigation measures which are required to ensure that there are no adverse effects on the Conservation Objectives of the four European Sites are also contained within the accompanying NIS. The implementation of mitigation through avoidance principles, pollution control measures, surface water drainage measures and other preventative measures have been incorporated into the project design in order to minimise potential significant adverse impacts on water quality at the Wind Farm Site and Hydrogen Plant Site .

Within the Wind Farm Site all turbine locations and associated infrastructure have a buffer zone of at least 50 m from natural streams, with a 20 m buffer to significant drains. No works will take place within these buffer zones except for the three watercourse crossings on the access track network. Within the Hydrogen Plant Site, the Site is located c.70 m from the Dooyeaghny River at its closest point with the exception of the drainage outfall on the river. Implementation of such buffer zones will result in the avoidance of sensitive hydrological features. Direct discharges to surface waters of dewatered loads will not be permitted under any circumstances. This in turn will avoid or reduce the potential for adverse impacts on downstream designated sites.

All of the mitigation measures described in **Chapter 6** and **Chapter 9** are contained in the Construction and Environmental Management Plan (CEMP) (appended to the EIAR in **Appendix 2.1**). The CEMP provides a contractual commitment to mitigation and monitoring, and reduces the risk of pollution whilst improving the sustainable management of resources. The environmental commitments of the Proposed Development will be managed through the CEMP and will be secured in contract documentation and arrangements for construction and later phases, such that there will be a robust mechanism in place for their implementation. The CEMP addresses the construction phase, and will be continued through to the commissioning, operation and final decommissioning phases.

It is noted that an Ecological Clerk of Works (ECoW) with experience in overseeing wind farm construction projects will be appointed by the Contractor for the duration of the

construction phase to ensure that the CEMP is effectively implemented and that all planning conditions relating to biodiversity are complied with. An Environmental Manager will be appointed by the Developer to oversee the environmental management of the project, advise on the environmental issues and ensure compliance by the Contractor.

With such mitigation in place and rigorously enforced, it can be concluded that there would not be any significant effects on the qualifying interests of the identified designated sites as a result of the Project.

5.5.2 Mitigation for Major Hazard Event

Health and Safety protocols for the safe storage and handling of chemicals at the Wind Farm Site and the Hydrogen Plant Site are outlined in **Chapter 2 (Section 2.6.6.2**). While there is a considerably larger risk associated with the Hydrogen Plant Site than with the Wind Farm Site, both components have been assessed in terms of potential environmental effects.

Chapter 16 (Section 16.2.3.2) identifies, classifies and evaluates the risk associated with a major hazard event. It is noted that a risk management programme, ATEX Assessment and Safety Management System will be in place for the Project, and an Emergency Response Plan will be produced for the Hydrogen Plant Site

Given the higher risk posed at the Hydrogen Plant Site, a Quantitative Risk Assessment and Major Accidents Prevention Policy has been formed as part of the application. A person is required to be onsite of the Hydrogen Plant 24/7. Further on-site Quantitative Risk Assessments (QRA) will be prepared as the Hydrogen Plant progresses towards construction, into and during operations. **Chapter 16** of EIAR outlines the potential major accidents arising from the project and how they are mitigated for. The Major Accidents Prevention Policy stipulates the protocols to be followed to lower the risk of such an event occurring. HAZID workshops will aim to foresee hazards and implement. Emergency Response plans are discussed in detail in the Major Accidents Prevention Policy for the Hydrogen Plant.

All liquid chemicals will be stored in a bunded area on the Hydrogen Plant Site and will be subject to requirements of the Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001 to 2021 (as amended) and compliance with the requirements of REACH, *i.e.,* European Communities Regulation 1907/2006 for the Regulation, Evaluation, Authorisation and Restriction of Chemicals. Chemicals will be managed in accordance with

European Chemicals Agency's Guidance for Downstream Users (2014). Final selection of bulk chemicals will be subject to an assessment of trace elements to ensure that they are within acceptable limits. Storage of large volumes of oils and other hazardous substances will have a secondary containment such as a bund to prevent hydrocarbon contamination to land/water. Waste oils and other chemicals, including oil rags/wipes will be disposed of as hazardous waste. Operational staff will receive training on the handling, containment, use, and disposal requirements for all potentially polluting products on the Hydrogen Plant Site.

