5 BIODIVERSITY

5.1 INTRODUCTION

This chapter has been prepared by Biosphere Environmental Services, on behalf of Inchamore Wind DAC, to accompany a planning application for the Development. This EIAR assesses the Project as a whole, including all relevant ancillary and subsidiary elements that are not part of the Development, and all direct and indirect effects, and cumulative impacts and interactions.

This chapter assesses the impacts of Inchamore Wind Farm (the Development) (as shown in **Figure 1.2**) on Terrestrial Ecology (namely habitats, flora, mammals and Kerry Slug). The Development refers to all elements of the application for the construction, operation and decommissioning of the proposed Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** 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 list for habitats encountered within the redline boundary of the Site for the proposed wind farm at Inchamore
- **Appendix 5.2** Plant species list for habitats encountered along forest tracks within the grid connection route
- **Appendix 5.3** Bat Report: proposed wind farm development at Inchamore, Co. Cork. Bat Eco Services, 2023
- **Appendix 5.4** Inchamore Wind Farm: Kerry Slug Survey. Prepared by Wetlands Survey Ireland, September 2021
- **Appendix 5.5** Proposed Wind Farm Development at Inchamore, Co, Cork: Habitat Enhancement Plan. Prepared by BioSphere Environmental Services, 2023.
- **Appendix 5.6** Gortyrahilly and Inchamore Wind Farms, Bat Survey 2019/2020 Report. Prepared by Fehily Timoney Consulting Engineers

A Construction and Environmental Management Plan (CEMP) for the Project is appended to the EIAR in **Appendix 2.1**. This document is a key construction contract document, which will ensure that all mitigation measures, which are considered necessary to protect the environment, are implemented. For the purpose of this application, a summary of all the mitigation measures for the proposed wind farm project is included in **Appendix 17.1**.

5.1.1 Details of the Proposed Development

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

5.1.2 Purpose of the Report

The purpose of the 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 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 compensation, enhancement or post-construction monitoring requirements.

5.1.3 Project Team

The following personnel have been involved in the terrestrial ecology assessment for the proposed Inchamore Wind Farm project.

Dr Brian Madden BA (Mod.), Ph.D, MCIEEM 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. Brian has been operating as a consultant ecologist since the 1990s and has worked on a broad range of projects in all counties on the island of Ireland. Dr Madden is the lead author of this chapter and he also carried out habitat and mammal surveys at the proposed wind farm development site.

Dr John Conaghan BSc., PhD, MCIEEM is an experienced plant ecologist who has worked as a consultant ecologist in Ireland since 1994. He is a specialist in the survey and assessment of wetland vegetation and habitats with bogs and fens his main area of expertise. These surveys and assessments have contributed towards Environmental

Impact Assessments of a range of wind farm, power line, road, and gas pipeline developments. John carried out the habitat and flora surveys for the project.

Dr Patrick Crushell BSc MSc PhD MCIEEM CEcol holds an honours degree in Applied Ecology from UCC, a Masters degree in Environmental Resource Management from UCD and a PhD on peatland ecology from Wageningen University, the Netherlands. Patrick carried out the surveys for Kerry Slug for the project.

Dr Tina Aughney holds a BSc in Environmental Science and a PhD degree from NUI Galway and has been working as a bat specialist since 2000. Tina carried out bat surveys at the proposed Inchamore Wind Farm in 2022 and prepared the bat impact assessment for the project.

Dr Jonathon Dunn (Fehily Timoney Consultants) – conducted bat static detector surveys in 2019/2020, Jonathon is an ecologist with over seven years' experience in the environmental sector and holds a BA (Hons) in Natural Sciences (Zoology) from the University of Cambridge, an MSc in Ecology, Evolution and Conservation from Imperial College London and a PhD in Avian Ecology from Newcastle University.

5.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

5.2.1 Chapter Structure

In line with the EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022), the structure of this Biodiversity chapter is as follows:

- Assessment Methodology and Significance Criteria.
- Description of baseline conditions within the Project area.
- Identification and assessment of impacts on biodiversity associated with the Project, during the construction, operational and decommissioning phases.
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual effects of the Project considering mitigation measures.
- Identification and assessment of cumulative impacts if and where applicable.

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
- The Birds Directive (Council Directive 2009/147/EC on the conservation of wild birds) 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 proposed Project, this chapter was prepared in accordance with 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

The principal study area for habitats and flora, terrestrial mammals and Kerry Slug was the actual Site for the proposed wind farm at Inchamore (as shown in **Figure 1.1**). This was considered adequate as the site does not adjoin any designated area or habitat of particular conservation value. However, the study area was extended to a distance of approximately 2 km from the wind farm boundary for the checking of potential bat roosts.

The study area also included the route for the underground grid connection (see **Figure 1.2**). This extends for a distance of approximately 19.9 km from the proposed 38 kV substation at Inchamore Wind Farm to the existing 220 kV GIS substation at Ballyvouskill. For the turbine delivery route, an assessment was made of locations where physical works are required to facilitate the passing of the vehicles (see **Figure 2.6**).

For habitats and flora species, the main study area is all land within the Redline boundary. 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 Project area 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 turbine and associated 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 any proposed crossing points of watercourses considered suitable to support otter (after NRA 2008 & NRA 2009b), including the margins of the watercourse to a distance of 10 m width.

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).

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 Project. The ZoI 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 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 Development, as well as the Grid Connection Route to Ballyvouskill substation and the Turbine Delivery Route.

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 birds and 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 more depending on connectivity.

5.2.5 Baseline Data Collection

5.2.5.1 Desk Study

Habitats, flora and terrestrial mammals

A comprehensive desktop review was carried out to identify features of ecological importance within the study area. This included a review of sites designated for nature conservation (European & National) as shown on NPWS website (see www.npws.ie/protected-sites) and protected species datasets held by the National Biodiversity Data Centre (see http://maps.biodiversityireland.ie).

Bats

The following sources of data on bats were accessed:

Bat Conservation Ireland Database

Bat Conservation Ireland acts as the central depository for bat records for the Republic of Ireland. The bat database is comprised of >60,000 bat records. A 1 km and 10 km radius search was requested for the Irish Grid Reference W1403878722 (central point of wind farm site) in February 2023.

Bat Conservation Ireland Landscape Favourability

Bat Conservation Ireland produced a landscape conservation guide for Irish bat species using their database of species records collated during the 2000 – 2009 survey seasons. An analysis of the habitat and landscape associations of all bat species deemed resident in Ireland was undertaken and reported in Lundy *et al*. 2011. The geographical area suitable for individual species was used to identify the core favourable areas of each species. This was produced as a GIS layer for local authorities and planners in order to provide a guide to the consideration of bat conservation. The island is divided into 5 km squares and the landscape favourability of each 5 km square for each species of bat was modelled. This model was used as part of the desktop study for this report.

Previous Survey Data for Inchamore Site

A full season bat survey was previously completed in 2019 and 2020 by Fehily Timoney. This report was in reference to Inchamore and a second proposed development site at Gortyrahilly, Co. Cork. The full report in included in **Appendix 5.6**.

Kerry Slug

The occurrence of the site for the proposed wind farm within the known range of Kerry Slug (*Geomalacus maculosus*) together with the presence of suitable habitat throughout the site suggested the likely presence of the species.

The Kerry Slug is protected by the Wildlife (Amendment) Act 2000. It is listed under Annex II of the Habitats Directive and seven Special Areas of Conservation (SACs) have been designated for the species with a combined total area of approximately 95,337 hectares. The Kerry Slug is also listed in Annex IV of the Habitats Directive and as such is strictly protected from injury, or disturbance / damage to their breeding or resting place wherever it occurs.

A review of data held by the National Biodiversity Data Centre (September 2021) confirms that the species has previously been reported from the 10 km square that the site intersects

(W17). The proposed wind farm is not located within any site designated for nature conservation. The nearest site designated for the protection of Kerry Slug is the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (NPWS Site Code: 0365).

Based on the habitats recorded during the ecological assessment of the proposed wind farm, the following potentially suitable habitats have been identified:

- wet heath / blanket bog and rock outcrop habitat present throughout much of the site.

Marsh Fritillary

Results from the habitat and flora assessment indicate that the site does not support habitat suitable for Marsh Fritillary (an Annex II listed species), i.e. damp meadows with substantial coverage (at least 25%) of *Succissa pratensis.*

5.2.5.2 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 27th October 2022 – see **Appendix 1.1** in **Chapter 1**)
- BirdWatch Ireland (no response received)
- An Taisce (no response received)
- Irish Peatland Conservation Council (no response received)

5.2.5.3 Field Surveys

Habitats, vegetation and flora

The site of the proposed wind farm at Inchamore was visited and a walkover survey was conducted over two days, *i.e.,* 7th July 2020 and 10th June 2021. Further survey was carried out on 20th December 2022 to review the locations of turbines in areas of heath and bog. The field survey was mainly concentrated in areas in which it is proposed to site wind farm infrastructure.

The route of the grid connection cable was surveyed in January 2022. This comprised a survey by car, with stops at intervals to review habitats and flora present alongside the roads and tracks. The route passes through open countryside before entering the existing substation at Ballyvouskill – this area was walked to record habitats and flora.

Habitats within the study area were classified after '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 input to a GIS and are shown in **Figure 5.1** accompanying this report. Where relevant, linkages with the EU Habitats Directive classification system are given.

During the site survey 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).

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

Terrestrial Mammals

Terrestrial mammal species were detected by direct observations and by search for signs, such as tracks or feeding signs during the multi-disciplinary walkover survey on 10th and 11th June 2021.

The approach to the badger *Meles meles* survey was developed using NRA (2009b) '*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road* Scheme', Transport Infrastructure Ireland. The extents of the development site was walked and checked for badger signs. Badger signs include setts, latrines, snuffle holes, prints, paths and tree scratching. Within the commercial plantations. search for badger signs was restricted to the margins of the forest stands and any accessible tracks or firebreaks through the plantations. Physical access through the interior of dense closed conifer plantation was not feasible. While conifer plantation on bog or heath provides poor habitat for badger, the areas which could not be surveyed, i.e. interior of closed canopy stands, will be assessed at time of tree felling - should such survey indicate a requirement for protection of badger, mitigation will be provided to comply with all relevant legislation (see **Section 5.6.3**).

Bat Field Surveys

Daytime Inspections

Building & structure inspection

A number of buildings on and surrounding the Site were assessed for potential bat usage. Evidence of bat usage is in the form of actual bats or their signs. Inspections are undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope). These structures were also assessed to determine their suitability as a bat roost and described using the parameters Negligible, Low, Medium or High suitability according to Collins (2016). Daytime inspections were completed on numerous dates in 2022.

Tree potential bat roost (PBRs) inspection

Deciduous trees located adjacent to buildings within the survey area were inspected (21/12/2022) to determine if they provide a roosting space for bats using the Bat Tree Habitat Key (BTHK, 2018) and the classification system adapted from Collins (2016). The Potential Roost Features (PRFs) listed in BTHK (2018) were used to determine the PBR value of trees. Evidence of bat usage is in the form of actual bats or their signs. A Phase 1 inspection was undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) during the daytime searching for PRFs, if visible.

Bat Detector Surveys

Dusk bat surveys – walking and driving transects

Dusk Surveys were completed from 10 minutes before sunset to 110 minutes post sunset. These dusk surveys were primarily completed by walking transects within the Development area along tracks and conifer plantation edges.

- Dusk Survey on 21/7/2022 from 21:30 hrs to 23:20 hrs;
- Dusk Survey on 28/8/2022 from 21:20 hrs to 23:10 hrs.

Walking transects involved the surveyor(s) walking in survey area along tracks and safe accessible points, noting the time, location and bat species encountered. Mapping of bat encounters was undertaken using QGIS and an excel file produced for mapping purposes (ITM Irish grid reference co-ordinates).

Driving transects were undertaken for large survey areas and were completed along large tracks and local road network in the greater area around the proposed development site (after Aughney et al. 2018).

Walking and Driving transects were undertaken to gather information on local bat populations within and adjacent to the proposed development area. Walking and Driving transects were undertaken on the following dates:

- Driving transect on 21/7/2022 from 22:00hrs to 00:00 hrs;
- Walking transect on 21/7/2022 from 23:20 hrs to 01:30 hrs;
- Walking transect on 29/8/2022 from 21:20 hrs to 02:00 hrs;
- Walking transect on 19/9/2022 from 20:30 hrs to 01:00 hrs.

All bat encounters were noted during surveys.

The following equipment was used: Anabat Walkabout Full Spectrum Bat Detector, Petersson D200 Heterodyne Bat Detector & Bat Logger M2 Full Spectrum Bat Detector and Petersson D200 Heterodyne Bat Detector.

Static bat detector survey

Static bat detectors were deployed at each turbine location to record bat calls (echolocation). The data collected were analysed using Kaleidoscope Pro. Version 2.1.0. These data were prepared for EcoBat Tool analysis.

Static Surveillance was undertaken in 2022. The location of static units was determined by the proposed location of turbines. The following static unit models were deployed during this static bat detector surveys. Additional static units were deployed to survey habitats in September in order to gather additional information as recommended by SNH, 2021 (i.e. paired habitat surveys).

Table 5.1: Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM4 Units 1-8	Wildlife Acoustics SongMeter 4 Bat FS	Full Spectrum	SMM-U2, 4 m cable
SM Mini Bat Units 1-12	Wildlife Acoustics SongMeter Mini Bat	Full Spectrum	SMM-U2

Note: ultrasonic microphone were annually checked to ensure that their sensitivity was accurate for static surveillance.

Summary Statistics, Mapping & Analysis

Summary statistics of data collated from static surveillance, walking and driven transects and dusk and dawn surveys were completed. All data collected was collated into excel files for each bat species in order to produce distribution maps.

In addition, the nightly number of bat passes recorded per species on the statics units were analysed using the website based tool Ecobat (http://www.ecobat.org.uk/).

Bat habitats & Bat activity analysis

All static recording locations sampled are also classed according to their favourability as a bat habitat within 200 m radius of the static location. Four classifications are used:

- Open – for example, open peat bog. Typically, there is little tall vegetation in this category which is generally required for bat species to forage and commute along (exception to this is Leisler's bats). This category would be considered to have a low potential for the majority of bat species.
- Edge – for example, hedgerows, treelines and woodland edge. Bat species such as *Pipistrellus* species have a preference to fly along linear habitat features. This category would be considered to have a high potential for the majority of bat species.
- Closed – for example woodland. Bat species such a brown long-eared bats have a preference to foraging within woodland habitats. This category would be considered to have a high potential for the majority of bat species.
- Water – while an open habitat, due to the insect resource associated with water, these habitat types are often favoured by foraging bats, especially Daubenton's bat.

Habitats deemed by the author, under guidance of Roche *et al.* (2014) and Lundy *et al.* (2011), as "Bat Habitat" are as follows:

- Mixed broad leaved woodland;
- Water bodies;
- Linear habitat;
- Bog Woodland;
- Mosaic;
- Scrub, and
- Conifer plantation.

Additional QGIS layers were created to aid analysis for this report. Each bat encounter was mapped and bat encounters within 1 km of the proposed turbine locations was extracted to represent the bat encounters of the principal proposed development area. As bats

echolocation calls can be detected some distance from where the actual bat is flying, a 50 m fly zone was created around each bat encounter to represent the general area that individual bat recorded could be located at that point in time. This was named the ***"Buffered Bat Encounters"*** and represents the potential distance that bat echolocation calls can be detected by an ultrasonic microphone (*i.e.,* bat detector zone).

5.2.5.3.1 Core Sustenance Areas

Bat Conservation Trust (BCT) defines Core Sustenance Zones (CSZs) for different bat species and this is based on an extensive literature review (www.bats.org.uk). A CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. With reference to development, the CSZ could be used to indicate:

- The area surrounding a communal roost within which development work may impact the commuting and foraging habitat of bats using that roost.
- The area within which it may be necessary to ensure no net reduction in the quality and availability of foraging habitat for the colony.

Amphibians and reptiles

Incidental sightings of amphibians, namely the common frog *Rana temporaria* and smooth newt *Lisstriton vulgaris,* were recorded during the survey. Habitats within the study area were evaluated for their potential to support breeding amphibians. Suitable breeding habitat include areas of still freshwater such as pond, drainage ditches and wetlands.

Sightings of reptiles, namely the common lizard *Zootoca vivipara*, were noted during the surveys. Habitats within the study area were evaluated for their potential to support the common lizard. Suitable breeding habitat include bog and heath with exposed rock.

Kerry slug

The approach to surveying Kerry slug at the proposed wind farm was live refuge trapping as recommended for use by McDonnell *et al.* (2013) supplemented by targeted diurnal hand searches during site visits. The live refuge trapping method is favoured over other techniques because it enables quantitative sampling (McDonnell and Gormley 2011a, b). In addition, it removes the requirement of undertaking searches during wet weather (in the case of diurnal searches as the species is usually only active in daytime during damp weather), and the health and safety risks associated with nocturnal searches (when species is most active) in remote locations. The metric trap method involves the following:

- The metric traps (0.25 m^2), manufactured by De Sangosse (Pont du Casse, France), are made up of absorbent material covered with a reflective upper surface and a black perforated plastic on the underside. They are wetted in advance of being laid out and are baited with Carrot. Traps are secured to rock outcrops (outcrop metric traps) or on surface vegetation (in the case of heath) using stones, tent pegs, or nails as appropriate. They can also be wrapped around tree trunks (banded metric traps) when undertaking surveys at wooded sites (not relevant to current survey as the target habitat at the current site is wet heath / blanket bog and rock outcrops). Traps are checked weekly for a period of up to six weeks. If required, traps are re-wetted during site visits using a watering can.

In addition to checking the metric traps, incidental observations of Kerry Slug were recorded during each site visit following hand searches amongst suitable habitat. A summary of the dates, methods, and weather conditions of each site visit undertaken are presented in **Table 5.2**.

Table 5.2: Kerry Slug assessment: Survey effort at Inchamore

Date	Site	Survey	Weather
23/07/2020	Inchamore	Hand searches and set traps	Light rain, wet conditions on site.
30/07/2020	Inchamore	Hand searches and check traps	Light persistent rain. Mild and calm.
13/08/2020	Inchamore	Hand searches and check traps	Light rain. Warm
20/08/2020	Inchamore	Hand searches and remove traps	Heavy showers, bouts of strong wind.

After an initial site walkover, the occurrence of suitable Kerry Slug habitat was identified and seven metric traps (see **Plate 5.1**) were deployed amongst wet heath and outcropping rock. The traps were deployed on the 23rd of July 2020 in areas of suitably identified habitats for Kerry slug and subsequently checked on three separate occasions with at least a weekly interval before being removed four weeks later. The location of each trap is summarised in **Table 5.3** and illustrated in **Figure 5.2** below.

Plate 5.1: Slug trap on rock outcrop.

Table 5.3: Trap locations and habitats at Inchamore

Trap	Location (ITM)	Habitat
Trap 1	512468, 578335	Rock outcrop (ER1) in wet heath (HH3) adjacent to a stone wall.
Trap 2	5124181, 578354	Rock outcrop (ER1) in wet heath (HH3) adjacent to a stone wall.
Trap 3	512460, 578537	Rock outcrop (ER1) in wet heath (HH3)
Trap 4	512405, 578583	Rock outcrop (ER1) in wet heath (HH3)
Trap 5	512406, 578594	Halved on wet heath (HH3) and rock outcrop (ER1)
Trap 6	512331, 578672	Halved on wet heath (HH3) and rock outcrop (ER1)
Trap 7	512482, 578615	Rock outcrop (ER1) in wet heath (HH3)

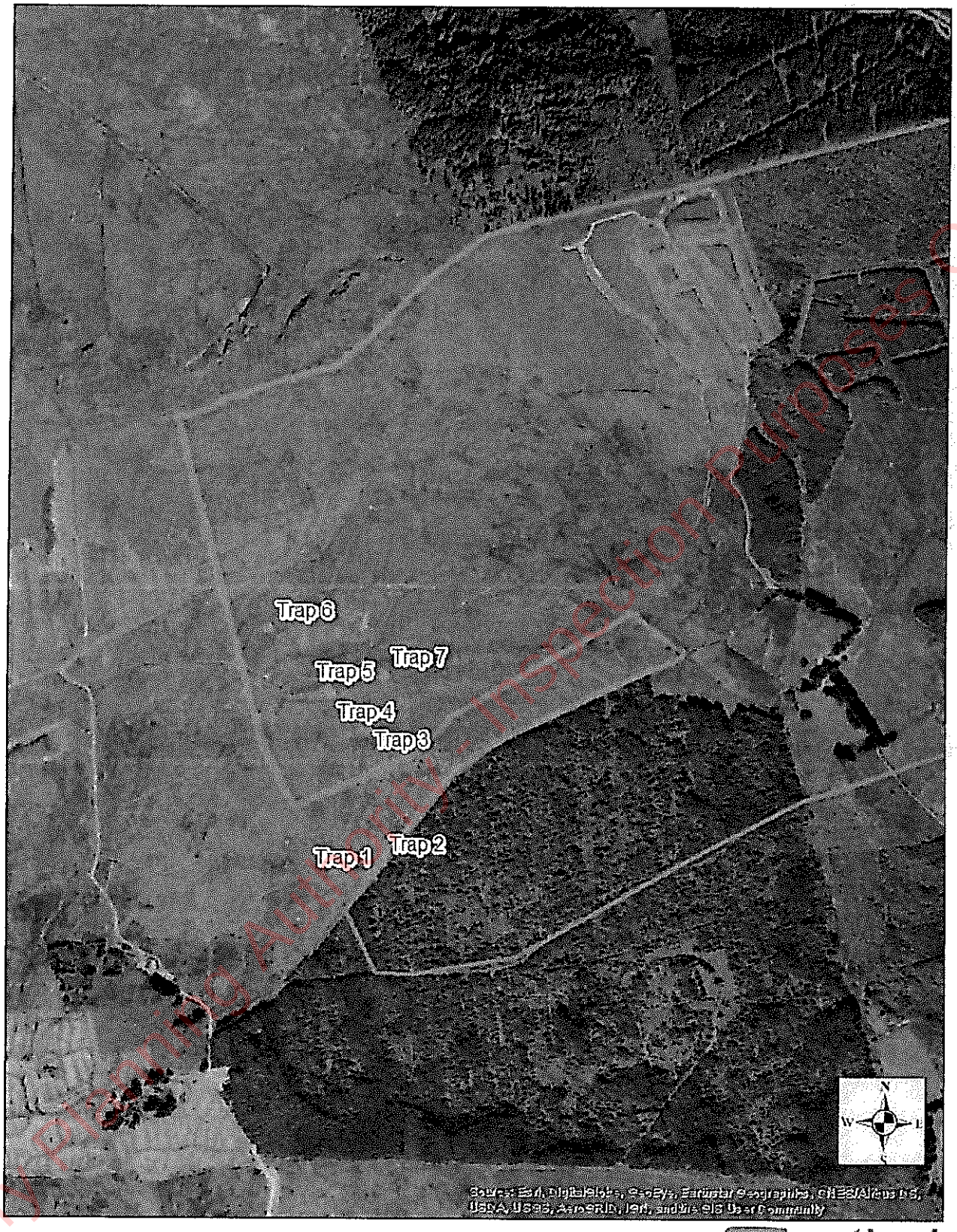

Figure 5.2: Slug trap locations at Inchamore.

5.3 ASSESSMENT APPROACH

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

5.3.1 Important Ecological Features

Ecological features 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.

5.3.1.1 Determining Importance

The importance of an ecological feature 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:

The following frame of reference has been used in this case:

- International and European;
- National (Ireland);
- County (County Cork), and
- Local (lower value / higher value).

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

The value of habitats has been measured against published selection criteria where available. Examples of relevant criteria include: descriptions of habitats listed on Annex 1 of the Habitats Directive, etc.

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); Irish Red Lists, *e.g.* Ireland Red List No. 3: Terrestrial Mammals, Marnell *et al.* (2019).

For the purposes of this report ecological features of Local importance or greater, and/or subject to legal protection, have been subject to detailed assessment. Effects on other ecological features are considered unlikely to be significant in legal or policy terms.

5.3.2 Impact Assessment

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:

- 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 occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or feature, e.g., the creation of roads which cause hydrological changes, which, in the absence of mitigation, could lead to the drying out of wet grassland. Example to be changed to one more specific to the project, if required.

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.

5.3.3 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.

Table 5.4: Criteria for determining the Significance of Effects, based on EPA Guidelines (2022)

Effect Magnitude	Definition
No change	No discernible change in the ecology of the affected feature.
Imperceptible effect	An effect capable of measurement but without noticeable consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight effect	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate effect	An effect that alters the character of the environment that is consistent with existing and emerging trends.
Significant effect	An effect which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound effect	An effect which obliterates sensitive characteristics.

5.3.4 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.

5.3.5 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 CIEEM 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.

5.4 BASELINE ECOLOGICAL CONDITIONS

5.4.1 Physical and General Ecological Description of Site

The proposed wind farm Development is situated on the border of Counties Cork and Kerry and is approximately 5.9 km west of Ballyvourney. The lands are within the townlands of Inchamore, Mileeny, Derryreag and Derreenaling.

The proposed Development is located within the Derrynasaggart Mountains and situated within a landscape dominated by agricultural land (mainly used for stock grazing), commercial forestry and bog and heath of varying quality. There are a number of established wind farms in the region, including Coomagearlahy Wind Farm (c.2.7 km), Coolknoohil Kilgarvan Wind Farm (4.4 km), Glanlee Wind Farm (4.9 km) and Grousemount Wind Farm (7.5 km) (all southwest of the Site).

The altitude of the site ranges from approximately 300 m to 460 m AOD, with the local peak of Knockbwee at 461 m AOD. The mapped geological formation underlying the site is classified as the Gun Point Formation (DUGNPT), which is comprised of Green-grey sandstone and Purple siltstone (see Chapter 8 for details). The primary soil type across the site is blanket peat, with some outcropping bedrock. Peat depth is generally shallow though localised pockets of deeper peat (> 2 m) occur in places.

The topography of the site varies, ranging from mostly gently to occasional steep inclinations. The site for the proposed Development is located within the Lee, Cork Harbour and Youghal Bay catchment. The site lies entirely within the Inchamore Stream sub-catchment where five tributaries flow into the Bardinch River, which then joins the Sullane River, a tributary of the Lee. All surface water drainage from the Site eventually combine in Carrigdrohid Reservoir, from which waters eventually flow to Cork Harbour. The Site itself is characterised by a relatively extensive network of non-mapped natural and artificial drainage channels. The natural streams within the Site are small 1st order tributaries which have high gradients and do not provide suitable habitat for fish or larger aquatic organisms. The Water Framework Directive status (2013-2018) for the mapped surface water body / river (Sullane_010) directly draining the Site is classified as 'Good'.

The Grid Connection Route runs in an east to north-easterly direction from the Inchamore site to the existing Ballyvouskill 220kV substation. Much of the drainage along the route corridor is to the Clydagh River.

Ecologically, the site for the proposed wind farm can be described as being dominated by conifer plantation (WD4 of Fossitt 2000). The unplanted area of the site is mostly wet heath (HH3), with areas of upland blanket bog (PB2) and cutover bog (PB4). Other habitats represented within the Site are dry siliceous heath (HH1), exposed siliceous rock (ER1) and eroding/upland rivers (FW1). The grid connection route is almost entirely along forest tracks.

5.4.2 Sites Designated for Nature Conservation

The potential for the Development 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 and EU Birds Directive respectively and are collectively known as 'European Sites' or 'Natura 2000' sites. The potential for significant effects on the integrity of European Sites is fully assessed in the AA Screening Report and Natura Impact Statement 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".*

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 report.

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 development site have been considered and are shown in **Figures 5-3 and 5-4** 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, especially where ecological and/or hydrological connectivity exists.

Information on the identified sites according to the site-specific conservation objectives is provided in **Tables 5.5** and **5.6.**

No part of the study site is within an area with a nature conservation designation or is adjacent to an area with such a designation.

European designated sites

A total of 13 European sites are identified where consideration is given for the potential of the proposed project to impact on their qualifying interests and/or Special Conservation Interests. These sites are listed in **Table 5.5** along with the reasons for designation, the distance from the proposed wind farm site and whether any linkages or connectivity exist between the two locations. The designated sites are mapped in **Figure 5.3a and b.**

The European sites are considered in detail in the AA Screening Report / NIS which accompanies this application.

National designated sites

A series of three Natural Heritage Area (NHAs) occur within a 15 km radius of the site (see **Figure 5.4** and **Table 5.6**). The nearest designated Natural Heritage Area to the Inchamore wind site is Sillahertane Bog NHA, which is approximately 5.5 km to the southwest.

Proposed designated sites

A series of proposed Natural Heritage Areas (pNHAs) occur within a 15 km radius of the Inchamore site (see **Figure 5.6** and **Table 5.6**).

Table 5.5 Relevant European sites, reasons for designation, distances from Inchamore site and summary of ecological connectivity.

Note that in the following, the use of the term 'Project' includes the grid connection route and turbine delivery route.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	SPECIAL AREAS OF CONSERVATION	
Killarney National Park, Macgillycuddy's Reeks & Caragh River Catchment SAC (site code 000365)	Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3110] Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoeto-Nanojuncetea* [3130] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion vegetation* [3260] Northern Atlantic wet heaths with *Erica tetralix* [4010] European dry heaths [4030] Alpine and Boreal heaths [4060] *Juniperus communis* formations on heaths or calcareous grasslands [5130] Calaminarian grasslands of the *Violetalia calaminariae* [6130] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [6410] Blanket bogs (* if active bog) [7130] Depressions on peat substrates of the *Rhynchosporion* [7150] 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] *Taxus baccata* woods of the British Isles [91J0] *Geomalacus maculosus* (Kerry Slug) [1024] *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] *Euphydryas aurinia* (Marsh Fritillary) [1065] *Petromyzon marinus* (Sea Lamprey) [1095] *Lampetra planeri* (Brook Lamprey) [1096] *Lampetra fluviatilis* (River Lamprey) [1099]	The Site at Inchamore is approximately 1.4 km south of the Caragh River component of the SAC. The closest point to the Turbine Delivery Route (along the access road from the N22 entrance) is 1.62 km south east of the SAC. The Site entrance/closest point of the TDR is located 1.75 km south east to the SAC. There are no ecological or hydrological linkages between the Project and the SAC. The location of the Development from the SAC is greater than the normal distance that foraging lesser horse-shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost. The majority of the grid connection route is located along the route of

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Salmo salar (Salmon) [1106] *Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] *Lutra lutra* (Otter) [1355] *Trichomanes speciosum* (Killarney Fern) [1421] *Najas flexilis* (Slender Naiad) [1833] *Alosa fallax killarnensis* (Killarney Shad) [5046] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Culture, Heritage and the Gaeltacht, 23rd October 2017), 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.	an existing forestry road which runs parallel to the Clydagh River. The closest distance between the cable route corridor and the SAC is 41 m. The route crosses three main streams and numerous drains which flow into the Clydagh. **It is concluded that hydrological connectivity exists between the Project (by way of the grid connection) and the SAC and that further assessment is required.**
Mullaghanish Bog SAC (site code: 001890)	Blanket bogs (* if active bog) [7130] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage Regional, Rural & Gaeltacht Affairs, 16th May 2017) 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 Site is approximately 6.9 km south-southwest of the SAC. The Turbine Delivery Route is 7.1 km at its closest point to the SAC. There are no hydrological links between these areas and the SAC. While a section of the grid connection corridor runs within a forest track 632 m from the SAC, the SAC is on higher ground to the forest track with established forestry and open heath in between. **It is considered that there is no potential for significant effects on this SAC.**
St Gobnet's Wood SAC (site code: 000106)	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] According to this SAC's site Conservation Objectives document (Version 1.0 Department of Housing, Local Government and Gaeltacht, NPWS 11th January 2022) for each of the listed QIs, the Conservation Objective is to maintain the favourable conservation	The Site is approximately 5 km west-northwest of the SAC. The Turbine Delivery Route at its nearest point (existing road of the N22) is 185 m northwest of the SAC. However, the

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	closest point to proposed works (site entrance) is 6.08 km in distance from the SAC. The closest point along the Grid Connection Route is 5.46 km northwest of the SAC. There are no hydrological links between the TDR and GCR to the SAC. The Site and the SAC are linked hydrologically by the Sullane River (channel length c.8 km). However, the qualifying interest of the SAC, Old Sessile Oak Woods, occurs on ground above the high water mark and could not be affected in any way by potential pollutants from the project site which could be carried in the river water. **It is concluded that while hydrological connectivity exists between the Project area and the SAC, there is no potential for significant effects on the qualifying interest of this SAC.**
Blackwater River (Cork/Waterford) (site code 002170)	Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Perennial vegetation of stony banks [1220] Salicornia and other annuals colonising mud and sand [1310] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410]	The site is approximately 11 km southwest of the SAC; the Grid Connection Route is located 4.1 km south of this SAC; the Turbine Delivery route is located 9.0 km south of this SAC; with no hydrological or ecological linkages between the locations and the SAC.

European Site	Reasons for designation (information correct as of 23rd January 2023) (* denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] 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] *Margaritifera margaritifera* (Freshwater Pearl Mussel) [1029] *Austropotamobius pallipes* (White-clawed Crayfish) [1092] *Petromyzon marinus* (Sea Lamprey) [1095] *Lampetra planeri* (Brook Lamprey) [1096] *Lampetra fluviatilis* (River Lamprey) [1099] *Alosa fallax fallax* (Twaite Shad) [1103] *Salmo salar* (Salmon) [1106] *Lutra lutra* (Otter) [1355] *Trichomanes speciosum* (Killarney Fern) [1421] According to this SAC's site Conservation Objectives document (NPWS 31st July 2012, Conservation objectives for Blackwater River SAC [002170]. 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.	**It is considered that there is no potential for significant effects on this SAC.**
Glanlough Woods SAC (site code: 002315)	*Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] According to this SAC's site Conservation Objectives document (NPWS 28th September 2018 Conservation objectives for Glanlough Woods SAC [002315]. Version 1.0. Department of Culture, 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.	The Site is approximately 14 km northeast of the SAC. The Turbine Delivery Route is located 16.6 km to the northeast of the SAC. The Grid Connection Route is located to 16.6 km to the northeast of the SAC. There are no hydrological links between these areas and the SAC. The location of the Development from the SAC is greater than the normal distance that foraging lesser horse-

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost. **It is considered that there is no potential for significant effects on this SAC.**
Kilgarvan Ice House SAC (site code 000364)	*Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] According to this SAC's site Conservation Objectives document (NPWS 6th November 2018, Conservation objectives for Kilgarvan Ice House SAC [00364]. Version 1.0. Department of Culture, 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.	The Site is approximately 10 km northeast of the SAC. The Turbine Delivery Route is located 12.5 km northeast of the SAC. The Grid Connection Route is located 12.3 km northeast of the SAC. There are no hydrological links between the Project and the SAC. The proposed wind farm site location from the SAC is greater than the normal distance that foraging lesser horse-shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		It is considered that there is no potential for significant effects on this SAC and no further assessment is required.
Old Domestic Building, Curraglass Wood SAC (site code 002041)	*Rhinolophus hipposideros* (Lesser Horseshoe Bat) [1303] According to this SAC's site Conservation Objectives document (NPWS 27th August 2018, Conservation objectives for Old Domestic Building, Curraglass Wood SAC [002041]. Version 1.0. Department of Culture, 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	The Site is approximately 8.1km east of the SAC. The Grid Connection Route is located 9.8 km east of the SAC. The Turbine Delivery Route is located 9.8 km east of the SAC. There are no hydrological links between the Project and the SAC. The location of the Site from the SAC is greater than the normal distance that foraging lesser horse-shoe bats would normally fly. McAney (in Lysaght & Marnell 2016) notes that the normal foraging distance is less than 2 km, while Schofield (cited in the NPWS Conservation Objectives for the site) notes that linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5 km around each roost. **It is considered that there is no potential for significant effects on this SAC.**
The Gearagh SAC (site code 000108)	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] Rivers with muddy banks with Chenopodion rubri p.p. and Bidention p.p. vegetation [3270] Old sessile oak woods with Ilex and Blechnum in the British Isles [91A0]	The Site is located 16.8 km northwest of the SAC. The Turbine Delivery Route (where works are proposed) is located 18.3 km northwest of the SAC. The Grid Connection Route (at its nearest point) is located 18.3 km northwest of the SAC.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Alluvial forests with Alnus glutinosa and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *Lutra lutra* (Otter) [1355] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, 15th September 2016) 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 Sullane River, which drains the Site for the proposed wind farm, flows in a south and then east direction for a distance of approximately 24 km before it enters the River Lee system at Coolcour, approximately 3 km downstream of the Lee Bridge, which marks the eastern extremity of the Gearagh SAC. Flow continues eastwards towards Cork Harbour. Taking into account (i) that the flow from the area of the proposed wind farm does not mix with water within the SAC, and (ii) the channel distance of over 20 km between the two locations, there is no realistic potential for water from the wind farm area (which could carry contaminants in absence of mitigation) to have effects on the qualifying interests of the SAC. **It is considered that there is no potential for significant effects on this SAC.**
Great Island Channel SAC (site code 001058)	Mudflats and sandflats not covered by seawater at low tide [1140] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage and the Gaeltacht, 6th June 2014) 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 Site is located 62.2 km west of the SAC. The nearest point along the Turbine Delivery Route is located 5.9 km from the SAC. The nearest point along the Turbine Delivery Route where works are proposed (site entrance) is a distance of 62.8 km west of the SAC. The closest point along the Grid Connection Route is near the existing

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		220 kV Ballyvouskill Substation at a distance of 51.7 km northwest of the SAC. The Sullane River, which drains the Site for the proposed wind farm, enters the River Lee system at Coolcour, approximately 24 km from the site of the proposed wind farm. The Lee then flows for approximately 40 km before entering Cork Harbour. There is a further 5 km distance across the harbour to the SAC. While there is a total distance of approximately 69 km from the Inchamore site to the SAC, hydrological connectivity does exist. However, in view of the distance between the two locations, it is considered that there is no potential for measurable effects on the qualifying interests of the SAC. Any pollutants or silts entering the drainage network at the site for the proposed wind farm, even in the most extreme scenarios and without mitigation of any form, would be completely attenuated by the dilution, dispersal and settlement that would occur within the river and estuarine system. **It is considered that there is no potential for significant effects on this SAC.**
	SPECIAL PROTECTION AREAS	

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
Mullaghanish to Musheramore Mountains SPA (site code: 004162)	Hen Harrier (*Circus cyaneus*) [A082] According to the First Order Site-specific Conservation Objectives Version 1.0 for Mullaghanish to Musheramore Mountains SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	The site of the proposed wind farm at Inchamore is approximately 6 km west of the SPA. Habitats suitable for foraging by hen harrier, including bog, heath, wet grassland and scrub, occur fairly widely between the SPA and the wind farm site. The habitats within the wind farm site have potential to support foraging hen harriers. A section of the grid connection route is located along the route of an existing forestry road which runs north of the SPA. The closest distance between the cable route corridor and the SPA is 170 m. The proposed works on the Turbine Delivery Route are at a distance of 5.6 km west of the SPA. **As the potential for significant effects on this SPA cannot be excluded, further assessment is required.**
Killarney National Park SPA (site code 004038)	Merlin (*Falco columbarius*) [A098] Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] According to the First Order Site-specific Conservation Objectives Version 1.0 for Killarney National Park SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	The Site is approximately 14.5 km east of the SPA. Habitats suitable for foraging by merlin, including bog, heath, wet grassland and scrub, occur fairly widely between the SPA and the wind farm site. The habitats within the wind farm site have potential to support foraging merlin.