Chemicals accidentally introduced to the environment will be intercepted by drainage and surface water networks associated at the Hydrogen Plant Site. Storm water systems will include oil water interceptors. In line storage throughout wastewater treatment process will facilitate buffering flow and discharge rates. This includes a wastewater storage tank, sized c.1500 m^3 which will achieve the ability to stop discharging completely. If firewater run-off cannot be treated on site to reach acceptable levels it will be pumped out and tankered off-site to a licenced disposal facility.

While storage of chemicals on the Wind Farm Site will be limited to minor quantities of hazardous materials used for maintenance purposes, these will be housed in the site compound within a secure bunded COSSH store for the operational phase of the project.

The implementation of mitigation through design, avoidance principles, choice of best alternatives for location of works, pollution control measures, surface water drainage measures and other preventative measures have been incorporated into the project design in order to minimise potential significant adverse effects on major accidents and disasters at the Wind Farm Site and especially the Hydrogen Plant Site.

The Quantitative Risk Assessment concluded that the Hydrogen Plant location is acceptable. The Preliminary Hazard Analysis reports includes safety requirements as mitigation for each hazard identified. This mitigation, along with implementation of the Major Accident Prevention Policy (MAPP), means that the Significance of the environmental impact arising from the vulnerability of the Hydrogen Plant to Major Accidents and Natural Disasters has been assessed as an Imperceptible, long-term effect.

5.5.3 Mitigation for Habitats

5.5.3.1 Habitat loss

As habitat loss cannot be mitigated, the loss of bog at the Wind Farm Site will be offset through a Biodiversity Enhancement and Management Plan (BEMP). The BEMP is outlined in **Section 5.8** and is presented in full in **Appendix 5.4**.

5.5.3.2 Mitigation to minimise disturbance of bog and promote re-vegetation

As described in **Section 5.4.4.3,** the construction works will inevitably cause disturbance to bog habitats around the turbine and hardstand work areas, as an area will be needed by the Contractor to facilitate the works. To minimise disturbance to the bog and to ensure good recovery, as well as to minimise areas of bare peat which would be prone to erosion, the following programme will be adhered to during the construction phase.

Restricted access to bog

At the commencement of works, for each of the turbine locations the required work footprint on the bog will be identified and the area will be marked by a rope fence (using wooden poles) and with appropriate signage. No construction activities will be allowed outside of the agreed work area for the duration of the construction period. The ECoW will inspect the site regularly whilst works are on-going. Excavated peat and subsoil will be removed to the approved deposition area(s), with no storage of peat or any other materials on the adjoining bog areas. The rope fences will remain in place until the works are fully complete.

The above is of especial importance at the sites of turbines T3 and T9, which impact areas of high bog, as well as at T1, T10 and T13 which adjoin or are very close to areas of high bog.

Protection of high bog

The work areas at turbines T3 and T9 will impact areas of high bog. To minimise disturbance from plant machinery, bog mats will be used over the surface where tracking is likely to take place. The use of bog mats is a proven (yet simple) technique that is highly efficient in reducing the impact on the bog surface.

Re-vegetation of bare surfaces at work areas

An ecological objective is to minimise the area of exposed peat surface and to encourage rapid re-vegetation of disturbed bog surfaces. This will be achieved by the removal of the vegetated bog surface within the work footprint, the storage of this material, and subsequent re-use around the turbine and hardstand margins.

First, suitable areas within the site will be identified where the removed material can be stored for the duration of the works or until needed – it is noted that such areas will not be on other vegetated bog surfaces but rather areas of bare or sparsely vegetated peat. Also, it is important that the selected storage areas will not be prone to disturbance for the duration of the required storage period.

Two approaches will then be used to 'save' the surface vegetated material. Where practical, the surface will be cut-out as sods or 'turves' to a depth of approximately 20-30 cm using a dumper/digger with a bucket. Care will be taken to keep the turves as intact as possible and the vegetated side upwards (though this is not always possible). The turves will be loaded to a trailer and transported to the pre-identified storage area. The turves will be off-loaded from the trailer and placed side by side and vegetation side upwards. They will be placed in single layers*, i.e*. not piled on top of each other.