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		From a review of the literature (Cramp 1980, Newton et al. 1978, Orchel 1992, Sale 2016), it can be concluded with certainty that the hunting range of merlins breeding within the Killarney National Park SPA, a nearest distance of 14.5 km from Inchamore, could not extend to the site for the proposed wind farm at Inchamore. Habitats outside of the National Park, or within the vicinity of the Inchamore site, are not suitable for supporting Greenland white-fronted goose (the other SCI for this SPA) and there are no historic or recent records of the species from these areas. The works along the Turbine Delivery Route are located 16.0 km east of the SPA. The Grid Connection Route is located 15.8 km east of the SPA. **It is considered that there is no potential for significant effects on this SPA.**
The Gearagh SPA (site code 0004109)	Wigeon (Anas penelope) [A050] Teal (Anas crecca) [A052] Mallard (Anas platyrhynchos) [A053] Coot (Fulica atra) [A125] Wetland and Waterbirds [A999] According to the First Order Site-specific Conservation Objectives Version 1.0 for The Gearagh SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	The Site is 16.8 km northwest of the SPA. The proposed works along the Turbine Delivery Route are located 18.3 km northwest of the SPA. The Grid Connection Route is 18.5 km northwest of the SPA. The Sullane River, which drains the Site for the proposed wind farm, flows in a south and then east direction for a distance of

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
		approximately 24 km before it enters the River Lee system at Coolcour, approximately 4 km downstream of the SPA. Flow continues eastwards towards Cork Harbour. Taking into account (i) that the flow from the area of the proposed wind farm is not likely to mix with water within the SPA, and (ii) the channel distance of approximately 28 km between the two locations, there is no realistic potential for water from the wind farm area (which could carry contaminants in absence of mitigation) to have effects on the Special Conservation Interests of the SPA, The habitats within the proposed wind farm site do not have potential to support any of the SCIs of the SPA. **It is considered that there is no potential for significant effects on this SPA.**
Cork Harbour SPA (site code 0004040)	Little Grebe (*Tachybaptus ruficollis*) [A004] Great Crested Grebe (*Podiceps cristatus*) [A005] Cormorant (*Phalacrocorax carbo*) [A017] Grey Heron (*Ardea cinerea*) [A028] Shelduck (*Tadorna tadorna*) [A048] Wigeon (*Anas penelope*) [A050] Teal (*Anas crecca*) [A052] Pintail (*Anas acuta*) [A054] Shoveler (*Anas clypeata*) [A056] Red-breasted Merganser (*Mergus serrator*) [A069] Oystercatcher (*Haematopus ostralegus*) [A130]	The closest point along the Turbine Delivery Route is 14 m from the SPA where the road is already in existence. However, the proposed works (site entrance) is located 57 km northwest of the SPA. The Grid Connection Route is located 57.1 km from the SPA. The Sullane River, which drains the site for the proposed wind farm,

European Site	Reasons for designation (information correct as of 23rd January 2023) (*denotes a priority habitat)	Distance from proposed Inchamore Wind Farm Project Area and summary of ecological connectivity
	Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Lapwing (*Vanellus vanellus*) [A142] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Black-headed Gull (*Chroicocephalus ridibundus*) [A179] Common Gull (*Larus canus*) [A182] Lesser Black-backed Gull (*Larus fuscus*) [A183] Common Tern (*Sterna hirundo*) [A193] Wetland and Waterbirds [A999] According to the First Order Site-specific Conservation Objectives Version 1.0 for Cork Harbour SPA (NPWS 2022, Department of Housing, Local Government and Heritage), for each of the listed SCIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA.	enters the River Lee system at Coolcour, approximately 24 km from the site of the proposed wind farm. The Lee then flows for approximately 40 km before entering Cork Harbour. While there is a total distance of approximately 64 km from the Inchamore site to the SPA, hydrological connectivity does exist. However, in view of the distance between the two locations, it is considered that there is no potential for measurable effects on the SCIS of the SAC. Any pollutants or silts entering the drainage network at the site for the proposed wind farm, even in the most extreme scenarios and without mitigation of any form, would be completely attenuated by the dilution, dispersal and settlement that would occur within the river and estuarine system. **It is considered that there is no potential for significant effects on this SPA.**

Table 5.6: Relevant sites designated under Irish legislation, reasons for designation, distances from subject site and summary of connectivity.

Note that in the following, the use of the term 'Project' includes the grid connection route and turbine delivery route.

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
	NATURAL HERITAGE AREAS	
Sillahertane Bog NHA (site code: 0001382)	Peatlands (4)	The pNHA site is located approximately 5.5 km to the south-southwest of the site for the proposed wind farm. There are no linkages, ecological or hydrological, between the NHA and the wind farm site.
Slaheny River Bog NHA (site code: 000383)	Peatlands (4)	The NHA site is located approximately 14 km to the southwest of the site for the proposed wind farm. There are no linkages, ecological or hydrological, between the NHA and the wind farm site.
Conigar Bog NHA (site code: 0002386)	Peatlands (4)	The NHA site is located approximately 14.5 km to the southwest of the site for the proposed wind farm. There are no linkages, ecological or hydrological, between the NHA and the wind farm site.
	PROPOSED NATURAL HERITAGE AREAS	
Killarney National Park, Macgillycuddy's Reeks & Caragh River Catchment pNHA (site code 000365)	Not Stated.	The proposed wind farm site at Inchamore is approximately 3 km south of the Caragh River component of the pNHA. There are no linkages, hydrological or otherwise, between the two areas. The majority of the grid connection route is located along the route of an existing forestry road which runs parallel to the Clydagh River. The closest distance between the cable route corridor and the

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
		pNHA is 41 m. The route crosses three main streams and numerous drains which flow into the Clydagh. It is concluded that hydrological connectivity exists between the Project area and the pNHA.
Mullaghanish Bog pNHA (site code: 001890)	Not stated.	The proposed wind farm site is approximately 7.5 km south-southwest of the pNHA. There are no hydrological links between the two areas. While a section of the grid connection corridor runs within a forest track 632 m from the pNHA, the pNHA is on higher ground to the forest track with established forestry and open heath in between. It is considered that there is no ecological or hydrological connectivity between the Project area and the pNHA
St Gobnet's Wood pNHA (site code: 000106)	Not stated.	The proposed wind farm site is approximately 5 km west-northwest of the SAC. The wind farm and the pNHA are linked hydrologically by the Sullane River (channel length c.8 km). It is concluded that hydrological connectivity exists between the Project area and the pNHA.
Prohus Wood pNHA (site code 001248)	Not stated.	The proposed wind farm site is approximately 13.5 km north-west of the pNHA. There are no ecological or hydrological linkages between the two areas. It is concluded that there is no ecological or hydrological

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
		connectivity between the Project area and the pNHA.
Lough Allua pNHA (site code: 001065)	Not stated.	The proposed wind farm site is approximately 11 km north-northwest of the pNHA. There are no ecological or hydrological linkages between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA
Ballagh Bog pNHA (site code: 001886)	Not stated.	The proposed wind farm site is approximately 11.5 km northeast of the pNHA. There are no ecological or hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA
Gouganbarra Lake pNHA (site code: 001057)	Not stated.	The proposed wind farm site is approximately 12 km northeast of the pNHA. There are no ecological or hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Kilgarvan Wood pNHA (site code: 001787)	Not stated.	The proposed wind farm site is approximately 12 km north-east of the pNHA. There are no hydrological links between the two areas. It is concluded that there is no ecological or hydrological

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
		connectivity between the Project area and the pNHA.
Roughty River pNHA (site code: 001376)	Not stated.	The proposed wind farm site is approximately 7 km northeast of the pNHA. There are no hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Kilgarvan Ice House pNHA (site code 000364)	Not stated (but expected to include Lesser Horseshoe bat).	The proposed wind farm site is approximately 11 km north-east of the pNHA. There are no hydrological links between the two areas. The proposed wind farm site location is greater than the normal distance (less than 2 km) that foraging bats would normally fly (Lysaght & Marnell 2016). It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Old Domestic Building, Lettir pNHA (site code 002040)	Not stated (but expected to include Lesser Horseshoe bat).	The proposed wind farm site is approximately 14 km north-east of the pNHA. There are no hydrological links between the two areas. The proposed wind farm site location is greater than the normal distance (less than 2 km) that foraging bats would normally fly (Lysaght & Marnell 2016). It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.

Site	Reasons for designation (information correct as of 23rd January 2023)	Distance from proposed Inchamore Wind Farm site and summary of connectivity
Old Domestic Building, Curraglass Wood pNHA (site code 002041)	Not stated (but expected to include Lesser Horseshoe bat).	The proposed wind farm site is approximately 7 km west of the pNHA. There are no hydrological links between the two areas. The proposed wind farm site location is greater than the normal distance (less than 2 km) that foraging bats would normally fly (Lysaght & Marnell 2016). It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.
Doo Lough pNHA (site code 00350)	Not stated	The proposed wind farm site is approximately 11 km southeast of the pNHA. There are no ecological or hydrological links between the two areas. It is concluded that there is no ecological or hydrological connectivity between the Project area and the pNHA.

5.4.3 Habitats, Vegetation and Flora

The main habitat within the survey area for the wind farm is conifer plantation (WD4). This occupies all but the north-western sector of the site and has been planted on sloping ground which is covered by relatively shallow peat soils. Other main habitats which occur within the site are wet heath (HH3), upland blanket bog (PB2) and cutover bog (PB4). Habitats which occur over small areas of the site are exposed siliceous rock (ER1), dry siliceous heath (HH1) and eroding/upland stream/river (FW1).

In the following sections the vegetation composition of these habitats is described, and the distribution of the principal habitats on site is shown in Figure 1. A list of plant species recorded in the main habitats is presented in **Appendix 5.1.**

Wet heath (HH3)

Wet heath vegetation occurs in the north-western portion of the survey area (see **Plate 5.2**). The vegetation is mostly dominated by varying proportions of purple moor-grass (*Molinia caerulea*), deer grass (*Tricophorum germanicum*) and the moss *Racomitrium lanuginosum.* The habitat has developed on sloping areas where the peat depth is generally between 10 and 50 cm. The vegetation is relatively species-poor, with ling heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*), many-flowered bog-cotton (*Eriophorum angustifolium*) and tormentil (*Potentilla erecta*) among the more frequent associates. The cover of ericoid shrub species (*Erica tetralix* and *Calluna vulgaris)* is in the range of 10 to 20%. The cover of Sphagnum mosses is generally between 10 and 30%, with *Sphagnum capillifolium* and *Sphagnum papillosum* the main species encountered.

The condition of the heath habitat is good[1] in respect of its representativity (i.e. a typical example) and conservation status (i.e. conservation structure and functionality). This is likely to reflect the low levels of livestock grazing evident in the local area. It is likely, however, that the relatively low cover of woody heath species (namely *Erica tetralix* and *Calluna vulgaris*) is a result of a past burning event and possibly over-grazing in previous decades. Small areas of bare peat do occur however the cover is less than 5%. While wet heath vegetation is a relatively widespread habitat in the upland areas of counties Cork and Kerry, the status at a National Level is given as 'Bad and deteriorating' in the review of EU Protected Habitats and Species in Ireland (Department of Culture, Heritage and the Gaeltacht, 2019).

Equivalent EU Annex 1 Habitat – Northern Atlantic wet heaths with *Erica tetralix* (4010)

1 A rating of 'good' follows a scale of 'Excellent', 'Good' and 'Average or Reduced' – this scale is used within the assessment criteria for Natural Habitats within Natura 2000 sites (see Natura 2000 Network – Standard Data Form, Final Version May 1994)

Plate 5.2: Wet heath on sloping ground in the north-west of the survey area.

Dry siliceous heath (HH1)

Dry heath is a widespread habitat in the unplanted areas of the site though it does not occur over large areas. Typically, the habitat is most commonly found along the edges of sandstone rock outcrops where the peat depth is less than 10 cm. Western gorse (*Ulex gallii*) is the main species in the vegetation with ling heather (*Calluna vulgaris*), bell heather (*Erica cinerea*), tormentil, hard fern (*Blechnum spicant*) and green ribbed sedge (*Carex binervis*) also occurring. The main mosses occurring in the vegetation are *Hypnum jutlandicum, Hylocomium splendens* and *Sphagnum capillifolium*. The habitat grades into adjoining areas of wet heath which occupies the slightly deeper peat soils which are adjacent.

Equivalent EU Annex 1 Habitat – European dry heaths (4030)

Upland blanket bog (PB2)

Upland blanket bog vegetation is confined to areas in the western parts of the site where the slope is relatively flat and the peat depth exceeds 50 cm. In general, the depth of peat within blanket bog habitat at Inchamore is between 1 and 1.5 metres. Purple moor-grass and Deer grass dominate the vegetation, with the cover of these two species generally exceeding 50%. As a result of the dominance of these two species the habitat is often difficult to separate the habitat from *Molinia*-dominated wet heath areas and the two habitats often intergrade with each other. Other frequent vascular plant species include cross-

leaved heath, ling heather, bog asphodel (*Narthecium ossifragum*), many-flowered bog-cotton (*Eriophorum angustifolium*) and hare's tail bog-cotton (*Eriophorum vaginatum*). The moss layer is typically well-developed with *Sphagnum capillifolium, Sphagnum papillosum, Sphagnum cuspidatum, Racomitrium lanuginosum* and the liverwort *Pleurozia purpurea* among the most conspicuous species.

Equivalent EU Annex 1 Habitat – Blanket bog (7130).

Cutover blanket bog (PB4)

Cutover blanket bog occurs in the south-western portion of the survey area (see **Plate 5.3**), as well as in the area where Turbine no. 3 is located. The vegetation of these areas is characterised by a type of degraded grassy heath vegetation dominated by purple moor-grass, deer grass, mat grass (*Nardus stricta*), heath rush (*Juncus squarrosus*), common bog cotton and the mosses *Racomitrium lanuginosum* and *Campylopus introflexus*.

These cutover bog areas are prone to erosion and overgrazing by livestock. As a result, the cover of bare peat/stone is generally between 10% and 40%.

No Equivalent EU Annex 1 Habitat.

Plate 5.3: Cutover bog surface dominated by *Molinia caerulea*, with outcropping bedrock visible. Uncut, shallow blanket bog is visible in the background.

Dry humid acid grassland (GS3)

Small areas of dry humid acid grassland occur on shallow soils close to rock outcrops in the north-west of the survey area. The vegetation is dominated by a range of grass species, especially velvet bent (*Agrostis canina*), sweet vernal grass (*Anthoxanthum odoratum*) and mat grass (*Nardus stricta*). Other frequent species in the low-growing vegetation include heath bedstraw (*Galium saxatile*), tormentil, heath rush and mosses such as *Rhytidiadelphus loreus, Hylocomium splendens* and *Pleurozium schreberi.*

No Equivalent EU annex 1 Habitat.

Wet grassland (GS4)

A few small fields of wet grassland occur in the south of the survey area. These fields are dominated by soft rush (*Juncus effusus*) with frequent creeping buttercup (*Ranunculus repens*), creeping bent (*Agrostis stolonifera*), Yorkshire fog (*Holcus lanatus*) and white clover (*Trifolium repens*). The fields have been utilised for stock grazing until recently and are semi-improved in places.

No Equivalent EU Annex 1 Habitat.

Coniferous woodland (WD4)

Conifer plantation is a widespread habitat within the survey area, covering approximately 128.3 ha. Most of the plantation areas are now between 6 and 10 metres tall, with planting occurring between the mid-1980's to the mid-1990's. Sitka spruce and Lodgepole pine are the main planted tree species, with occasional shrubs of eared willow (*Salix aurita*), downy birch (*Betula pubescens*) and common gorse (*Ulex europaeus*) along the plantation margins.

The ground layer of these woodland areas is mostly heavily shaded, species-poor and dominated by a deep layer of conifer needles. The few plant species which occur are scattered tufts of purple moor-grass and hard fern, along with mosses such as *Hypnum jutlandicum, Plagiothecium undulatum* and *Rhytdiadelphus loreus*.

In recent years, areas of coniferous woodland have been established in the south/centre of the survey area. Prior to planting these areas were dominated by a range of grassland habitats including dry humid acid grassland (GS3), Improved grassland (GA1) and Wet grassland (GS4). Planting of these areas took place between 2 and 10 years ago, with Sitka spruce the main species planted.

No Equivalent EU Annex 1 Habitat.

Plate 5.4: Species-poor conifer plantation in the east of the survey area.

Exposed siliceous rock

Exposed sandstone bedrock occurs sparingly within the survey area and is largely confined to the western sector. The vegetation of exposed rock surfaces is typically sparse. In suitable rocky crevices plant species such as hard fern (*Blechnum spicant*), broad buckler fern (*Dryopteris 45rticula*), St. Patrick's cabbage (*Saxifraga spathularis*) and Wilson's filmy fern (*Hymenophyllum wilsonii*) are characteristic.

Equivalent EU Annex 1 Habitat – Siliceous rocky slopes with chasmophytic vegetation (8220).

Eroding/upland stream (FW1)

Short lengths of eroding upland stream (First order tributaries) occur within grassland areas in the south of the survey area. These streams flow through steeply sloping ground and have a stony bed. They support a typical, species-poor vegetation which includes bulbous rush (*Juncus bulbosus*) and lesser spearwort (*Ranunculus flammula*).

No Equivalent EU Annex 1 Habitat.

Plate 5.5: View of typical stream in survey area.

Table 5.7: Summary of the main habitats occurring at turbine and substation and borrow pit locations.

Turbine location	Main habitats occurring within infrastructure footprint
No. 1	Wet heath (HH3) / Blanket bog (PB2)
No. 2	Wet heath (HH3) / Conifer plantation (WD4)
No. 3	Cutover bog (PB4) / Conifer plantation (WD4)
No. 4	Conifer plantation (WD4)
No. 5	Conifer plantation (WD4)
No. 6	Conifer plantation (WD4)
Substation area	Conifer plantation (WD4)
Borrow Pit	Conifer plantation (WD4)

Grid route corridor description

The route is dominated by forest tracks. Habitat descriptions follow, along with a description of the section which traverse open countryside leading towards the Ballyvouskill substation.

Forest tracks (BL3)

Forestry tracks (BL3) dominate the proposed cable route corridor between the site for the proposed Inchamore Wind Farm and the existing substation at Ballyvouskill. The forestry

tracks along the survey route are dominated by gravel and generally have a very low cover of vegetation. Any vegetation that does occur is patchy and is located in narrow strips along the track margins which are not subject to vehicular movement. The sparse vegetation of forest tracks is dominated by a mixture of ruderal and grassland species (see **Appendix 5.2**). The main species include *Agrostis stolonifera, Juncus articulatus, Juncus effusus, Cirsium palustre, Plantago major, Ranunculus repens, Prunella vulgaris* and *Trifolium repens*.

A notable plant species which was recorded growing along track margins is *Filago minima* (Least cudweed). The species is considered to be Near Threatened in Ireland (Wyse Jackson *et al.* 2016) and had been listed in the Flora (Protection) Order, 2015 but is not listed in the Flora (Protection) Order, 2022. Approximately 10 flowering heads of the species were noted at two locations in the townland of Derryreagh, where forest track runs through areas of recently felled and replanted coniferous plantation. In the Republic of Ireland, the species has a scattered distribution which includes the Killarney region, areas west of Cork city, Co. Wexford, South Wicklow, Co. Cavan and South Mayo.

Plate 5.6: View of typical forest track through recently felled conifer plantation in Derryreag townland.

Plate 5.7: View of forest track through an area of tall conifer plantation in Glashacormick.

Other habitats traversed by grid route

Between the N22 (chainage 16,200) and the forest road leading to the wind farm location (chainage 16,750), the cable route passes through a strip of grazed wet heath (HH3) alongside the N22 and then through conifer plantation (WD4).

To the north-west of Ballyvouskill substation **(see Figure 5.5)** the cable route passes through a field of improved grassland (GA1). The proposed route then crosses through an area of wet heath (HH3) on sloping ground. This heath vegetation is dominated by *Molinia caerulea* and *Calluna vulgaris,* with frequent *Erica tetralix, Erica cinerea, Potentilla erecta, Tricophorum germanicum, Carex panicea, Juncus squarrosus* and the moss *Sphagnum capillifolium*. The heath has an uneven surface topography which suggests overgrazing/ erosion in the past.

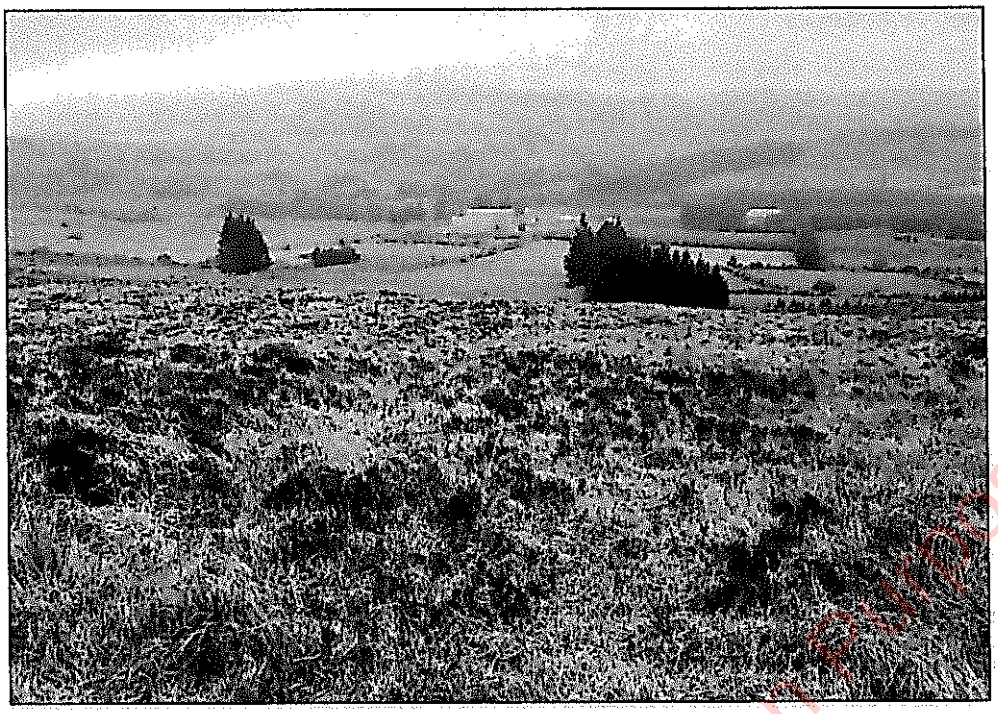

Plate 5.8: View of wet heath vegetation on sloping ground, looking back towards Ballyvouskill substation.