Alternatively, where the cutting out of turves will not be practical due to shallow peat or an undulating surface from past turbary, the surface vegetated areas will be scrapped off and removed to storage areas where piles will be formed until ready to re-use when works are complete. Such material will contain root and rhizome material, as well as a seed bank.

Should storage of the above materials be for prolonged periods (months), the stored turves and peat piles will need to be watered during dry spells.

When ready for placement at the finished turbine/hardstand, the turves or peat piles will be lifted with a dumper and bucket and taken to the destination. Here they will be off-loaded and placed side by side on the disturbed bog surface with vegetation side up. The turves will be bedded in with the bucket of a dumper so that they form a continuous layer without gaps between them. This approach will provide almost immediate cover of the bare surfaces. Alternatively, the surface peat material from the stored peat piles will be spread over the bare surfaces.

All of the above processes will be monitored by the ECoW.

5.5.3.3 Mitigation to promote re-vegetation of Spoil Deposition Areas

As described in **Section 5.4.4.2**, there is a requirement to store excavated peat and subsoil on-site, with three Spoil Deposition Areas identified on cutover bog amounting to 8.93 ha. With the following mitigation, cutover bog vegetation similar to that originally at the proposed deposition areas will be re-established when the deposition works are complete.

The process of re-vegetation will essentially be the same as described in **Section 5.5.2.2** above, with surface turves cut out, or surface vegetation scrapped off, and then stored until needed. It is noted that when filling the deposition areas to the allowed depth, the uppermost 50 cm (at the least) should be pure peat and not include subsoil. The saved material will then be spread across the surface using a wide track machine for access. Where used, turves will be bedded in using the bucket of the dumper.

5.5.3.4 Tree removal along Turbine Delivery Route

Any trees removed along the Turbine Delivery Route will be replaced by similar trees at the various impact locations. It is noted that ash trees removed will be replaced with another native species, preferably oak, due to the prevalence of ash dieback disease throughout the country.

5.5.4 Otter

While the watercourses within the site are not suitable for otter, downstream of the site the main rivers are likely to support otter populations. Such populations could be affected adversely by pollutants entering the watercourses, including the Dooyeaghny River which drains the site for the Hydrogen Plant, as a result of activities associated with the project.

The mitigation proposed to maintain water quality in the aquatic zones (as detailed in **Chapter 6: Aquatic Biodiversity** and **Chapter 9: Hydrology and Hydrogeology**, and summarised in the CEMP) will ensure that the food supplies for otters within local watercourses are not affected by contaminants generated by the Proposed Development.

5.5.5 Common frog and common lizard

The common frog is widespread on the Wind Farm Site occurring throughout the cutover bog. Areas where construction works are due to commence during the period February to August will be checked by the ECoW for the presence of frog spawn, tadpoles and adult frogs. If present, these will be removed under licence from NPWS and transferred to suitable ponds, drains or wetlands in the vicinity and away from the construction footprint.

During the walk-over survey for presence of the common frog, any common lizards observed will be removed from the work area and placed on bog elsewhere within the site.