The proposed route then follows an old stony track through wet heath which is dominated by *Juncus effusus, Agrostis capillaris, Juncus articulates, Polytrichum* sp. And *Nardus stricta* which eventually joins with the main forest road further west.

Plate 5.9: View of old track running through wet heath.

Invasive species

During the field surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015) was conducted.

No species listed on this schedule were recorded during the surveys.

5.4.4 Terrestrial Mammals

Irish hare *Lepus timidus hibernicus* was observed on the heath and bog areas within the site and is expected to breed on site. Deer are widespread throughout the site and especially within the afforested areas. Several sightings indicated Sika deer *Cervus nippon* though fallow deer *Dama dama* and sika/red hybrids could also occur as these are widespread in the south-west.

While full search for badger *Meles meles* presence could not be carried out in the afforested areas of the site, no signs were observed in those areas which could be searched (*i.e.* margins of conifer plantations and tracks or firebreaks within the planted areas). It is noted that peat habitats and conifer plantation provide relatively poor habitat for badger as they normally require well drained soils to excavate setts and in Ireland setts are particularly associated with clay banks with hedgerows, native woodland and scrub (Smal 1991).

Pine marten *Martes martes* had been recorded within the local conifer plantations during the 2019/20 bird surveys but there were no signs of its presence during the baseline surveys in 2021. The preferred habitat of pine marten in Ireland is deciduous woodland or scrub with good ground cover, though mixed woodland and coniferous thickets are also used (Hayden and Harrington 2000). Pine martens may nest within larger trees with hollows, rock clefts or outbuildings. Taking into account the low suitability of the habitats within the Site for pine marten, it is considered that the Site is likely to be within a pine marten territory (which can be up to 80 ha) but that breeding on site is not likely.

There is no significant habitat on site to support otter *Lutra lutra*. This reflects the small size of the tributary streams and the absence of fish or larger aquatic organisms. However, otter occurs widely in the main channel of the Sullane River and it is possible that otter might at times travel upstream to the site.

5.4.5 Amphibians

The common frog *Rana temporaria* is widespread on site including within forest drains and in wet bog. Habitat suitable for the smooth newt *Lissotriton vulgaris* is absent within the site.

5.4.6 Reptiles

The common lizard *Zootoco vivipara* was recorded in June 2021 on a rock outcrop within the site and is expected to occur at low densities throughout the heath dominated areas of the site.

5.4.7 Bats

5.4.7.1 Desk review

5.4.7.1.1 Bat Conservation Ireland Database

A 1 km and 10 km radius search was requested from the Bat Conservation Ireland Database for the Irish Grid Reference W1403878722 in February 2023. There were no records on the database for the 1 km search while the records at a 10 km search are presented on the map below (**Figure 5.6**). The nearest BCIreland database recorded is 2.5 km from the boundary of the proposed development site.

Table 5.8: BCIreland Bat Records for 10 km radius search.

Bat Species	Records	Roost Records	Transect Records	Ad Hoc Records
Brown long-eared bat	8	5	0	3
Common pipistrelle	17	0	4	13
Daubenton's bat	6	0	0	6
Leisler's bat	10	0	1	9
Lesser horseshoe bat	7	5	0	2
Nathusius' pipistrelle	0	0	0	0
Natterer's bat	3	1	0	2
Soprano pipistrelle	13	0	1	12
Whiskered bat	4	0	0	4
Pipistrellus species	7	1	0	6

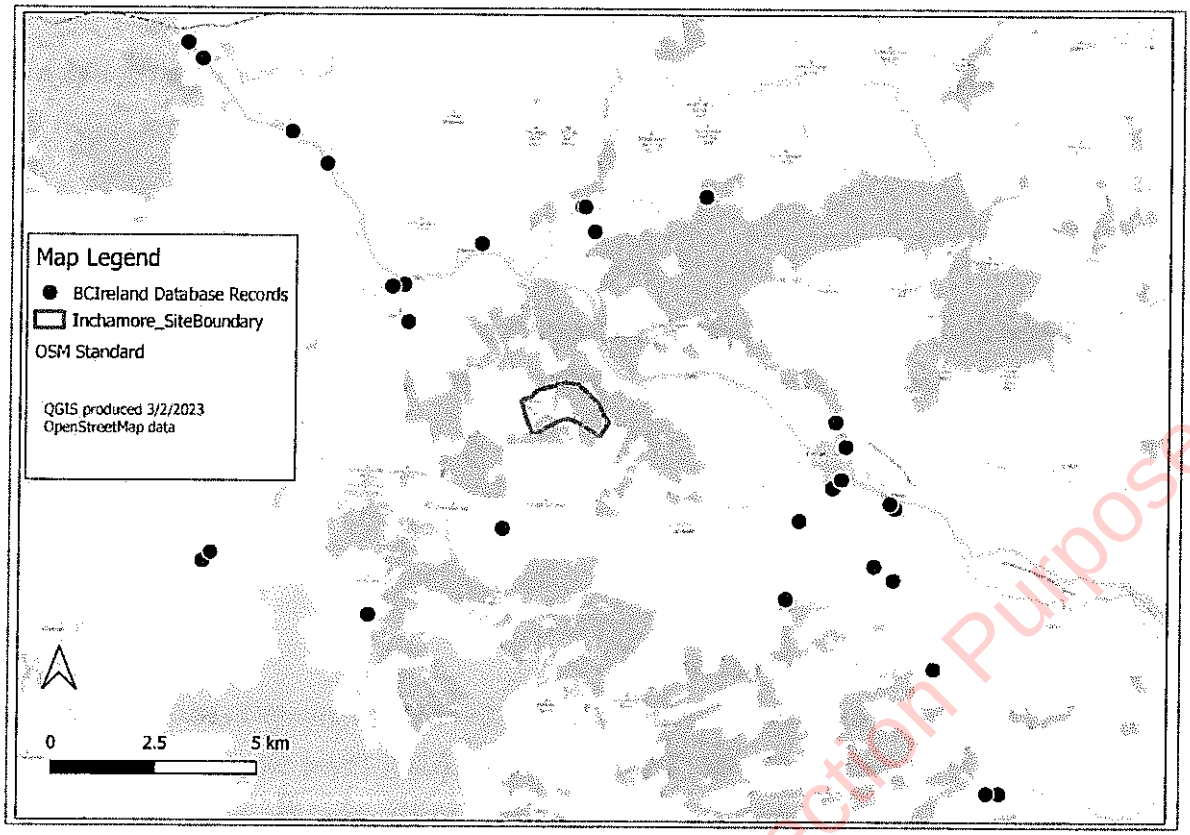

Figure 5.6: Bat Conservation Ireland Database Records (10 km radius).

5.4.7.1.2 Bat Conservation Landscape Favourability

The BCIreland Bat Landscape Favourability Model (Lundy *et al.*, 2011) identified the 5 km square within which the proposed development is located as having a Low to Medium favourability for bats. For the bat species recorded during this bat survey, the 5 km square has a Low or Low to Medium favourability value for eight recorded bat species recorded during the surveys.

Table 5.9: Bat Conservation Ireland Bat Landscape Favourability Model – 5 km Square value.

Bat species	5 km Square
Common pipistrelle	26% Low to Medium)
Soprano pipistrelle	23% (Low to Medium)
Nathusius' pipistrelle	0% (Low)
Leisler's bat	17% (Low)
Brown long-eared bat	13% (Low)
Daubenton's bat	11% (Low)
Natterer's bat	17% (Low to Medium)
Whiskered bat	13% (Low to Medium)
Lesser horseshoe bat	5% (Low to Medium)

5.4.7.1.3 Previous Survey Data

A previous bat survey report includes the proposed development area as part of the survey area (see **Appendix 5.6**): *Fehily Timoney (2020) Gortyrahilly and Inchamore Wind Farms Bat Survey 2019/2020 Report. Unpublished report prepared for SSE Renewables.*

This bat survey completed the following bat survey elements:

- Spring Static Surveillance: 10 static units, 11 nights surveillance;
- Summer Static Surveillance: 10 static units, 10 nights surveillance;
- Autumn Static Surveillance: 10 static units, 26 nights surveillance;
- 1 extra static unit was deployed on 30/7/2019 for 24 nights;
- Daytime assessment of 4 buildings;
- Daytime assessment of trees;
- Dusk bat emergence surveys:
- Walking transects along pre-mapped routes.

This bat survey recorded all nine resident bat species during the surveys. The majority of the bat survey data was recorded by the static surveillance surveys. A total of 22,877 recordings over the 46 nights of surveys were recorded on the static units. The most commonly recorded species was common pipistrelle, followed by soprano pipistrelle, and Nathusius' pipistrelle.

Table 5.10: 2019 Static Surveillance Results (Calculations based on recordings over 46 nights).

Bat Species	No. of Recordings	Percentage	No. of Recordings/ Night
Brown long-eared bat	419	1.84%	9.11
Common pipistrelle	16,180	70.29%	616.09
Daubenton's bat	563	2.55%	22.33
Leisler's bat	872	3.84%	18.96
Lesser horseshoe bat	39	0.17%	0.85
Nathusius' pipistrelle	1,001	4.41%	21.76
Natterer's bat	174	0.89%	4.41
Soprano pipistrelle	3,219	14.17%	69.98
Whiskered bat	381	1.68%	8.28

5.4.7.2 Field surveys

5.4.7.2.1 Daytime Inspections

Building & structure inspection

Four sets of buildings were inspected, one set of buildings is located within the Site, but not in area of proposed infrastructure, while the remaining three are located outside the Site (**Figure 5.6**). Daytime inspections were undertaken on 21/12/2022 and 6/1/2023 of the buildings and the results of these inspections are presented in the table below. In addition, static units were deployed in three of the buildings and left in-situ (recording from sunset to sunrise from 21/12/2022 to 6/1/2023).

Building 2, located within the Site (see **Figure 5.7**), was recorded as a bat roost for three species of bat: lesser horseshoe bat (bat droppings), Natterer's bat (bat droppings and audio files) and brown long-eared bat (audio files). The level of droppings and the number of audio files recorded (4 bat encounters, see **Table 5:11**) indicates that this building is used as a night roost for these three species of bat. Turbine 5 is the closest turbine to Building 2 (423 m).

Table 5:11: Buildings / Structures inspection results.

Building Code	Description	Grid Reference (ITM)	Daytime Inspection	Static Unit Results
Building 1	2-storey dwelling and 5 single storey sheds. Natural stone walls, mixed roofs (slate and corrugated iron). No evidence of bat usage.	514755, 578855	No bat evidence recorded during daytime inspection Suitability: Low to Medium level	No bats recorded on static unit
Building 2	2-storey derelict house, slate roof, timber fascia, small lean-too shed with corrugated roof	513562, 578539	Small number of bat droppings on ground floor room (Lesser horseshoe bat) and in lean-too shed (Myotis spp.). Suitability: Medium to High level	Static Recordings - Main House: Natterer's bat and Brown long-eared bat. Lean-too: Natterer's bat.
Building 3	2-storey derelict dwelling (slate roof in poor	514338, 577982	No bat evidence recorded during daytime inspection	Unknown - permission

Building Code	Description	Grid Reference (ITM)	Daytime Inspection	Static Unit Results
	condition) and numerous stonewall ruins.		Suitability: Low to Medium level	refused to collect static unit
Building 4	Single storey shed.	514703, 578897	No bat evidence recorded during daytime inspection Suitability: Low level	Not applicable

Table 5.12: Static unit results of winter surveillance of Building 2.

Date	Time	Bat Species	Survey Type	Bat Detector Model
21/12/2022	23:52:00	Natterer's bat	Statics in buildings	Mini Bat
27/12/2022	16:57:00	Brown long-eared bat	Statics in buildings	Mini Bat
28/12/2022	20:57:00	Natterer's bat	Statics in buildings	Mini Bat
29/12/2022	19:29:00	Natterer's bat	Statics in buildings	Mini Bat

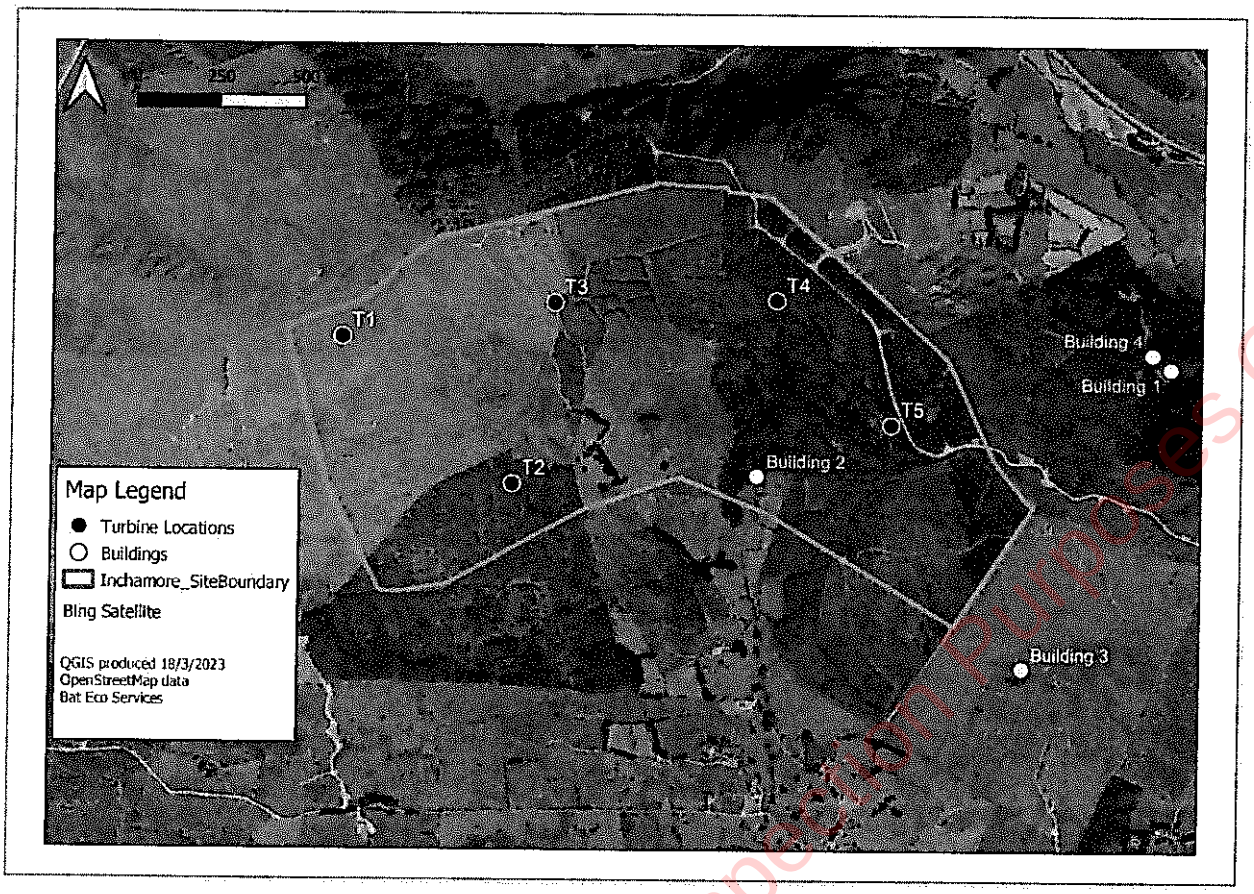

Figure 5.7: Location of buildings surveyed.

5.4.7.2.2 Tree Potential Bat Roost (PBRs) Inspection

There is an area of mature trees surrounding Building 2 within the proposed development area. All of the trees within this located were inspected on 21/12/2022 for features such as tree holes, spilt limbs etc. that can provide roosting features for bats. The majority of trees in this area are conifer trees and therefore do not have a Potential Bat Roost or PBR value for local bat populations.

5.4.7.3 Field Survey Results – Bat Detector Surveys

5.4.7.3.1 Dusk Bat Surveys, Walking & Driving Transects

The bat encounters recorded for these surveys (completed on 21/7/2022, 28/8/2022, 29/8/2022 and 19/9/2022) are reported as part of overall summary maps for each of the bat species. The following bat species were recorded during dusk surveys and the transects: soprano pipistrelle, common pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bat, *Myotis* species and brown long-eared bat. This information provides distribution results for the bat species recorded, which are presented in the full report (**Appendix 5.3**). Full breakdown of the nightly data is provided in the appendices.

5.4.7.3.2 Static Bat Detector Survey

The tables presented in the full bat report (**Appendix 5.3**) summarise the results recorded on the static units deployed over four surveillance periods (see **Figure 5.8**). The information collated by the static surveillance is analysed using the EcoBat Tool (discussed under that section of the report). Figures are provided to show the location of each of the static unit in relation to the proposed turbine locations. The location of static units was determined by the proposed location of turbines. All static units were deployed for a minimum of 10 days and therefore meet the level of surveillance recommended by guidance documents.

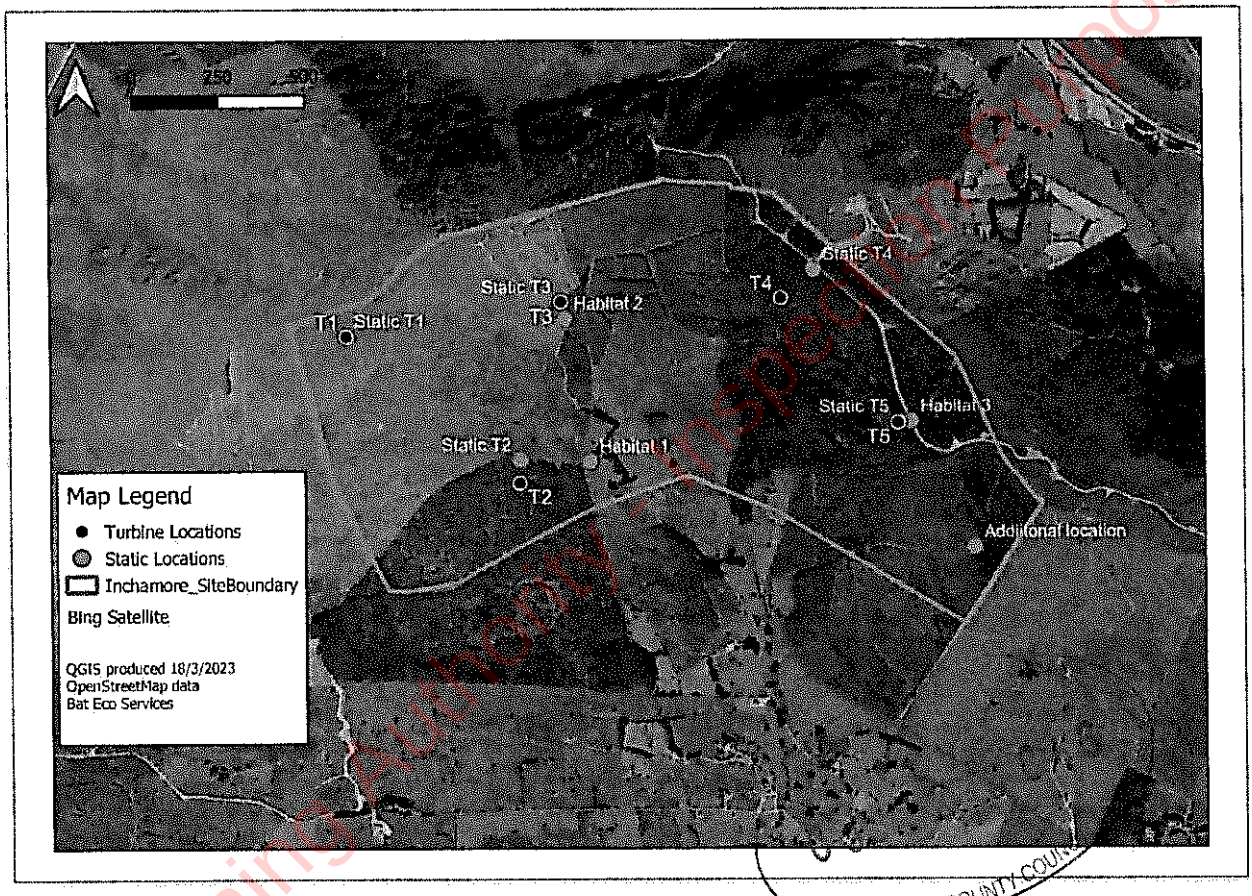

Figure 5.8: Location of static units deployed during static surveillance relative to proposed turbine locations.