5.5.6 Bats

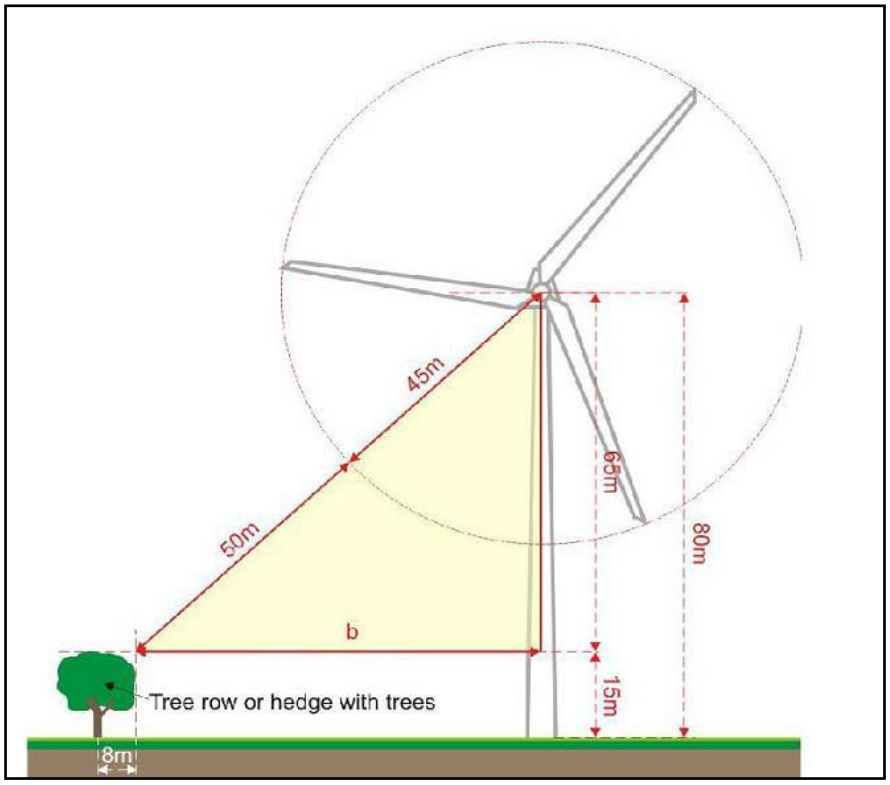
5.5.6.1 Construction phase mitigation

5.5.6.1.1 Buffer

Bats typically use woodland edge habitats for commuting and feeding purposes. Areas of conifer plantation surrounding the immediate vicinity of the proposed turbines should be

felled in order to discourage bat species from flying close to turbines. Various publications provide guidelines on buffer zones surrounding turbines to reduce the favourability of the site for bat activity. Eurobats 'Guidelines for consideration of bats in wind farm projects' (Rodrigues *et al*. 2015) recommend buffer zones of 200 m from turbine base to high potential features whilst Natural England Bats (England 2014) recommend 50 m buffers from blade tip to tree. NIEA (2021) recommends a minimum buffer of 100 m between the turbines at the edge of commercial forestry where wind farms are proposed to be key-holed.

The following formula will be used to calculate the required felling buffer for turbines for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



$$b = \sqrt{\{(50 + bl)^2 - (hh - fh)^2\}}$$

where: b = the distance on the ground
between the edge of the canopy and the turbine (m)
bl = blade length (m)
hh = hub height (m)
fh = feature height (m)

$$b = \sqrt{\{(50 + 77.5)^2 - (110.5 - 25)^2\}}$$

$$b = 94.6 \text{ m}$$

The proposed wind turbines have the following dimensions:

- Hub Height ranging from 110.5 to 102.5 m
- Rotor diameter ranging from 155 to 149 m
- Tip Height ranging from 185 to 179 m

All turbines are located a minimum of 140 m from conifer plantation edge. At this distance a buffer of 85 m from blade tip to forestry edge is achieved at all locations, adequately surpassing the typical 50 m buffer. The only other shrub plants found within this buffer zone surrounding the proposed turbine locations are small stands of gorse or willow. These will be removed prior to the powering up of the turbines.

5.5.6.1.2 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 and Hydrogen Plant Site will take place during the hours of daylight where possible 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 Environmental Manager/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.

5.5.6.1.3 Retention of trees

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.

5.5.6.2 Operation phase mitigation

This section refers to ongoing mitigation for bats once turbines are operational. Two methods are proven to reduce bat fatalities; feathering (reduced rotation speed when turbines are idling) and curtailment (keeping turbines turned off when conditions are suitable for bat activity).

No impacts have been identified for bats during operation of Hydrogen Plant and thus no mitigation measure are prescribed.

5.5.6.2.1 Feathering of blades

Turbines should operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed. This is usually 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 feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (NIEA, 2021), (SNH, Bats and Onshore Wind Turbines – Survey, Assessment and Mitigation., 2021), (Wellig S.D., 2018), (Rydell J., 2010), (Arnett, 2011) and (Baerwald, 2009).

As such, the feathering of blades to prevent 'idling' during low wind speeds will be implemented for all turbines.

5.5.6.2.2 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.