The following bat species were recorded during the static surveillance: soprano pipistrelle, common pipistrelle, Leisler's bat, Natterer's bat, whiskered bat, Daubenton's bat, *Myotis* species, lesser horseshoe bat and brown long-eared bat. These records were also used to prepare distribution maps for the individual bat species recorded.

In summary, the total number of common pipistrelles bat passes recorded during all four static surveillance periods was 10,980 while soprano pipistrelles (720 bat passes) and Leisler's bats (650 bat passes) were the second and third most frequently recorded bat species, respectively. However, overall, common pipistrelles accounted for 85% of the recordings.

In relation to distribution across the static unit locations and during all surveillance periods, common pipistrelle was the most frequently recorded bat species, *i.e.* recorded on all static units deployed. The highest level of common pipistrelle bat passes was recorded on the static located in the easternmost part of the site (labelled in Figures as additional location) during the Spring Surveillance. All other bat species were recorded at a lower level of bat passes and less frequently across static surveillance locations. These totals included the three additional static units deployed in the second Autumn Surveillance.

In order to compare with Table 3 in Section 4.2.1 (see full bat report in **Appendix 5.3**), only data from the static units deployed at the proposed turbine locations are used for the following summary table. Apart from the common pipistrelles and Leisler's bats, the level of recordings detected was less in 2022 compared to 2019 for all other bat species noted. No Nathusius' pipistrelles were recorded in the 2022 static surveillance.

Table 5.13: 2022 Static Surveillance Results at proposed turbine locations only (250 nights / 6 static units = mean of 42 nights).

Bat Species	No. of Recordings	Percentage	No. of Recordings/ Night
Brown long-eared bat	86	0.81%	2.05
Common pipistrelle	9,061	84.94%	215.74
Daubenton's bat	75	0.7%	1.79
Leisler's bat	636	5.96%	15.14
Lesser horseshoe bat	1	0.01%	0.02
Natterer's bat	75	0.7%	1.79
Soprano pipistrelle	584	5.47%	13.9
Whiskered bat	47	0.44%	1.12
Myotis species	103	0.97	2.45

Four static surveillance periods were undertaken in 2022. This was a total of 2,688 hours of surveillance. In order to provide an overall visual in relation to the total level of bat activity recorded at the static units a series of graphs were prepared (see **Appendix 5.3**).

The bat species were divided into two groups:

- Common bat species: common pipistrelle, soprano pipistrelle and Leisler's bat;
- Less Common bat species: all remaining Irish bat species.

The principal summary points from the graphs are as follows:

- Common pipistrelles were consistently recorded across the survey site in high bat activity levels during all four static surveillance periods but particularly high levels were recorded during the spring surveillance.
- Common pipistrelle bat activity levels was highest at the additional location (see Figure 5.8).
- During the 2nd Autumn Surveillance, common pipistrelle bat activity levels was higher on the static located adjacent to one of the 'habitat' sites surveyed. This 'habitat' was the road access through the conifer plantations and therefore is indicative of commuting individuals along the open roads through a generally cluttered environment.
- Generally, Leisler's bat activity levels recorded was low and therefore are likely to indicate commuting individuals through the landscape. The highest level of bat activity for this specie was recorded at the additional location during the Spring surveillance.
- Soprano pipistrelle bat activity levels was consistently low during all static surveillance period at all proposed turbine locations.
- T1 was not an important location for the less common bat species and this is primarily a reflection of the habitats at this location *(i.e.* no tall tree vegetation). For all other turbine locations, the level of bat activity for the less common bat species was consistent during each of the surveillance periods.
- Habitat 1 (mature deciduous treeline) was particularly important for brown long-eared bats during the 2nd Autumn Static Surveillance.

5.4.7.3.3 Bat Survey Results - Summary

The figures provided in Appendix 5.3 illustrate the location of bat encounters recorded during all of the bat surveys completed. A total of eight bat species were recorded within the Site. The only Irish resident bat species not recorded during these surveys was Nathusius' pipistrelle. While the Auto-Id function of the audio file analysis reported the presence of this bat species, manual inspection of such files confirmed such calls as low-echolocating common pipistrelles.

While a large array of night-time surveys were undertaken, an overall low level of bat activity was recorded during dusk and dawn surveys and walking/driving transects. For less common bat species, the bat encounters recorded were primarily on static units as these were left in the "field" for a minimum of 10 days and therefore provide a greater opportunity to record bat species.

5.4.7.4 Field Survey Results – EcoBat Tool Results

All of the static surveillance results were entered into the "Per Night" forms and submitted for analysis using the EcoBat tool[2]. These forms were collated for the three seasonal surveillance periods – Spring, Summer and Autumn 2022.

The reference range datasets were stratified to include:

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

The Ecobat tool provides a series of summary tables to enable analysis of the bat activity level at each static location. These are presented in **Appendix 5.3** and categorisation of activity level is based on the following table:

Table 5.14: Percentile score and categorised level of bat activity.

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

Additional figures are presented in the appendices which provide information on the spread of nightly activity according to the five percentile ranges in the above table.

[2] The ECOBAT tool has been offline since November 2022. Only four of the six static units for the summer surveillance data were analysed prior to this. The analysis carried out for the present assessment was carried out in line with the ECOBAT tool using the professional judgment of Dr Aughney.

5.4.7.4.1 Summer Surveillance 2022 – Preliminary EcoBat Tool Analysis

Bat surveys were conducted at Summer 5, Summer additional location, Summer 1, Summer 4, for 11 nights between 2022-07-21 and 2022-07-31, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 111 passes, and 8 species were recorded.

The reference range dataset was stratified to include:

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

Only one species had a High level of bat activity according to the Median Percentile value (highlight in table below).

Differences in activity between static detector locations split by species and location were analysed (see details in **Appendix 5.3**). The analyses indicate that, in general, the level of bat activity varied greatly from static location and that there was not a consistent of species activity from night to night.

5.4.7.4.2 Summer Surveillance 2022 – Preliminary EcoBat Tool Analysis

The EcoBat Tool analysis demonstrated that levels of bat activity is reported as "High" when the number of nightly passes is greater than 40. Therefore, using this information, all of the static surveillance data collected in 2022 for each individual bat species recorded was examined to complete analysis in absence of the EcoBat Tool. Only the nightly bat activity level of common pipistrelles exceeded this criteria and therefore this species is used to determine the assessment of the proposed location of the turbines.

The number of nights when the number of nightly passes was greater than 40 for common pipistrelles was calculated (raw data are presented in the appendices). Over the course of the 2022 surveillance, at the proposed turbine locations for T1, T4 and T5 were deemed to have a Low level of bat activity. T3 was deemed to have a Medium level of bat activity while T2 and the additional location were deemed to have a High level of bat activity.

Table 5.15: Summary table showing the number of nights recorded bat activity fell into High activity band for common pipistrelles only.

Turbine No.	No. of Nights >40 bat passes	No. of Nights of Surveillance	Percentage	Activity Level
T1	0 nights	37 nights	0%	Low
T2	23 nights	47 nights	49%	High
T3	18 nights	47 nights	38%	Medium
T4	1 night	34 nights	3%	Low
T5	2 nights	34 nights	6%	Low
Additional location	21 nights	37 nights	57%	High

5.4.8 Summary of Important Ecological Features and Conservation Value of Site

5.4.8.1 Habitats, vegetation and flora

The north-western sector of the site comprises a mosaic of wet heath and upland blanket bog, which is part of a larger area of bog and heath which continues to the west. The heath and bog habitat mosaic within the site is of good quality as it appears largely intact (uncut) and has not been burned or over-grazed in recent times. However, the low cover of woody heath species such as cross-leaved heath and ling heather present may reflect past events of burning and/or over-grazing. Both wet heath and blanket bog are Annex I listed habitats, with active blanket bog having priority status. In addition, the Annex I listed habitats dry heath and exposed siliceous rock occur scattered throughout the unplanted sector of the site, typically in association with each other and/or wet heath. The total area of this heath/bog area within the Red-line study area is approximately 22 ha. As the condition of the heath and bog habitat is good, in respect of representativity (*i.e.* a typical example) and conservation status (*i.e.* conservation structure and functionality), the area is assigned a rating of County Importance. It is noted that while wet heath and blanket bog are relatively widespread habitats throughout much of the upland areas of counties Cork and Kerry, the status at a National Level for both habitats is given as 'Bad and deteriorating' in the review of EU Protected Habitats and Species in Ireland (Department of Culture, Heritage and the Gaeltacht, 2019). Reasons given for the 'Bad and deteriorating' rating are new forestry, paths, tracks and land clearance, while overgrazing, burning, wind farm development and erosion continue to be issues for these habitats.

The condition of the area of cutover bog habitat on site is poor due to ongoing erosion caused by peat-cutting and subsequent livestock grazing/poaching. It was observed during field surveys that sheep tend to graze preferentially on the cutover areas of the site rather than the wetter heath and bog habitats. The cutover bog habitat is assigned an overall rating of Local Importance (lower to higher value).

The other habitats recorded on site are assigned overall ratings varying from Local Importance (lower value) to Local Importance (higher value) – these comprise dry humid acid grassland, wet grassland and eroding/upland rivers. The conifer plantation is a non-native habitat managed entirely by man, is species-poor and is not of conservation importance.

There were no plant species listed in the Flora (Protection) Order 2022 recorded within the survey area. There is a ten-kilometre-square record (W17) for the protected species Killarney fern (*Vandenboschia speciosa*) (see https://bsbi.org/maps), however the species was not recorded from within the survey area during the present survey.

The Project area supports a number of plant species which have a relatively restricted distribution in Ireland, *i.e.* large-flowered butterwort (*Pinguicula grandiflora*) and St. Patrick's cabbage (*Saxifraga spathularis*). These species are considered to be locally common in suitable habitats in the south-west of Ireland (Parnell and Curtis, 2012).

The project area supports least cudweed *Filago minima*, a species which had been legally protected on the Flora (Protection) Order 2015. This occurs within a section of forest track which will support the grid connection cable.

5.4.8.2 *Terrestrial mammals, amphibians and reptiles*

The study site supports a typical mammalian fauna of open bog/heath habitat and conifer plantation. All mammal species recorded on site or expected to occur on site are listed as 'Least Concern' on the Irish Red List (Marnell *et al.* 2019).

The Irish hare, pine marten and all deer species are protected under the Wildlife Acts 2007-2022 as amended.

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).

5.4.8.3 Bats

A total of eight bat species were recorded within the Site. The only Irish resident bat species not recorded during these surveys was Nathusius' pipistrelle.

While a large array of night-time surveys were undertaken, an overall low level of bat activity was recorded during dusk and dawn surveys and walking/driving transects. For less common bat species, the bat encounters recorded were primarily on static units as these were left in the "field" for a minimum of 10 days and therefore provide a greater opportunity to record bat species.

A bat roost occurs within a building on site though this is not at or near a location for wind farm infrastructure development – there was evidence of three species of bat using the building, including lesser horseshoe bat.

All bats recorded are listed as 'Least Concern' on the Irish Red List and protected under the EU Habitats Directive Annex IV and Wildlife Acts. One species, Lesser Horseshoe, is listed as 'Annex II' under the EU Habitats Directive.

5.4.8.4 Kerry Slug

The Kerry slug (*Geomalacus maculosus*) is protected by the Wildlife (Amendment) Act 2000 and is listed under Annex II of the Habitats Directive. The Kerry slug is also listed in Annex IV of the Habitats Directive and as such is strictly protected from injury, or disturbance / damage to their breeding or resting place wherever it occurs.

Historically, the Kerry Slug has been considered to be restricted to Devonian Old Red Sandstone areas of Kerry and West Cork where it occurs most commonly in either of three distinct habitats:

- deciduous woodlands in particular those with rocky outcrops or boulders;
- rock outcrops associated with heath or blanket bog; and
- lake shores.

Within these habitats, the species tends to only be present if there is outcropping Devonian Old Red Sandstone, humid conditions and lichen, liverwort and / or mosses in which the species shelters and feeds (Platts and Speight 1988).

The overall conservation status of the species has been reported as 'favourable and improving' and it is not currently considered threatened within its range (NPWS 2019).

Based on the 2020 survey, it is considered that the habitat types "wet heath / blanket bog and rock outcrop habitat" at the Site support an important population of Kerry Slug, which is rated as County Importance.

5.5 ASSESSMENT OF EFFECTS

5.5.1 The 'Do-Nothing' Impact

Without the proposed wind farm development proceeding, it is expected that the present main landuses on site, namely livestock grazing and forestry, will continue. It is possible that further afforestation would occur on the site in the future.

The ecology of the site would be expected to remain fairly similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats on site. Also, any further afforestation on heath and bog habitats would be detrimental.

5.5.2 Potential Impacts on European Conservation Sites

The Appropriate Assessment report that accompanies this planning application has shown objectively that for 11 of the European sites identified within the zone of influence, there are no realistic Source-Pathway-Receptor linkages and hence there is no potential for effects on qualifying interests or Special Conservation Interests as a result of the proposed Inchamore Wind Farm project. These sites are:

- Mullaghanish Bog SAC (code 001890)
- St. Gobnet's Wood SAC (code 00106)
- Blackwater River (Cork/Waterford) SAC (code 002170)
- Glanlough Woods SAC (code 002315)
- Kilgarvan Ice House SAC (code 000364)
- Old Domestic Building, Curraglass Wood SAC (code 002041)
- The Gearagh SAC (code 000108)
- Great Island Channel SAC (code 001058)
- Killarney National Park SPA (code 004038)
- The Gearagh SPA (code 004109)
- Cork Harbour SPA (code 004040)

In the absence of mitigation, likely significant effects on two of the European listed in Table 5.5 could not be excluded during the construction, operational and/or decommissioning stages of the proposed development:

- Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC (code 000365)
- Mullaghanish to Musheramore Mountains SPA (code 004162)

For the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC impacts of potential concern may arise as a result of contaminants originating within the project area, and specifically the grid connection route, reaching the designated site and causing harmful effects on relevant qualifying interests for the site. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Full details are presented in the accompanying NIS.

For the Mullaghanish to Musheramore Mountains SPA, a section of the route for the grid connection cable will pass within 170 m of the SPA. Construction works along the grid connection route carried out during the breeding season could have disturbance effects on hen harriers breeding within the SPA. The significance of an effect is unknown as such would be dependent on the locations of the nesting sites and the foraging ranges of the breeding pairs at the time of the works.

5.5.3 Potential Impacts on National Conservation Sites

There are three Natural Heritage Areas within a 15 km radius of the proposed wind farm site (see **Table 5.6**), namely Sillahertane Bog NHA (5.5 km distance), Slaheny River Bog NHA (14 km distance) and Conigar Bog NHA (14.5 km distance). All three sites are designated for 'Peatlands'.

As these sites are geographically separated from the proposed Inchamore wind farm site, and without any ecological or hydrological connectivity between the sites and the proposed wind farm location, it can be concluded with full scientific certainty that the proposed wind farm project could not have any impacts on these three NHA sites.

5.5.4 Potential Impacts on proposed Natural Heritage Areas

There are 13 No. proposed Natural Heritage Areas within a 15 km radius of the proposed wind farm site (see **Table 5.6**). For eleven of these sites, there are substantial geographical separation distances and/or no ecological or hydrological linkages – these sites are:

- Mullaghanish Bog pNHA (c.300 m distance)

- Prohus Wood pNHA (13.5 km distance)
- Lough Allua pNHA (11 km distance)
- Ballagh Bog pNHA (11.5 km distance)
- Gouganbarra Lake pNHA (12 km distance)
- Kilgarvan Wood pNHA (12 km distance)
- Roughty River pNHA (7 km distance)
- Kilgarvan Ice House pNHA (11 km distance)
- Old Domestic Building, Leitir pNHA (14 km distance)
- Old Domestic Building, Curraglass Wood pNHA (7 km distance)
- Doo Lough pNHA (11 km distance)

It can be concluded that the proposed wind farm project could not have any impacts on these ten pNHA sites.

For the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment pNHA impacts of potential concern may arise as a result of contaminants originating within the project area, and specifically the grid connection route, reaching the designated site and causing harmful effects on relevant qualifying interests for the site. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Mitigation is required to avoid or minimise any risk to the designated site.

The St. Gobnet's Wood pNHA has hydrological connectivity to the site for the proposed wind farm via the Sullane River. While there is a channel distance of approximately 8 km from the wind farm site to the pNHA, there is still a risk that contaminants generated on site during the construction, operational and/or decommissioning phase could flow to the pNHA and possibly have adverse effects on water quality of the river within the pNHA. Mitigation is therefore required to avoid or minimise this risk.

5.5.5 Impacts on Habitats, Vegetation and Flora

The construction of the proposed development will result in the following:

- permanent loss of habitat;
- disturbance to habitat , and
- changes to existing habitats.

For this assessment on habitats, the worse-case scenario is assumed for the turbine range in respect to turbine foundation diameter (22-25.5 m)

5.5.5.1 *Permanent loss of habitat*

The permanent loss of habitat to facilitate the construction of the project is estimated at 30.75 ha. This will result from the following:

- Turbines foundations and hardstand areas
- Foundation for substation
- Foundation for met mast
- Wind farm road system

The majority of the affected habitat, approximately 26.13 ha, is conifer plantation. As conifer plantation is a non-native habitat that is not classed as a key ecological receptor, the permanent loss of this habitat is rated as Not Significant.

The construction of turbine T1 will result in the permanent loss of 2.32 ha of wet heath and wet heath/blanket bog mosaic. A small area of wet heath (0.2 ha) will be lost as a result of the T2 construction. The total loss of wet heath and wet heath/blanket bog mosaic is approximately 2.5 ha. The peatland habitat within the site is part of a larger complex of heath/bog habitats, which is rated as of County Importance. The loss of 2.5 ha of Annex I listed habitats, which have good representivity and conservation status and functionality, is rated as a Significant Adverse effect of Permanent duration. Compensation for loss of heath and bog habitats will be provided through a Habitat Enhancement Plan (see Appendix 5.5).

The construction of turbine T3, and associated roads, will result in the loss of 1.63 ha of cutover bog. However, the cutover bog at this site is of poor quality (rated as being of Local Importance, higher-lower value). The significance of the effect is rated as Slight Adverse of Permanent duration.

5.5.5.2 *Disturbance to habitats*

Areas adjoining the infrastructure will be disturbed by the construction works, including the need for construction of a drainage system and for the insertion of the electrical cabling including along the grid connection route.

Such disturbance within the conifer plantation and along the forest tracks and roads is rated as Not Significant due to the low ecological importance of this habitat.

Disturbance to wet heath and wet heath/blanket bog mosaic will occur around the location of T1 and its hardstand, and along part of the hard stand of T2. The extent of the zone of disturbance will vary, with both direct physical disturbance of heath/bog and probable indirect drying effects on adjoining heath/bog due to hydrological changes. Areas of heath and bog that may become drier would be expected to support more vigorous growth of ling heather *Calluna vulgaris* and less development of bog mosses. As the habitats affected by this impact are listed as Annex I habitats, disturbance is rated as a Significant Adverse effect of Medium-term duration. Mitigation to minimise disturbance of heath and bog as a result of construction works will be implemented.

5.5.5.3 *Changes to existing habitats*

The proposed borrow pit will result in removal of existing conifer plantation (c.42.6 ha). This will be reinstated using surplus inert material from the site, such as peat and subsoil and allowed to revegetate naturally. It is expected that a vegetation dominated by rushes will develop. Depending on the portion of peat, some bog plants, such as *Molinia caerulea*, are likely to become established in the long-term. Scrub (brambles / willows) and self-seeded conifers would also be expected in the long-term.

Further conifer plantation will be removed from the location of the proposed compound (0.36 ha), from alongside the road and other infrastructure (to facilitate construction works) and from the stretch of grid route between chainage 16,420 to 16,750 m. After the works are complete, including removal of the compound, these areas are expected to regenerate to a mix of rush and scrub vegetation, with self-seeded conifers becoming established over time.

The loss of conifer plantation (a non-native habitat) and replacement with more open habitat which support native plant species will be of benefit to small mammals, birds and insects, and overall the creation of open habitat will be of more value to local biodiversity than the existing conifer plantation. The impact of this change in habitat is rated as a Positive effect of Moderate significance of Long-term duration.

5.5.6 Potential Impact on terrestrial mammals, amphibians and reptiles

The effect on terrestrial mammal species by the loss and disturbance of habitats due to the proposed development is considered to be not significant on the basis that the species involved are all widespread species of the countryside which occur in similar habitats in the immediate and wider environs.

Pre-construction survey will take place to confirm possible badger presence before any felling of conifer plantation occurs. Should a sett be located, appropriate mitigation will be implemented (see **Section 5.6.3**).

The local otter populations associated with the Sullane River downstream of the Site could be affected adversely if there was a water pollution incident that affected their prey items (fish etc.). With appropriate mitigation to maintain water quality during the construction and operational phases of the proposed development (see CEMP in Appendix 2.1, Chapter 9: Hydrology and Hydrogeology and Chapter 6: Aquatic Ecology), the risk to the otter population is minimised.

Construction activity may cause larger mammals such as the Irish hare and deer to remain in cover. 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 habitat during the construction works and some individuals may be killed.

In the absence of mitigation, the significance of the effect on amphibian and reptile species within the site is rated as Significant.

5.5.7 Impact on Bats

For this assessment on bats, the worse-case scenario is assumed for the turbine range, in respect to overall ground to blade tip height (177-185 m), rotor diameter (149-155 m) and hub height (102.5-110.5).

5.5.7.1 Bat Species Recorded and Sensitivity

Eight species of bat and additional records for *Myotis* species group were recorded during the 2022 bat surveys. This represents eight of the nine bat species know to be resident in County Kerry. The ninth bat species, Nathusius' pipistrelle, was recorded in previous bat surveys completed in 2019/2020.

The table below provides an ecological valuation of each the nine bat species and the collision risk factor in relation to wind farms. Three of the bat species recorded are considered to be High risk.

Table 5.16: Evaluation of the bat species recorded during the bat survey.

Yellow = low population vulnerability
Orange = medium population vulnerability
Red = high population vulnerability

Bat Species	Ecological Value / Geographical Scale of Importance	Irish Status	Bat Risk	Population Numbers / Core Area
Leisler's bat	International	Least Concern	High	Common
Natterer's bat	County	Least Concern	Low	Widespread
Whiskered bat	Regional	Least Concern	Low	Rare
Nathusius' pipistrelle	Regional	Least Concern	High	Rare
Daubenton's bat	County	Least Concern	Low	Common
Brown long-eared bat	County	Least Concern	Low	Widespread
Common pipistrelle	Local	Least Concern	High	Common
Soprano pipistrelle	Local	Least Concern	High	Common
Lesser horseshoe bat	National	Least Concern	Low	Rare

5.5.7.2 EcoBat Tool Evaluation

While the static surveillance data collected during 2022 was only partially analysed using the EcoBat Tool, this partial analysis was used to form an analysis to continue the evaluation process and was sufficient for assessment purposes. This identified locations where a high value of bat activity for specific bat species was recorded. Over the course of the 2022 surveillance, the proposed turbine locations for T1, T4 and T5 were deemed to have a Low level of common pipistrelle bat activity. T3 was deemed to have a Medium level of common pipistrelle bat activity, while T2 was deemed to have a High level of common pipistrelle bat activity.

Therefore, in summary, the following proposed turbine locations are considered to be important in relation to level of bat activity recorded during static surveillance and their potential impact on local bat populations:

- T2 and T3.

5.5.7.3 Site Risk Assessment

The Site Risk Assessment is calculated according to SNH, 2021. The assessment value (i.e. Turbine Risk value) is compared to the ranges below:

- Low (green) 0-4;
- Medium (amber) 5-12, and
- High (red) 15-25.

While Leisler's bat can be considered as common in Ireland, its status as an "Internationally Important" population, ranks it higher than the two common *Pipistrellus* species. However, both the bat activity level of Leisler's bat and soprano pipistrelle was low during the 2022 surveillance while the majority of bat passes recorded was identified as common pipistrelle. Therefore, the Risk Assessment were completed for this bat species only (i.e. for common pipistrelle).

Common pipistrelle

With reference to the nightly bat activity at each of the static locations, T1, T4 and T5 were deemed to have a Low level of common pipistrelle bat activity. T3 was deemed to have a Medium level of common pipistrelle bat activity while T2 was deemed to have a High level of common pipistrelle bat activity. In order to complete the table below, the Bat Activity Category (using similar values as per EcoBat Tool) is valued as follows:

- Low = 1 point;
- Medium = 3 points, and
- High = 5 points.

Table 5.17: Risk assessment for each proposed turbine location for local bat populations using Common pipistrelle bat activity levels.

Turbine No.	Site Risk Value	Bat Activity Category	Turbine Risk
			Site Risk x Bat Activity Category
1	3	1	3
2	3	5	15
3	3	3	9
4	3	1	3
5	3	1	3

In summary, for common pipistrelles, the proposed turbine locations have the following Risk Factor:

- Low: T1, T4, T5
- Medium: T3
- High: T2

5.5.7.4 Impact Assessment

The impact assessment takes into consideration the following:

- Eight bat species were recorded during the 2022 and 2023 bat surveys of the proposed development site.
- Three of these species are considered to be High Risk bat species in relation to wind turbines: Leisler's bat, common pipistrelle and soprano pipistrelle.
- The remaining five species are Low Risk: Natterer's bat, Daubenton's bat, whiskered bat, lesser horseshoe bat and brown long-eared bat.
- Partial Eco Bat Analysis results highlighted turbine locations with High Risk and Medium Risk for common pipistrelle, as this bat species were recorded at High levels of bat activity during static surveillance.
- Spread of bat encounter records within the proposed development site, particularly, in relation to infrastructure.
- Bat habitats present within 200 m of turbine locations and along infrastructure routes.

Potential Impact on Local Bat Populations

One set of buildings is located within the proposed development area and this was recorded as a bat roost for three bat species: lesser horseshoe bat, Natterer's bat and brown long-eared bat (Building 2). However, all three bat species recorded roosting are considered to be Low Risk bat species in relation to wind farms and there is no proposed turbine or infrastructure adjacent to the buildings (the nearest turbine, T5, is 423 m from the roost).

The following table summarises the result of the impact assessment for each of the turbine locations. If no mitigation measures are implemented, there are two High Risk turbines (T2 and T6) and one Medium Risk turbine (T3).

Table 5.18: Summary table showing the number of nights recorded bat activity fell into High activity band for common pipistrelles only.

Turbine No.	Risk Assessment: Common pipistrelle	Other bat species recorded within 200 m of turbine	If no mitigation is applied, what is the potential impact level?
T1	Low	SP, BLE, Leis, Daub	Low
T2	High	SP, BLE, Leis, Daub, Natt, Whis	High
T3	Medium	SP, BLE, Leis, Daub, LHB, Natt, Whis	Medium
T4	Low	SP, BLE, Leis, Daub, Natt	Low
T5	Low	SP, BLE, Leis, Daub, Natt, Whis	Low

The above table summarises the result of the impact assessment for each of the turbine locations. If no mitigation measures are implemented, there is one High Risk turbine (T2) and one Medium Risk turbine (T3).

Cumulative Impacts of Existing Forestry Operations

Forestry operations will continue within sections of the proposed development site outside of the felling required to enable the development of the Project and the turbine buffer zones throughout the life span of the proposed development. Such operations include clear felling and new planting. The cumulative impact of these forestry operations in combination with the proposed development will not cause a significant increase to potential impacts of the proposed development identified above.

5.5.8 Impact on Kerry slug

The development of the Project could potentially impact on the local population of Kerry Slug due to loss and disturbance of suitable habitat. Based on the likely extent of habitat loss (see terrestrial habitats section) throughout the wind farm site, this impact is likely to be minor and localised as only a small proportion of suitable Kerry Slug habitat (primarily the mosaic of heath and outcropping rock) within the site will be impacted. It is noted that the species is known to populate extensive areas of this type of habitat throughout the wider landscape and has a favourable conservation status across its range (NPWS 2019). However, during construction, works could also result in the death of individual Kerry Slugs due to machinery movements in areas of suitable habitat. Mitigation is required to minimise potential loss of individual slugs.

5.5.9 Decommissioning Phase Potential Effects

The applicant is applying for a consent for a period of 35 years for the operation of the wind farm. A detailed Decommissioning Plan is included as part of the CEMP in **Appendix 2.1**. Briefly, decommissioning will involve the following:

- Removal of five wind turbines and concrete plinths.
- Removal of permanent meteorological mast.
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain *in-situ*

All other elements of the proposed development will remain in-situ. The Site Access Roads and associated drainage systems will serve ongoing forestry and agriculture activity in the area. All other hard surfaced areas will be allowed to revegetate naturally.

Cranes of similar size to those used for construction will disassemble each turbine using the same crane hardstands. The towers, blades and all above ground components will be removed from site and reused, recycled, or disposed of in a suitably licenced facility.

Turbines will be cut on site so as to fit on articulated trucks, therefore allowing the use of the civil construction delivery route for removal.

The key targets of the 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 peatland habitats, namely wet heath, blanket bog and cutover bog at T1, T2 and T3 locations;
- Disturbance to breeding birds and protected mammal species which may be on site at the time;
- Potential pollution of local waterways, and
- Creation of new habitats on site.

5.5.9.1 *Disturbance of peatland habitats*

The Annex I listed heath and bog habitats are of ecological importance (County level), while cutover bog is of Local importance. Any disturbance to these habitats during the works to dismantle turbines no. 1, 2, and 3 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 bog surface for any reason. The Plan also highlights a target of providing training on sensitive receptors on site to all involved personnel.

With work carried out in accordance with the Plan, it is not expected that the decommissioning works will have adverse effects on the peatland habitats on site.

5.5.9.2 *Disturbance of fauna species*

Particular care will be taken to ensure that the decommissioning works do not cause disturbance to animal species occurring on site at the time. Pre-construction baseline surveys will be carried out for species identified of conservation importance at the present time (2023), as well as for further species of importance which may be on site 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 expected that the decommissioning works will cause significance disturbance to fauna species associated with the site.

5.5.9.3 *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 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 Development, 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 expected to be an imperceptible to slight, neutral, permanent impact on the hydrological and hydrogeological setting surrounding the Site.

On this basis, it can be expected that the decommissioning works will not result in adverse impacts on local watercourses and associated species, including otter.

5.5.9.4 *Creation of new habitat*

The Plan specifies that the turbine plinths and 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 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 physical and chemical character of the gravel surface. Such recolonising surfaces, which retain warmth in sunshine compared to surrounding areas of soil, 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.

5.6 MITIGATION MEASURES

5.6.1 Designated sites

The present report has identified pathways between the site of the proposed wind farm project and two European sites and four proposed Natural Heritage Areas. The pathways are via the River Clydagh and the Sullane River.

In the absence of mitigation, there is a risk that contaminants generated on site during the construction phase 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.

The mitigation proposed to maintain water quality in the drainage channels and watercourses which drain the site is detailed in **Chapter 9: Hydrology and Hydrogeology**. 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 Site. A 50 m stream buffer zone will be implemented at the Site which will largely 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 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 Project 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)/Environmental Manager 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. The Contractor will be required to appoint an Environmental Manager.

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 proposed wind farm project.

5.6.2 Habitats and flora

5.6.2.1 Mitigation for habitat disturbance

The construction works will cause substantial disturbance to adjoining wet heath and blanket bog habitats around the turbine, hardstand and access road for the T1 turbine, as well as the cutover bog at the T3 turbine. To minimise disturbance to the heath and bog habitats and to ensure good recovery, as well as to minimise areas of bare peat which would be prone to erosion, the following approach will be adhered to during the construction phase:

Restricted access to bog and heath

At the commencement of works at the T1 and T3 locations, the required work footprint on the bog will be identified and the area will be marked by a rope fence (using range poles or similar) and with appropriate signage. No activities of any type will be allowed outside of this agreed work area. The ECoW will inspect the area regularly whilst works are on-going at T1 and T3. Excavated peat and other material will be removed to the approved storage area with no storage of spoil or materials on unplanted bog or heath. The fence will remain in place until the works are fully complete.

Revegetation of bare surfaces

An ecological objective is to minimise the area of exposed peat surface and to encourage revegetation. This will be achieved by the removal from suitable areas of the vegetated heath and bog surface (cut out as sods or 'turves') within the work footprint at T1, the storage of this material, and subsequent reuse around the turbine and hardstand margins.

The surface turves of vegetated bog and heath will be dug out to a depth of 30 cm or more using a dumper/digger with a bucket. Care will be taken to keep the turve 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 a pre-identified storage area. The storage area will be located in an area of site (not heath or bog) where disturbance during the storage period will not occur. 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. Should storage be for prolonged periods (months), the turves will need to be watered during dry spells (as determined by the ECoW). When ready for placement at the finished turbine/hardstand, they will be lifted with a dumper and bucket and taken to the destination. Here they will be off-loaded, placed side by side on the disturbed peat 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. All of the above will be monitored by the ECoW.

It is noted that where adequate peat depth is not available to dig out turves, as well as in the cutover bog at T3, the surface peat will be scraped off and stored in piles in a location similar to that for turves. This material will contain root stock, rhizomes and seed of peatland plant species and will be spread on disturbed surfaces when works are complete to assist in revegetation.

5.6.3 Badgers

As the interior of the conifer plantations on site could not be physically accessed at the time of the baseline surveys, a pre-construction survey for badger will be carried out just before and during the time of the tree felling operations within a minimum of 50 m of the working/construction corridor. Surveys will be undertaken by an ecologist with experience of badger surveys and working in association with the tree felling contractor. Before any felling commences, the ecologist will survey marginal areas around the plantation and internal tracks and firebreaks for signs of badger presence. Once felling commences, the ecologist will monitor the progression of the works as the required trees are cleared to facilitate the proposed Development.

Should there be any evidence of a badger sett within the works area or within 50 m of the works area, all felling work will cease immediately and a buffer zone will be established where felling works will be restricted. The surveyor will determine whether the sett is active and whether closure of the sett is necessary to avoid disturbance to the animals. Note that since closure of active setts is prohibited during the badger breeding season (December to June inclusive), appropriate scheduling of the tree felling process will occur to avoid delays.

Furthermore, should 3 years elapse between the time of the baseline surveys (in 2021) and the commencement of construction works, the entire site will be re-surveyed for badger presence as the local distribution may have changed since then.

5.6.4 Otter

Otter was not recorded on site and are not likely to occur due to the small size of the watercourses within the site and the absence of fish and larger aquatic organisms (see **Chapter 6: Aquatic Ecology**). However, they are present within the main channel of the Sullane River system downstream of the site.

The mitigation proposed to maintain water quality in the aquatic zones (as detailed in **Chapter 9: Hydrology and Hydrogeology**, **Chapter 5: Aquatic Ecology** and the CEMP) will ensure that the food supplies for otters are not affected.

5.6.5 Common frog

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.

5.6.6 Bats

In order to reduce the potential impact of the proposed development on local bat populations the following mitigation is proposed.

5.6.6.1 Construction Phase

Mitigation is best achieved through avoidance especially in relation to bat fauna. It is proposed that the following measures be put in place to avoid or lessen the degree of impacts on local bat populations.

Minimum buffer zone

To minimize risk to bat populations, a buffer zone will be implemented around any forestry, treeline, hedgerow or woodland feature, into which no part of the turbine will intrude. Using the formula quoted below, the minimum distances of wind turbines for bat mitigation are calculated for each of the potential turbine models (information supplied by Jennings O'Donovan). 50 m is used in the formula as it is considered an average of the distance a bat species will be detected on standard ultrasonic microphones (NatureScot 2021).

formula: $\text{Buffer distance} = \sqrt{(50 + b1)^2 - (hh - fh)^2}$

where bl = blade length, hh = hub height, fh = feature height (all in meters)

The dimensions of the potential wind turbine models proposed to be used are provided in the table below.

Feature height is 25 m (typical conifer plantation height, the predominant habitat type present within the survey area). Dimensions of Blade length and Hub height were provided and the calculation is as follows:

Buffer distance = $\sqrt{(50 + 77.5)^2 - (102.5 - 25)^2}$

Buffer distance = 101.24 m

Construction Phase Bat Mitigation Measures

Following the formula in the above section, ensure that the required minimum distance from tall vegetation is achieved.

Table 5.19: Bat Mitigation Measures recommended during the Construction Phase

HcoBat Tool High Level Turbine Locations This applies to T2	EcoBat Tool Medium Level Turbine Locations This applies to T3 This also applies to remaining Internal Road Network	EcoBat Tool Low Level Turbine Locations This applies to T1, T4 & T5
Ensure that wind turbine is 101.2 m away from plantation edge.	Ensure that wind turbine is 101.2 m away from plantation edge.	Ensure that wind turbine is 101.2 m away from plantation edge.
A zone of 101 m around the wind turbines (from the tip of the blade) will be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. A low level of vegetation will be maintained for the entire operational phase. This will be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.	A zone of 50 m around the wind turbines (from the tip of the blade) will be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. A low level of vegetation will be maintained for the entire operational phase. This will be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.	A zone of 50 m around the wind turbines (from the tip of the blade) will be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. A low level of vegetation will be maintained for the entire operational phase. This will be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.
Clearance work will be completed at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels.	Clearance work will be completed at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels.	Clearance work will be completed at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels.
Building 2 and mature trees surrounding the building will not be removed during construction of the proposed development. This area will be protected from any construction works proposed to be undertaken in vicinity of this area. This area will also be protected during the operation of the proposed development.		

5.6.6.2 *Operational Phase*

Feathering of blades

The operation of the turbines should be in a manner that will restrict the rotation of turbine blades as much as possible below the manufacturer's cut-in speed (*e.g.* by feathering the blades during low wind levels - changes in blade feathering by altering the angle of the blade and therefore preventing the blades from rotating during low wind situations). This would prevent freewheeling or idling of the blades. Therefore, to ensure that blades of turbines are prevented from freewheeling (idling/spinning), feathering of the blades during low wind conditions will be implemented for all turbines.

Turbine cut-in speeds

There are bat mitigation measures available in relation to wind farms to reduce fatalities. One successful measure applied to wind farms in Europe is to increase the cut-in speeds of the individual turbines. This is important in order to protect High Risk species (Leisler's bat, soprano and common pipistrelle) foraging/commuting in vicinity of turbine locations.

Increasing the cut-in speed to 5.5 m/s from 30 minutes prior to sunset and to 30 minutes after sunrise to reduce bat collisions with turbines will be employed where required, *i.e.* at turbine locations where surveillance recorded high bat activity levels for High Risk and Medium Risk bat species and/or bat carcasses were recorded. The duration required depends on the level of bat mitigation required for individual turbine sites (i.e. full bat activity season or confined to spring & autumn months – this will be determine by first year surveillance – see below). A risk assessment will be undertaken using the surveillance data and analysed using best practice e.g. assessment of static data should be completed using the online tool *EcoBat* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by SNH, 2021 or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

Where cut-in speeds are required, they will be operated according to specific weather conditions. In a previous bat survey undertaken by the author, static units were erected on an anemometer at 4 m and 50 m level. The number of bat passes recorded on the static units was analysed according to temperature and wind speed recorded at similar height levels. During this survey, it was determined that:

1. The vast majority of bat passes were recorded at the temperatures of 8°C and greater. Therefore, when the air temperature was less than 7°C there was no bat activity recorded below this temperature during the surveys completed.

2. In general, bat activity was highest at low wind speeds (<5.5 m/s). It has been shown that curtailing the operations of wind turbines at low wind speeds can reduce bat mortality dramatically, especially during the late summer and early autumn months.
3. SNH (2021) recommend that curtailment is implement for 10°C and above.

Reducing fatalities can be reduced by changing the speed trigger or cut-in speeds of the turbines (i.e. meaning that the turbine is not operational during low wind speeds) or by changing the turbine blades angles which will mean that higher wind speeds are needed to start the wind turbine blades moving. Modern remotely operated wind turbines allow such cut-in speeds to be controlled centrally and automatically. Due to the high levels of bat activity, cut-in speed is required at T2.

a. Surveillance will be undertaken at the High and Medium Risk turbine (T3) over a period of three years (first three years of operation, but an annual review is required to determine the cut-in speeds after 1 year of operation). If the *Common pipistrelle* activity remains moderate to high at the T3 Medium Risk turbine after the first year of surveillance then the cut-in speeds (coupled with carcass search results) will be put in place immediately. High and Medium Risk turbines surveillance will continue to review the situation at each individual turbine location for the remaining two years. This will allow refinement of the curtailment regime.

For all other turbines, operation without cut-in speeds coupled with 3 years of surveillance (according to SNH, 2021 guidelines) to determine if cut-in speeds are required at these turbine locations.