Increased cut-in speeds will be implemented from commencement of operation on all turbines baring T4 and T10. Cut-in speeds restrictions will be operated according to specific weather conditions:

- Cut-in speeds will be increased during the bat activity season (01st of April to 30th October) where temperatures are optimal for bat activity (above 11 degrees) and where wind speeds are at or below 5 m/s from 30 minutes prior to sunset to 30 minutes after sunrise (Betts, 2020).

Due to the considerable unnecessary down time resulting from the proposed "blanket curtailment" (above) and the advances in smart curtailment a focused curtailment regime should be an option available to the developer from year two of operation.

Smart curtailment focuses on times and dates, corresponding with periods when the highest level of bat activity occurs within the site. Such a system involves the use of 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 at individual turbines.

Post-constructions 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)

With the above mitigation implemented in full, the risk of bat fatalities on site will be minimised.

5.6 CUMULATIVE IMPACTS

There are ten wind farms within a 20 km radius of the Proposed Development (see **Table 5.10** and **Figure 2.3 in Vol III**), comprising a total of 66 turbines. The Carrowleagh Wind Farm and Carrowleagh Extension Wind Farm occur immediately to the east and north-east respectively of the Firlough site. Also, to the north are the Cloonkeelaun and Stockane Wind Farms. The other wind farm projects are located at distances between 1.3 km and 12.6 km from the Firlough site. The Firlough project will add a further 13 turbines to the total of 65 turbines in the 20 km review zone.

An inventory of permitted projects within the vicinity of the site for the Firlough Wind Farm and Hydrogen Plant has been compiled (see **Appendix 2.3, Chapter 2**). There projects received planning permission between 2015 and 2022. Most of the projects are domestic scale developments or agricultural related developments and no potential pathways

between their locations and the Wind Farm or Hydrogen Plant sites are identified. Potentially relevant projects which have received planning permission are:

Planning Ref. Sligo 16422 granted on 11/07/2017 for a Grid Connection Route from permitted wind farm at Tawnamoe, Sligo to the Sligo/Mayo county boundary on County Road L-2604-39. Consists of a 20kV connection cable over 10.4 km, including 2.52 km overhead line

All of the wind farm and other projects have been rigorously assessed by the competent authorities for environmental and ecological effects and where such effects are identified, mitigation has been incorporated into the planning.

However, based on the locations of the other wind farms, other than Killala Community Wind Farm, Lackan Wind Farm, and Kingsmountain 2, it appears that all are built mostly on peatland habitats. As the construction of such projects would have caused loss and disturbance of peatland habitats, the proposed wind farm project at Firlough will contribute to further loss of cutover bog habitat.

At the actual site of the Wind Farm, past and ongoing turbary activity has reduced the original area of intact blanket bog to a small proportion of what was once present. Turbary continues at the site and it is likely that further intact high bog will be cut into the future. As the proposed Wind Farm has almost entirely avoided the area of intact high bog (apart from approx. 0.48 ha), the contribution by the project to an expected net loss of intact high bog is minimal.

Table 5.10: Wind Farms within 20 km of the Proposed Development at Firlough.

Planning Ref.	Location (Townland)	No. of Turbines	Distance from the Proposed Development
17/93 11/379	Black Lough Wind Farm	6	1.3 km north-east
06/3861	Carrowleagh Wind Farm	13	Adjacent wind farm
10235 15466	Carrowleagh Wind Farm Extension	4	Adjacent wind farm
08/617	Bunnyconnellan Wind Farm	12	3.6 km South

Planning Ref.	Location (Townland)	No. of Turbines	Distance from the Proposed Development
04/1010	Ounagh	3	7.5 km to the south-east
97/469 (10)	Kingsmountain Wind Farm	10	12 km north-east
03/619	The Dunneill Wind Farm	13	12 km north-east
02/816	Lacken Wind Farm	3	12.6 km north-west
22/161	Stokane Wind Turbine	1	1.09 km north
22/176	Bunnyconnellan East Turbine	1	3.5 km south

5.7 RESIDUAL EFFECTS OF THE PROPOSED DEVELOPMENT

The strict mitigation measures which will be enforced to maintain water quality in local drains and watercourses during the Construction, Operational and Decommissioning phases of the Project (as described in detail in **Chapter 6: Aquatic Ecology** & **Chapter 9: Hydrology and Hydrogeology**) will ensure that there will be no significant residual effects on water quality or aquatic habitats or species, including otter.

As potential effects on designated sites (both European and National) as a result of the Project would arise from contaminants carried within watercourses, it follows that there will be no likely significant effects on identified designated sites with hydrological connectivity with the Project Site.

While the project will result in the loss of an estimated 0.49 ha of relatively intact high bog, an adverse effect rated as of Moderate Significance, and the loss of 15.23 of cutover bog, an adverse effect also rated as of Moderate Significance, the loss of bog will be off-set by the implementation of the Biodiversity Enhancement and Management Plan which will preserve and enhance an area of 10.6 ha of blanket bog.

With mitigation measures implemented in full to minimise disturbance to high bog and cutover bog adjoining the work areas, the significance of the disturbance effect can be reduced from a Moderate effect to a Slight effect of medium-term duration.

With mitigation measures as presented implemented in full, it is considered that the significance of the predicted impact on terrestrial mammal species and amphibian and reptile species as a result of the Proposed Development will be Not Significant.

Following extensive surveys within and surrounding the site for the Wind Farm and the Hydrogen Plant, it is considered that the landscape in which the proposed wind farm is situated is of high suitability for Leisler's bat and moderate suitability for Common, Soprano and Nathusius Pipistrelle. With the implementation of the mitigation outlined above the potential risk of fatality from collision and/or barotrauma events to foraging and/or commuting high risk species such as pipistrelle and Leisler have been significantly reduced, it is concluded that the Proposed Development will not have any long-term adverse effects on the local bat populations.

5.8 BIODIVERSITY ENHANCEMENT

The Biodiversity and Enhancement Management Plan is presented in **Appendix 5.4**. The Plan will preserve and enhance an area of blanket bog habitat (10.6 ha), which has been partly cutover in the past. This will provide compensation to off-set the loss of cutover bog (approx. 15.23 ha) required to facilitate the Wind Farm.

The objectives of the Plan are as follows:

Objectives - primary

To preserve and rehabilitate an area of lowland blanket bog which has been partly cutover and drained in the past to compensate for the loss of cutover bog as a result of the proposed wind farm.

Objectives - secondary

To provide enhanced habitat for peatland associated species such as red grouse, meadow pipit (both Red-listed), skylark, the common frog and the common lizard, which may be affected by the loss of some cutover bog habitat as a result of the proposed project.

The objectives for the Plan are achievable as similar work has been carried out successfully at other bog sites throughout Ireland. The Plan is underwritten by a detailed monitoring programme, which will allow modifications to ensure that the objectives are being achieved.

5.9 PRE-CONSTRUCTION AND CONSTRUCTION PHASE MONITORING

5.9.1 Pre-construction bat surveys

If two years lapse from between the planning-stage baseline surveys and installation of the wind turbines, it will be necessary to repeat one full season of surveys during the activity period (EUROBATS, 2014). Future survey work will be completed according to best practice guidelines available (NatureScot 2021, NIEA 2021) and will include static detector, activity and roost inspection surveys.

At the site for the Hydrogen Plant, pre-construction surveys will require the climbing of trees ranked categories 1 and 2 (see **Appendix 5.3**) and the examination of potential roost features using torch and endoscope. In addition, a night-time detector survey will be conducted on sheds with potential to host a brown long-eared bat roost.

Pre-construction bat roost surveys will be required on any tree which will need to be removed along the selected Turbine Delivery Route, as well as on major branches that may need to be cut back. Trees identified with potential for bat roosts will require the climbing of trees ranked categories 1 and 2 (see **Appendix 5.3**) and the examination of potential roost features using torch and endoscope.

5.9.2 Pre-construction badger survey

If three years lapse from between the planning-stage surveys and commencement of construction works, including tree-felling, it will be necessary to carry out a survey for badger in areas of potential suitable habitat which will be disturbed by the works as the local distribution of badger may have changed in that period. In the case of the Firlough wind farm project, such potential suitable habitat is largely the conifer plantation along the western boundary of the Wind Farm Site.

It is noted that should the pre-construction survey indicate a requirement for protection of the relevant species (in this case badger), appropriate measures will be taken to comply with all relevant legislation and best practice guidance in force at the time.