As recommended by SNH, 2019 if curtailment is put into operation, *"then the effectiveness of curtailment needs to be monitored in order to determine (a) whether it is working effectively* (i.e. *the level of bat mortality is considered to be incidental), and (b) whether the curtailment regime can be refined such that turbine down-time can be minimised whilst ensuring that it remains effective at preventing casualties".*

"Where the need for curtailment has been identified, a curtailment regime should be developed and presented as a part of the supporting Environmental Statement for the project. The proposed operating regime should specify, and be designed around the values for the key weather parameters and other factors that are known to influence collision risk which may include any or all of the following:

- *Wind speed in m/s (measured at nacelle height)*

- *Time after sunset*
- *Month of the year*
- *Temperature (°C)*
- *Precipitation (mm/hr)*

Post construction acoustic surveys provide additional information which, when used in conjunction with appropriate carcass search data, can support any proposed changes to pre-application predictions concerning the need for curtailment or adjustments to an agreed curtailment regime.

This surveillance and annual review should be carried out by an independent experienced bat ecologist and all reports should be issued to the Local Authority and NPWS for review.

Table 5.20: Bat Mitigation Measures proposed during the Operational Phase.

EcoBat Tool High Level Turbine Locations This applies to T2	EcoBat Tool Medium Level Turbine Locations This applies to T3 This also applies to remaining Internal Road Network	EcoBat Tool Low Level Turbine Locations This applies to T1, T4 & T5
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).
Operate the wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.5 m/s during specified weather conditions and during the active bat season (April to October) when air temperatures are 10°C or more at the nacelle height. Undertake monitoring the first three years of operation to determine bat activity levels post construction. Review the results of monitoring at individual High Risk turbines after Year 1. Operate wind farm with specific cut-in speeds from Day 1 of Year 2, if required, and review after surveillance/monitoring is completed.	Put in a monitoring programme for the first year of operation to ensure that bat activity is at a low level in vicinity of these turbines. Review monitoring results to determine if further bat mitigation measures are required (e.g. cut-in speeds).	

EcoBat Tool High Level Turbine Locations This applies to T2	EcoBat Tool Medium Level Turbine Locations This applies to T3 This also applies to remaining Internal Road Network	EcoBat Tool Low Level Turbine Locations This applies to T1, T4 & T5
Undertake a carcass search for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required. Review after Year 1 along with bat activity monitoring.	Undertake a carcass search for 3 years post operation of the wind farm.	Undertake a carcass search for 3 years post operation of the wind farm.
Annual inspection of each buffer zone around each turbine will be undertaken and any regenerating trees or tall shrubs will be cut back.	Annual inspection of each buffer zone around each turbine will be annually inspected and any regenerating trees or tall shrubs will be cut back.	Annual inspection of each buffer zone around each turbine will be annually inspected and any regenerating trees or tall shrubs will be cut back.

Bat mitigation measures during the Operational Phase will be reviewed by implementing a strict surveillance programme for the first three years of operation of the wind farm in order to identify if there exists a substantial risk at a particular turbine location or during a particular time-period (3 years - as per recommendation of SNH, 2021 guidelines). This surveillance required is as follows (following SNH 2021 guidelines):

a) Bat activity surveillance

The level of bat activity will be monitoring for a minimum of 10 nights at each turbine location (ground level) during three of the eight month activity period (March/April to October/November). The surveillance periods will be divided into three survey periods to represent the three main periods where bat collisions have been documented: Spring (April/May); Summer (June/July) and Autumn (August/September).

b) Carcass search

During the surveillance periods of specific wind turbines, carcass search is proposed for a minimum of 1 morning per turbine (i.e. 3/4 mornings in total over the 1 year surveillance i.e. one per surveillance period). For each turbine, the search area will be 100 m radius after ideal bat foraging weather conditions (mild, calm and dry weather and greater than 10°C). A scavenger trial is required to facilitate analysis (as per SNH, 2021 guidelines).

c) Assessment of static data will be completed using the online tool *EcoBat Tool* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by SNH, 2021 or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

5.6.7 Kerry Slug

The following measures will be implemented for Kerry Slug:

- Areas of suitable habitat that occur outside of the footprint of the development will be avoided during the course of construction thereby minimising the loss and disturbance of Kerry Slug habitat.
- Immediately prior to undertaking works in areas of suitable habitat (wet heath / blanket bog / rock outcrop), the project ecologist will check for the presence of Kerry Slug. Should slugs be discovered, then they will be transferred to suitable habitat in the surroundings. Similar on-going monitoring of suitable habitat within works areas will continue throughout the construction phase. Such monitoring will be undertaken during periods of wet weather when slugs are most active and feeding on the surface and therefore at greater risk of impacts by movement of machinery. The transfer of Kerry Slugs will be subject to a derogation licence from the Department of Housing, Local Government and Heritage.

Subject to the above mitigation being implemented it is concluded that impacts of significance on the conservation status of Kerry Slug will not arise, i.e. the effect of the proposed development on Kerry Slug would be Not Significant.

5.7 RESIDUAL EFFECTS OF THE DEVELOPMENT

With mitigation measures as presented implemented in full, and specifically preservation of water quality in local watercourses and avoidance of disturbance to breeding hen harrier, it is considered that the significance of the effect of the predicted impact on designated sites as a result of the proposed wind farm project will be 'Not Significant'.

With mitigation measures as presented implemented in full, it is considered that the significance of the predicted effect on wet heath and blanket bog habitats as a result of the proposed wind farm development will be a Significant Long-term adverse effect. However, compensation will be provided for the loss of habitat through a Habitat Enhancement Plan (see section 5.9).

With mitigation measures as presented implemented in full, including preservation of water quality in local watercourses, it is considered that the significance of the predicted impact on terrestrial mammal species as a result of the proposed wind farm development will be Not significant.

As long as the mitigation measures presented are implemented in full, the impact of the proposed development on local bat populations is considered to be a Slight to Imperceptible residual negative effect. The conservation status of each of the local bat species will remain unaffected.

With mitigation measures as presented implemented in full, it is considered that the significance of the predicted impact on the Kerry Slug population as a result of the proposed wind farm development will be Not significant.

5.8 CUMULATIVE EFFECTS

There are 26 wind farms within 20 km[3] of the Inchamore proposed development (an area of 1,256 km^2). **Figure 5.12** shows the location of proposed, permitted and operational wind farms within a 20 km radius of the Inchamore site and further information on these wind farms is provided in the accompanying EIAR (**Appendix 2.3, Chapter 2**). Of the 26, 18 no. are operational (175 turbines total), 6 no. are permitted (25 turbines), 1 no. is at pre-planning stage (17 turbines) and 1 no. is proposed (14 turbines).

The nearest operational wind farms to the Inchamore site is Coomagearlaghy, Kilgarvan Wind Farm (15 turbines), which is located 2.7 km to the south-west, and Inchee, Poulbatha & Foilgreana (6 turbines), which is located 3.3 km to the south-west. The permitted Gortnakilla, Clonkeen, Killarney Wind Farm is located 1.87 km to the west of the Inchamore site.

Most of the wind farms are clustered to the north-east, south and south-west of the Inchamore site.

The Inchamore project will add a further 5 turbines to the total of 231 turbines. Based on the locations of the 26 wind farms (see **Figure 5.12**), it is expected that most are on heath and/or bog habitats and the construction of such projects would have (or will) caused loss and disturbance of peatland habitats. The proposed wind farm project at Inchamore will contribute to further loss of heath and bog habitats (from T1 and T2).

A detailed inventory of permitted projects within a 3 km radius of the site for the Inchamore wind farm and 50 m either side of the grid connection route has been compiled (see **Appendix 2.5, Chapter 2**). These projects received planning permission between 2017

[3] A distance of 20 km is taken as a precautionary distance for potential in-combination effects to occur – such a distance is beyond the normal foraging range of bird species associated with SPAs.

and 2022. Most of the projects are domestic scale developments or agricultural related developments and no potential pathways to European sites are identified. Potentially relevant projects which have received planning permission are:

Planning Ref. 174167 – A solar photovoltaic panel array consisting of up to 37,800 m^2 of solar panels on ground mounted steel frames and all associated infrastructure and site works. Located at Coumaclovane, Coolea, Co Cork, approximately 4 km south-southwest of the Inchamore site. Permission granted by Cork County Council 01/07/2017.

Planning Ref. 215127 – The erection of a temporary meteorological mast for a period of 5 years, located at Inchamore, Coolea, Co. Cork (within the site for the proposed Inchamore Wind Farm). This consists of a 100 m high lattice mast and associated stay wires. Permission granted by Cork County Council 31/08/2021.

Planning Ref. 217318 – A 30 m high telecommunications structure together with antennas, dishes and associated telecommunications equipment and all associated works. Located at Derreenaling, Ballyvourney, Co. Cork, approximately 2 km east of the Inchamore site. Permission granted by Cork County Council 15/02/2022.

All of the wind farm and other projects will have been assessed by the competent authority for potential adverse effects on designated sites and habitats and species of conservation importance. As it has been demonstrated in this report that the Project, with mitigation in place, will not have adverse effects on the integrity of any designated site, it can be concluded that there is no pathway for it to act in-combination with other plans and projects to give rise to cumulative effects.

The peatland habitat in much of the Site has been severely degraded by afforestation. The construction of the proposed wind farm will contribute to an existing and ongoing adverse effect on the peatland resource of the site and county.

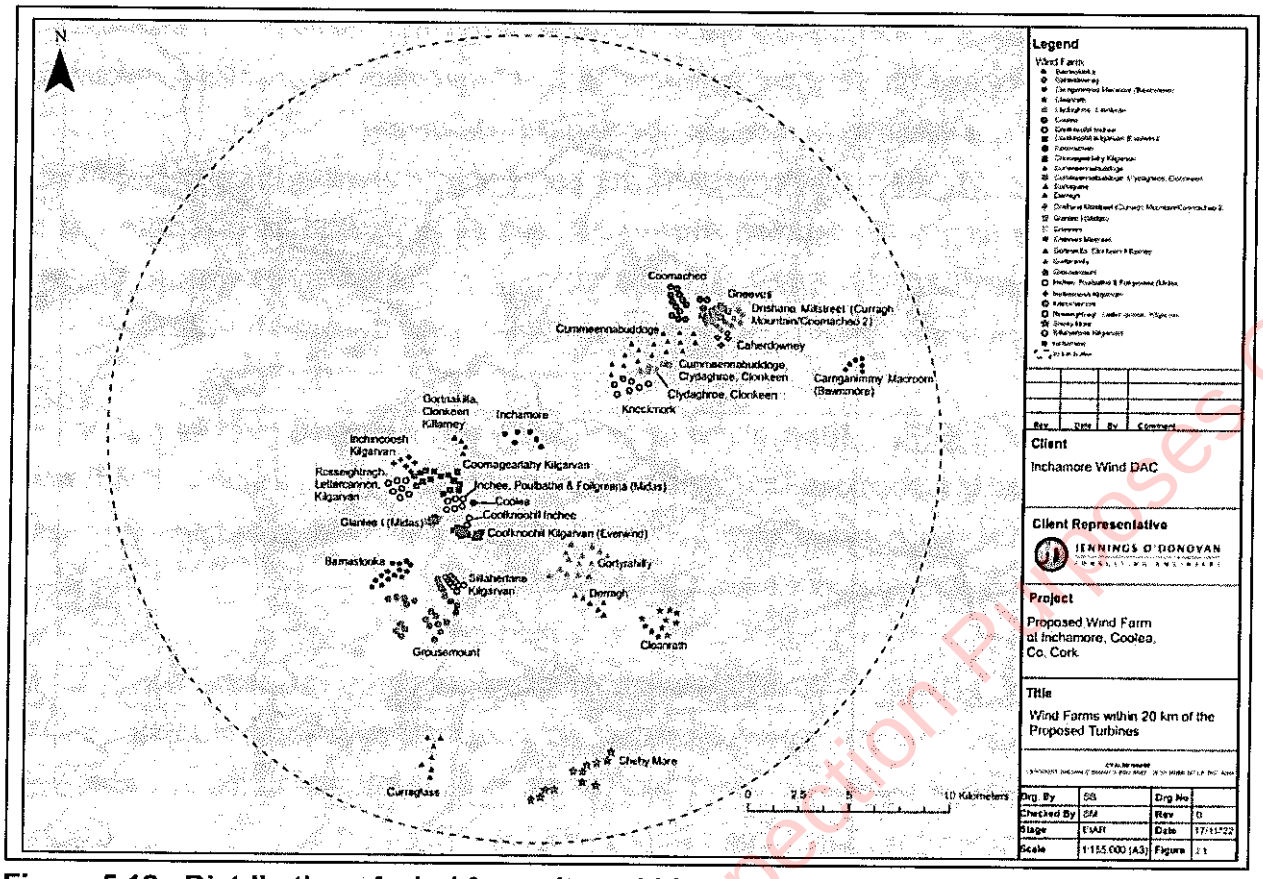

Figure 5.12: Distribution of wind farm sites within a 20 km distance of the proposed Inchamore Wind Farm.

5.9 PROPOSED BIODIVERSITY ENHANCEMENT

The Habitat Enhancement Plan is presented in **Appendix 5.5**. The Plan will restore and enhance an area of blanket bog habitat that has been severely eroded following over-grazing by sheep. This will provide compensation for the loss of heath and bog habitats on site as a result of wind farm construction (total of 2.5 ha intact heath and bog and 1.6 ha of cutover bog). The total area of the HEP, which includes some relatively intact blanket bog and some cutover bog, is 10.8 ha.

The objectives of the Plan are as follows:

Objectives - primary

- To enhance existing areas of blanket bog (Annex I habitat) which are subject to ongoing erosion.
- To increase the vegetation cover in areas of cutover blanket bog that have been intensively grazed by livestock in the recent past.

Objectives - secondary

- To enhance existing habitats for peatland associated species such as Red Grouse, (Red-listed), Snipe (Red-listed), Meadow Pipit (Red-listed) and the Irish Hare.

The objectives for the Plan are achievable as similar work has been carried out successfully at other sites in Ireland. The Plan will be underwritten by a detailed monitoring programme, which will allow modifications to ensure that the objectives are being achieved (See **Appendix 5.6**).

5.10 MONITORING

5.10.1 On-going monitoring during construction

An Ecological Clerk of Works (ECoW) and Environmental Manager will be on site as required during the construction phase. As required, a consultant ecologist with expertise in peatland habitats will assist the ECoW and Environmental Manager. The consultant ecologist will be employed by the developer and will be independent of the Contractor.

The ECoW will ensure that all mitigation relating to ecological impacts is being implemented throughout the construction phase of the project.

Mitigation for Kerry Slug, as described in **Section 5.6.7**, will involve monitoring of potential Kerry Slug habitat prior to any works commencing. This will be carried out by an ecologist with proven expertise in the ecology of Kerry Slug and will be under licence.

5.10.2 Pre-construction bat survey

Should three years lapse from between planning-stage surveys in 2022 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 should be completed according to best practice guidelines available. The most current guidance document for Irish wind farms is from NatureScot (NatureScot, 2021) (NIEA, 2021)

5.10.3 Pre-construction badger survey

Should three years lapse since the 2021 baseline survey before construction commences, all work areas will be subject to a pre-construction survey for badger. This survey will give particular focus to the afforested part of site where badger is most likely to occur (and where full survey was not achieved in the 2021 baseline survey due to difficulty of access through dense conifer plantation).

5.10.4 Bat monitoring

Bat mitigation measures during the Operational Phase can be reviewed by implementing a strict surveillance programme for the first three years of operation of the wind farm in order to identify if there exists a substantial risk at a particular turbine location or during a particular time-period (3 years - as per recommendation of SNH, 2021 guidelines). This surveillance will then be repeated at Year 10 and Year 20 of the operation of the wind farm to ensure the efficacy of the mitigation being implemented. This surveillance required is as follows:

- Bat activity surveillance

  The level of bat activity will be monitored for a minimum of 10 nights at each turbine location (ground level) during three of the eight-month activity period (March/April to October/November). The surveillance periods will be divided into three survey periods to represent the three main periods where bat collisions have been documented: Spring (April/May); Summer (June/July) and Autumn (August/September).
- Carcass search

  During the surveillance periods of specific wind turbines, carcass search will be conducted for a minimum of 1 morning per turbine (i.e. 3/4 mornings in total over the 1 year surveillance i.e. one per surveillance period). For each turbine, the search area will be 100 m radius after ideal bat foraging weather conditions (mild, calm and dry weather and greater than 10°C). A scavenger trial is required to facilitate analysis (as per SNH, 2021 guidelines).
- Assessment of static data will be completed using the online tool *EcoBat Tool* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by SNH, 2021 or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

5.11 SUMMARY OF SIGNIFICANT RESIDUAL EFFECTS

From the perspective of Biodiversity, the principal residual effect as a result of the proposed wind farm project is the permanent loss of approximately 2.5 ha of wet heath and blanket bog habitat, which includes areas of dry heath and outcropping silicious rock (all Annex I listed habitats) – this adverse effect is considered Significant and of Long-term duration at the County Level. With implementation of a Habitat Enhancement Plan to compensate for the loss of habitat, the significance of the loss is reduced.

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6 AQUATIC ECOLOGY

6.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Figure 1.2**) on Aquatic Biodiversity. The Project refers to all elements of the Inchamore Wind Farm (**Chapter 2: Project Description**) including the Grid Connection Route and the Turbine Delivery Route. This chapter will identify, describe and assess the direct and indirect effects of the Project on aquatic biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC". Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Project:

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

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** This chapter of the EIAR is supported by Figures provided in Volume III.

A detailed Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1.** This document includes all of the mitigation prescribed within the EIAR. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1.**

6.1.1 Statement of Authority

This chapter has been written by Paul Murphy of EirEco Environmental Consultants who also undertook the aquatic field surveys and Freshwater Pearl Mussel surveys. He holds an MSc in Environmental Science and a Diploma in Aquatic Biology, is a Chartered Environmentalist (Society for the Environment), a full member of the Chartered Institute of Ecology and Environmental Management and a member of the Institute of Fisheries Management. Paul has been operating in the environmental field for over three decades covering a broad range of projects in a variety of countries. He has expert knowledge of the various EU Environmental Directives and extensive experience in Environmental Impact Assessment and ecological mitigation design for numerous major infrastructural schemes (roads, bridges, power plants, wind farms, etc.).

Karen Banks assisted during the Freshwater Pearl Mussel survey as bankside recorder. Karen is a professional ecologist with 15 years' experience in the field of ecological assessment and holds a BSc in Environment and Development from Durham University, and is a full member of the Chartered Institute of Ecology and Environmental Management.

Electro-fishing surveys were undertaken by Ross Macklin (Triturus Environmental Ltd.) and John Brown (Stillwater's Consultancy). Ross is an environmental scientist who specialises in freshwater and fisheries ecology, in addition to informing engineering solutions for construction works on rivers, including site improvement and rehabilitation. He has fifteen years professional experience and holds a PhD and BSc. John is a retired Inspector of Fisheries in the Fisheries Research Centre of the Department of Fisheries and Forestry, and Head of the Stock Assessment Section in the Marine Institute. He established Stillwaters Consultancy in 1999 to provide fisheries management and water quality advice to the public and private sector.

The assessments in this chapter, together with the desktop study outlined in Section 6.2.1.2 and the field investigations outlined in Section 6.2.1.4 are considered adequate to allow the Council to carry out an assessment of the Development.

6.1.2 Assessment Structure

In line with the revised EIA Directive and EPA 2022 Guidelines on the information to be contained in Environmental Impact Assessment Reports, the structure of this Aquatic Biodiversity chapter is as follows:

- Assessment Methodology and Significance Criteria.
- Description of baseline conditions at the Site.
- Identification and assessment of impacts to Biodiversity associated with the Development, during the construction, operational and decommissioning phases of the Development.
- Identification of cumulative impacts if and where applicable
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual impact of the Development considering mitigation measures.

6.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

6.2.1 Assessment Methodology Aquatic Biodiversity

6.2.1.1 Guidance

The general approach used for the evaluation of ecological receptors and assessment of potential impacts for this current assessment is based on the '*Guidelines for Ecological Impact Assessment in the UK and Ireland*' (CIEEM, 2018). The evaluation of ecological receptors contained within this report uses the geographic scale and criteria defined in the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009).

Effects were considered to be either significant or not significant at a geographic scale equivalent to or less than the conservation importance of the ecological feature being assessed (Chartered Institute of Ecology and Environmental Management, 2018). Duration of impacts is considered according to Environmental Protection Agency (EPA) guidance (EPA, 2022). The magnitude of an impact will depend on the nature and sensitivity of the ecological features and will be influenced by intensity, duration (temporary/permanent), timing, frequency and reversibility of the potential impact (CIEEM, 2016).

6.2.1.2 *Desktop Study*

A review was completed of existing data and records for fish, protected aquatic species and habitats (including Annex II species and aquatic Annex I habitats), and invasive species (listed under the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011)) on watercourses hydrologically connected (i.e., downstream) of the Development. The main sources of information are the National Biodiversity Data Centre and National Parks and Wildlife Service websites.