5.9.3 On-going monitoring during construction

An Ecological Clerk of Works (ECoW) will be employed by the Contractor for the duration of the construction phase and will ensure that all mitigation measures relating to terrestrial ecology described in this report and contained within the planning permission are implemented.

5.10 POST-CONSTRUCTION MONITORING

5.10.1 Habitats

Post-construction habitat monitoring will focus on the following:

- Selected areas of the cutover bog which had been disturbed by construction activities;
- One of the larger Spoil Deposition Areas (at T2 or T12);
- The Biodiversity and Enhancement Management Plan area.

When all ground works are complete within the Wind Farm Site, a vegetation survey will take place by an ecologist. This will describe the state of the vegetation in the various selected areas (as above) where disturbance has occurred. A series of monitoring quadrats will be established to accurately describe the vegetation, including proportion of bare peat, at the time (Year 1) and in subsequent years. Details will be worked out by the ecologist but it is likely that quadrats will be 2 m x 2 m in size and will be geo-referenced and photographed.

Vegetation recovery will be monitored over a period as follows: Years 1, 2, 3, 5, 10, 15, 20, 25.

Reports will be prepared for each year of monitoring and issued to the relevant planning authority.

5.10.2 Bat monitoring

As mentioned in **Section 5.5.5.2.2** above, static acoustic and bat collision 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.

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).

5.10.2.1 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 low then consent will be sought from Mayo 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 year (spring, summer and autumn).

Acoustic monitoring will be supplemented with thermal imaging cameras *etc.* to provide more detailed information on bat activity in the vicinity of turbines.

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.

5.10.2.2 Buffer zones

The vegetation-free buffer zones (refer to above) around the identified turbines will be managed and maintained during the operational life of the Proposed Development 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). This should be achieved through physical management of developing scrub but without the use of toxic substances.

5.10.2.3 Bat fatality monitoring

Whilst no significant residual impacts on bats are likely, the Proposed Development will provide an opportunity to gain baseline data on bat/turbine interaction and hence the Project will be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 10, 15, 20, 25 and 30 as part of the additional curtailment monitoring schedule. A comprehensive onsite fatality monitoring programme will be undertaken following published best practice (*e.g.* SNH 2021 or equivalent at the time of operation).

The primary components of the bat mortality programme are outlined below, and an assessment of bat mortality would 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.

b) Turbine searches for fatalities will be undertaken following best practice in terms of search area (minimum radius hub height) 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.

A summary of the required monitoring schedule for the bat mitigation measures is presented in the table below.

Table 5.11. Monitoring schedule for bat mitigation measures.

Mitigation measure	Monitoring required	Description	Duration
Bat activity survey	Static placement at turbines	3 years of static monitoring at turbine locations in conjunction with placement of weather station. Assessment of bat activity compared with 2021 baseline survey	1, 2, 3 (and years 5, 7, 10, 15, 20, 25 and 30 should activity levels stay the same or increase)
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 and 25 post construction.

5.11 SUMMARY OF SIGNIFICANT EFFECTS

With the implementation of mitigation through avoidance principles, pollution control measures, surface water drainage measures and other preventative measures which have been incorporated into the project design, and construction and operational phases, in order to minimise potential significant adverse impacts on water quality within the zone of influence of the Project, it can be concluded that the Project will not adversely affect the integrity of any European or National designated site.

From the perspective of terrestrial habitats, the principal significant effect (rated as of Moderate Significance) as a result of the Project is the loss of 0.48 ha of intact high bog (from a total of 72.46 ha on site) and 15.23 ha of cutover bog habitat (from a total of 368 ha on site) – the significance of these losses can be reduced by the implementation of the Biodiversity and Enhancement Management Plan.

With mitigation measures as presented implemented in full, including preservation of water quality in local watercourses used by otter, it is considered that the significance of the predicted impact on terrestrial mammal species and amphibian and reptile species, as a result of the Project will be Not Significant.

Following detailed surveys for bats within and surrounding the Wind Farm and Hydrogen Plant Sites, it is considered that the Proposed Development will not have a significant long term negative effect on the local bat populations in the area.

5.12 REFERENCES AND BIBLIOGRAPHY

Andrews, H. (2016) *Bat Tree Habitat Key* (3rd Edition). AEcol, Bridgewater.

BCI. (2010) Bats and Lighting. Guidance Notes for Planners, Engineers, Architects and Developers. Noticenature.

BCI. (2012) Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8. Bat Conservation Ireland.

BCT. (2018) Bats and artificial lighting in the UK. Guidance Note 08/18. ILP.

European Commission (2013) Interpretation Manual of European Union Habitats EUR28

CIEEM (2022) *Guidelines for Ecological Impact Assessment: Terrestrial, Freshwater, Coastal and Marine.* Version 1.2. Chartered Institute of Ecology and Environmental Management

Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn.). The Bat Conservation Trust, London.

Conaghan, J. and Fuller, J. (2005). *A survey of rare/threatened and scarce vascular plants in County Sligo*. Report to National Parks and Wildlife Service, Dublin.

Curtis, T.G.F. & McGough, H.N. (1988) *The Irish Red Data Book. 1 Vascular Plants*. Stationary Office, Dublin.

EC (2007) *Interpretation Manual of European Union Habitats.* Version EUR 27. European Commission, DG Environment.

EPA (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports.* Published by the Environmental Protection Agency, Johnstown Castle Estate, Co. Wexford, Ireland.

Fossitt, J. A. (2000). *A Guide to Habitats in Ireland.* Dublin: The Heritage Council.

Hayden, T. & Harrington, R. (2000) *Exploring Irish Mammals*. Town House, Dublin.

Marnell, F., Looney, D. & Lawton, C. (2019) *Ireland Red List No. 12: Terrestrial Mammals,* National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland.

Mathews, F.M. (2013) Effectiveness of search dogs compared with human observers in locating bat carcasses at wind turbine sites: a blinded randomized trial. *Wildlife Society Bulletin* 37: 34-40.

NPWS (2019). The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

NPWS Online map for protected bryophytes, http://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=71f8df33693f48edbb70369d7fb26b7e Online, Accessed: November 2021.

NPWS Protected Site Synopses and maps available on http://www.npws.ie/en/ProtectedSites/. Last accessed May 2023.

NRA (2005) Guidelines for the Treatment of Bats prior to the Construction of National Road Schemes. Environmental Series on Construction Impacts, Transport Infrastructure Ireland - TII (formerly NRA), Dublin. Available at: https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Bats-during-the-Construction-of-National-Road-Schemes.pdf

NRA (2006) Guidelines for the Treatment of Badger Prior to the Construction of National Road Schemes. Dublin: Transport Infrastructure Ireland.

NRA (2008) Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes. Dublin: Transport Infrastructure Ireland.

NRA (2009a) *Guidelines for Assessment of Ecological Impacts of National Road Schemes*. Dublin: Transport Infrastructure Ireland.

NRA (2009b) *Ecological Surveying Techniques for Protected Flora and Fauna during the planning of National Road Schemes.* Dublin: Transport Infrastructure Ireland.

Preston, C., Pearman D. and Dines. T. (2002). *New Atlas of the British and Irish Flora*. Oxford University Press.

Rodrigues, L., Bach, L., Dubourg-Savage, M., Karapandza, B., Kovac, D., Kervyn, T. & Mindermann, J. (2015) Guidelines for consideration of bats in wind farm projects. Revision 2014. EUROBATS.

Smal, C.M. (1991) The National Badger Survey: preliminary results for the Irish Republic. In: Hayden, T.J. (ed.) *The Badger*. Pp. 9-22. Royal Irish Academy, Dublin.

Smith, A.J.E. (2004). *The Moss Flora of Britain and Ireland* (2nd edition). Cambridge University Press.

Stace, C. (2010). *New Flora of the British Isles* (3rd edition). Cambridge University Press.

Wellig, S.D. (2018) Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. PLOS ONE, 13.

Whilde, A. (1993) *Irish Red Data Book 2: Vertebrates*. HMSO, Belfast.

Wyse Jackson, M., Fitzpatrick, U., Cole, E., Jebb, M., McFerran, D., Sheehy-Skeffington, & Wright, M. (2016). *Ireland Red List No. 10: Vascular Plants*. NPWS, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs. Dublin.