6.2.1.3 *Consultations*

A sensitive species data request was made to the NPWS for aquatic flora and fauna within 10 km grid squares IW17 and IW27 on 13th March 2023. Consultations were also undertaken with Inland Fisheries Ireland in relation to existing data on fish stocks and in relation to concerns or requirements vis-a-vis the Development. Licence applications were submitted to NPWS in relation to Stage 1 survey for Freshwater Pearl Mussel and to IFI in relation to Electro-fishing surveys.

6.2.1.4 *Field Survey*

Zone of Influence

The Zone of Influence (ZOI) differs for different habitats and species. Within terrestrial habitats, the ZOI may be confined to the study area, whereas for aquatic habitats, the ZOI will be much more extensive and the surveys undertaken were scoped accordingly. In view of hydrological connectivity, this entailed establishing the baseline conditions in aquatic habitats at a range of points downstream in the various watercourses draining the site and is reflected in the range and extent of surveys undertaken. An Appropriate Assessment Screening Report and Natura Impact Statement have been prepared as part of this application which assesses potential impacts on European designated sites (the Natura 2000 network), a number of which are hydrologically connected via surface water flow.

Aquatic Habitats

A survey of watercourses at the Site and within a potential zone of influence of the Development and for c. 500 m downstream was undertaken on 3rd June 2020 and on the 14th and 15th July 2020. The surveys identified and mapped aquatic habitats, determined fisheries value and potential, and determined presence or suitability for Annex listed species or invasive alien species. The aquatic habitat assessment conducted at all sites was based on the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003'* (EA, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland'* (Fossitt, 2000). All sites were assessed in terms of:

- Stream width, depth and other physical characteristics.
- Substrate type, listing substrate fractions in order of dominance, i.e., bedrock, boulder, cobble, gravel, sand, silt etc.
- Flow type, listing percentage of riffle, glide and pool in the sampling area.
- In-stream macrophyte, bryophytes occurring and their percentage coverage of the stream bottom at the sampling sites.
- Riparian habitats and species composition.

A Biosecurity protocol was rigidly followed to avoid the potential for transfer of invasive alien species to or from the site in accordance with guidance produced by Invasive Species Ireland and Inland Fisheries Ireland (Decontamination and Disinfection procedures for equipment and personnel). A specific Biosecurity Method Statement was produced for the survey operation.

Electro-fishing Survey and Fisheries Habitat Assessment

Electro-fishing was undertaken at six (6 No.) locations on watercourses downstream of the wind farm site under Section 14 authorisation (dated 9th July 2020) from the Department of Communications, Climate Action and Environment. The electro-fishing survey was undertaken by Ross Macklin (Triturus Environmental Ltd.) and John Brown (Stillwater's Consultancy). A single anode Smith-Root LR24 backpack (12V DC input; 300V, 100W DC output) was used to electro-fish a total of six sites on the Inchamore Stream within the Sullane catchment.

The electro-fishing survey is considered adequate for the following reasons: As three primary species groups were targeted during the survey, i.e., salmonids, lamprey, and eel, the electro-fishing settings were tailored for each species. By undertaking electro-fishing using the rapid electro-fishing technique, the broad characterisation of the fish community at each sampling reach was determined. Electro-fishing methodology followed accepted European standards (CEN, 2003) and adhered to best practice (e.g., Central Fisheries Board, 2008). Stations were

selected on the basis of representative and accessible locations along each of the watercourses within or draining the Development. Each station was fished over a length of 30 m of channel with a series of three electro-fishing passes (these are shown as the upstream and downstream extents in **Figure 6.1**). All captured fish were removed from the water using dip nets with insulated handles and transferred into water filled plastic bins. All specimens fished were anesthetized to facilitate identification, age class and length measurement before being subsequently returned to the water. Photographs of each survey location were recorded.

Given the occurrence and ecological implications of a number of aquatic invasive alien species and diseases throughout the country, appropriate measures were undertaken to ensure there was no risk of transfer of any alien invasive species or diseases to or from the survey locations. Guidance produced by Invasive Species Ireland and Inland Fisheries Ireland (*Decontamination and Disinfection procedures for equipment and personnel*) in relation to reducing the risks of spread was adhered to rigorously and a specific Biosecurity Method Statement was produced for the fish survey operation.

The river channel morphology, substrate and flow regime were assessed to determine the suitability of the habitat for spawning or as nursery habitat by salmonids and other species including lamprey and ammocoete larvae in marginal silt beds. The presence and abundance of aquatic vegetation in the river was recorded and a species list compiled. A photographic record was made with locations noted on the field maps.

Freshwater Pearl Mussel Stage 1 Survey

On the basis of the known distribution of Freshwater Pearl Mussel (FPM) within the catchment of the Development derived from consultation with NPWS, a review of OSI mapping and aerial imagery was undertaken to identify potentially suitable locations for survey. A licence application to carry out a Stage 1 Survey was submitted to NPWS and this was subsequently received (Licence No. C171/2020). Field maps and data sheets were prepared and the NPWS Divisional Manager was notified in advance of the proposed survey. The surveys were undertaken on 14th, 15th and 16th July 2020 using the NPWS Stage 1 methodology (presence/absence survey) detailed in the Irish Wildlife Manual No. 12 (2004) aimed specifically to establish presence or absence at eight locations. At each survey location a total length of c. 200 m was intensively searched using a bathyscope wading in an upstream direction covering areas of fast flowing water, glides and pools. Specific attention was given to areas under overhanging vegetation where mussels frequently are found in rivers subject to periodic algal growth. Bankside shingle banks were also surveyed for dead shells where they occurred. The operation was undertaken by two people with one operator instream (Paul

Murphy) and one bank-side recorder (Karen Banks). The surveys were carried out in conditions of moderate flow though with high water clarity. The weather during the survey period was generally bright and sunny with occasional cloudier periods.

Biotic Index (Q Value) Macro-invertebrate Assessment

Water quality was assessed using the Q Value biotic index system at the six locations sampled for electro-fishing on each of the watercourses draining the wind farm. This standardised approach for the biological assessment of water quality as used by the Environmental Protection Agency is based on the composition of the macroinvertebrate community which inhabit the substratum of rivers and streams. These comprise in the main, immature aquatic stages of insects, together with crustacean (shrimps), molluscs (snails and bivalves), oligochaetes (worms) and hirudinea (leeches). Shallow, fast-flowing stretches of riffle habitat are sampled in preference to non-riffle areas as they show most clearly the water quality status and effects of pollution. For assessment purposes the invertebrate communities are divided into four groups – sensitive, less sensitive, tolerant and very tolerant forms. The relative proportions of the various organisms in samples are determined and the water quality status is inferred by comparison with the expected ratios in unpolluted habitats of the type under investigation. The assessment procedure also takes into account other relevant factors such as the intensity of algal and or / aquatic plant growth, water turbidity, bottom siltation, nature of the sub-stratum, speed of current, and water depth. The biological information is then condensed to readily understandable form by means of a 5-point biotic index (Q values) in which invertebrate diversity and water quality are related as outlined in **Table 6.1**. Intermediate values (e.g., Q3-4) are used to describe conditions where appropriate.

Table 6.1: EPA Water Quality and Status Summary (EPA, 2010)

Biotic Index	Quality Status	Water Quality	WFD Ecological Status
Q5	Unpolluted	Good	High
Q4-5	Unpolluted	Fair-to-Good	High
Q4	Unpolluted	Fair	Good
Q3-4	Slightly Polluted	Doubtful-to- Fair	Moderate
Q3	Moderately Polluted	Doubtful	Poor
Q2-3	Moderately Polluted	Poor-to-Doubtful	Poor
Q2	Seriously Polluted	Poor	Bad
Q1-2	Seriously Polluted	Bad-to-Poor	Bad

6.2.1.5 *Ecological Evaluation and Impact Assessment Methodology*

The evaluation of the key ecological receptors and the criteria used to assess the significance of impacts are derived from the Guidelines for Assessment of Ecological Impacts on National Road Schemes (TII, June 2009) (the "TII Guidelines"), Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA, May 2022) (the "EPA Guidelines") and the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2016) (the "CIEEM Guidelines").

The criteria used for assessment of the value of the ecological resources sets out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular site is of importance on the following scale:

- International Importance;
- National Importance;
- County Importance;
- Local Importance (Higher Value), and
- Local Importance (Lower Value).

Receptors of Local Importance (Lower Value) contain habitats and species that are widespread and of low ecological significance and of importance only in the local area. Internationally Important sites are either designated for conservation as part of the Natura 2000 network, i.e., Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) or provide the best examples of habitats or internationally important populations of protected flora and fauna.

The CIEEM Guidelines define a significant effect as, "an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'...or for biodiversity in general". The criteria used for assessment of impacts are as follows while the Criteria for Assessing Impact Significance are presented in **Table 6.2**:

Positive or Negative: Positive and negative impacts/effects should be determined according to whether the change is in accordance with nature conservation objectives and policy;

Extent: Extent should be predicted in a quantified manner and relates to the area over which the impact occurs;

Magnitude: Magnitude refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population;

Duration: Duration is intended to refer to the time during which the impact is predicted to continue, until recovery or re-instatement (which may be longer than the impact-causing activity). Duration should be defined in relation to ecological characteristics (such as a species' lifecycle);

Frequency and Timing: The timing of impacts in relation to important seasonal and/or life-cycle constraints should be evaluated. Similarly, the frequency with which activities (and concomitant impacts) would take place can be an important determinant of the impact on receptors and should also be assessed and described;

Reversibility: An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

Likelihood:

- Certain/Near Certain: >95% chance of occurring as predicted;
- Probable: 50-95% chance as occurring as predicted;
- Unlikely: 5-50% chance as occurring as predicted and
- Extremely Unlikely: <5% chance as occurring as predicted.

Table 6.2: Criteria for Assessing Impact Significance (EPA, 2022)

Impact Magnitude	Definition
No change	No discernible change in the ecology of the affected feature
Imperceptible Impact	An impact capable of measurement but without noticeable consequences
Slight Impact	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate Impact	An impact that alters the character of the environment that is consistent with existing and emerging trends
Significant Impact	An impact which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment
Profound Impact	An impact which obliterates sensitive characteristics

6.3 BASELINE DESCRIPTION

6.3.1 Aquatic Environment

6.3.1.1 Aquatic Habitats

The Proposed Wind Farm Site

The Site lies entirely within the Inchamore Stream sub-catchment where five tributaries flow into the Bardinch River which then joins the Sullane River, a tributary of the Lee. The Sullane River supports good populations of brown trout (*Salmo trutta*) with resident populations as well as larger fish running up from the reservoir downstream (O'Reilly, 2004). The catchment of the Development is listed as supporting extant populations of Freshwater Pearl Mussel (*Margaritifera margaritifera*). The watercourses within the proposed wind farm site itself are small 1st order tributaries which have high gradients and do not provide suitable habitat for fish or larger aquatic organisms. There are three minor watercourses within the site that will be crossed by the proposed road network within the site, all of which will entail clear-span structures and thus will not interact with the waterbodies and will avoid instream works.

Grid Connection Route

The Grid Connection Route is 19.9 km in length and traverses in an east to south easterly direction from the existing Ballyvouskill 220 kV substation to the Inchamore Wind Farm substation location utilising public local road networks, and existing forestry access tracks. There are three minor streams along the length of the Grid Connection Route (refer to planning drawings 05934-DR-201-210) which will be crossed by horizontal directional drilling (HDD) thereby avoiding any instream works. These are small watercourses with no fisheries value or the potential to support any protected aquatic species. Other minor watercourses (streams and drainage ditches) along the length of the route will be crossed on existing culverts as they have adequate depth of fill to accommodate the cable.

Turbine Delivery Route

The Turbine Delivery Route (TDR) extends from Ringaskiddy Port to the Site via the N28, N40 and N22, and from there onto an upgraded forestry road as shown on **Figure 2.5**. The TDR is on a public road and crosses innumerable existing watercourses – all on existing bridges / culverts and with no requirement for modification to the watercourses to enable turbine delivery.

6.3.1.2 *Electro-fishing Survey and Fisheries Habitat*

The six locations of watercourses surveyed by electro-fishing is shown in **Figure 6.1**. A description of the aquatic and riparian habitats at each site and summary of the results of the electro-fishing survey with an appraisal of their ecological value is presented below.

Site1. Inchamore Stream (Sullane Catchment) (photos of locations provided below in Table 6.3)

Site 1 was situated in an upland eroding stream (FW1) with 1.5 m water width and was predominantly shallow (0.1 m to 0.4 m depth). The bank heights were variable between 1.0 m and 3.0 m. The channel comprised of boulder cascade reaches with equal proportions of pool, riffle and glide. The bed was boulder and cobble dominated with very localised pockets of coarse gravels and medium energy (reflective of the higher gradient and higher energy environment). The bed comprised loose (unconsolidated) bed material with low siltation levels. The riparian areas comprised of semi-improved grassland (wet in nature) and were predominantly sheep grazing lands. The channel was open with no overhanging trees, and bordered by open pasture (i.e., semi-improved grassland as previously described).

From a fisheries perspective the small upland spate stream could be considered a moderate to good quality brown trout nursery. The stream had a good semi-natural profile with holding and nursery habitat being good overall for an upland trout stream. Spawning areas were as expected for a stream of this nature, being localised and restricted to small pockets in pools between boulder areas. Overall spawning potential can be considered moderate within the survey reach.

Site 2. Inchamore Stream (Sullane Catchment)

Site 2 was an upland eroding stream (FW1) that had 1.5 m to 2.0 m water width. The stream was predominantly shallow (0.1 m to 0.3 m depth). The bank heights were typically 1.5 m high. The channel was of high energy with dry boulder and cobble bars indicating much higher winter flows. The bed was boulder and cobble dominated with frequent pockets of coarse, medium and fine gravels. The stream gradient was lower than site 1 and had higher proportions of gravel. The bed comprised loose (unconsolidated) bed material but siltation levels were moderate with evident silt deposition in pools. The riparian areas comprised of semi-improved grassland.

From a fisheries perspective the upland spate stream could be considered a moderate to good quality brown trout nursery but this was not reflected in the fish population recorded. It is considered that land use practices may have impacted the stream fish population (e.g.,

heavily afforested upstream catchment). The stream had a good semi-natural profile with holding and nursery habitat being good overall for an upland trout stream. Spawning areas were locally good with mixed unconsolidated gravels at pool tailings. Overall spawning potential can be considered good within the survey reach for brown trout. Surprisingly recruitment was much poorer than would be expected for a stream of this nature as reflected in the fisheries demographic.

Site 3. Inchamore Stream (Sullane Catchment)

Site 1 was an upland eroding stream (FW1) that had a 1.0 m water width. The stream was predominantly shallow (0.1 m to 0.2 m depth) with bank heights typically between 2.0 m to 2.5 m high. The channel was of very high energy with boulder cascade reaches. The profile comprised of 50% pool, 10% riffle and 40% glide. The bed was boulder and cobble dominated with locally frequent pockets of coarse, medium and fine gravels. These were most common in the glide tailings of pool. The stream gradient was steep and higher than at sites 1 and 2. The bed comprised loose (unconsolidated) bed material and siltation levels were low. The riparian areas were either open (east bank) or comprised dense grey willow stands with scattered Sitka spruce, gorse and bramble. The upstream catchment comprised of gorse scrub and conifer plantation.

From a fisheries perspective the upland spate stream could be considered a lower quality brown trout nursery given very high energy and smaller size. The stream had a good semi-natural profile with holding being good overall for an upland trout stream. Spawning areas were locally good with mixed unconsolidated gravels at pool tailings. However, despite relatively good habitat characteristics for an upland brown trout stream, the recorded population was very small (single adult recorded). The high energy and small upland nature of the stream likely accounted for the lower fisheries value overall.

Site 4. Inchamore Stream (Sullane Catchment)

Site 4 was an upland eroding stream (FW1) site that had a 1.0 m water width widening locally to 1.5 m and had an average depth of 0.2 m. The river was bank heights were typically 1.0 m to 1.5 m high. The river had a sinuous profile with no evident historical modifications at the survey area. The channel was of high energy with boulder cascade areas with equal proportions of pool, riffle and glide. The bed was dominated by boulder and cobble. Pockets of coarse and medium gravels were present in pool and glide areas behind boulders. The stream gradient was high and similar to site 1. The riparian areas comprised of willow, bracken and bramble scrub with frequent fuchsia. The site was bordered by improved pasture (GA1; sheep grazing).

From a fisheries perspective the stream could be considered a moderate quality brown trout nursery given the smaller size and shallower depth. The stream however had a well-defined profile, with good sinuosity and riffle, glide and pool sequences. The substrata while dominated by boulder and cobble had good areas of mixed coarse and medium gravels for spawning. Consequentially, the river spawning was considered good. Holding habitat value was also locally good.

Site 5. Inchamore Stream (Sullane Catchment)

Site 5 was an upland eroding river (FW1) site that had a 4.0 m water width and an average depth of 0.3 m. The river had bank heights that were1.0 m to 1.5 m high. The river was historically straightened along the road with boulder armour present. However, the river exhibited excellent recovery with a good semi-natural profile with clean unbedded substrata. The channel was of moderate energy with exposed bedrock, large boulders and cobbles present but was not cascading as with upstream areas. Pockets of coarse and medium gravels were present in pool and glide areas behind boulders. The profile comprised of 30% shallow pool, 50% glide and 20% riffle. No macrophytes were present in the channel but *Fontinalis squamosa* moss was frequent on instream boulders. The stream gradient was significantly lower than upstream sites (i.e., Sites 1, 2 and 3) resulting in improved spawning potential. The riparian areas comprised of mature willow with bracken and bramble scrub.

From a fisheries perspective the river could be considered a good quality brown trout nursery given the larger size and good river profile with mixed pool, glide and riffle sequences. The river had good riparian cover that improved the holding value in deeper glide and shallow pool areas between boulder and bedrock. The river spawning was considered good with mixed unconsolidated gravels in pool areas behind bedrock and boulder.

Site 6. Inchamore Stream (Sullane Catchment)

Site 6 was an upland eroding river (FW1) site that had a 6.0 m water width and an average depth of 0.3 m but deepened to 0.8 m locally. The river had bank heights that were 1.0 m to 1.5 m high. The channel was of moderate energy with exposed bedrock, large boulders and cobbles present but was not cascading as with upstream areas. Pockets of coarse, medium and fine gravels were present in pool and glide areas behind boulders. The profile comprised of 30% pool, 50% glide and 20% riffle. No macrophytes were present apart from localised *Myriophyllum* species. The moss species *Fontinalis squamosa* was localised. The river gradient was significantly lower than upstream sites and was similar to site 5, meaning spawning potential improved. The riparian areas comprised of mature willow and gorse

with scattered mature Sitka spruce. The banks were however more open immediately downstream of the bridge and the river was adjoined by improved pasture (GA1).

From a fisheries perspective the river could be considered a very good quality brown trout nursery given the larger size and good river profile with mixed pool, glide and riffle sequences. The spawning habitat was considered good given large pockets of coarse, medium and fine gravels in glide areas and also in pools. The nursery habitat was also very good given the presence of abundant shallow glide and riffle sequences. Holding habitat as with nursery habitat and spawning habitat was also very good. The combination of very good, nursery, spawning and holding habitat was reflected in the mixed cohort fish population recorded.

6.3.1.1 Freshwater Pearl Mussel Stage 1 Survey

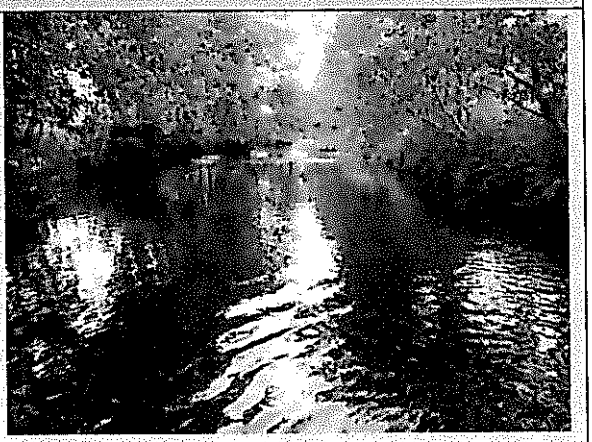
The known distribution of Freshwater Pearl Mussel (*Margaritifera margaritifera*) (FPM) in the catchment is shown in **Figure 6.2** based on records provided by the NPWS (2020). The nearest records of FPM to the wind farm site are on the River Sullane at Coolea approximately 6 km downstream of the Site.

A total of eight locations (see **Figure 6.3**) were surveyed for FPM using a bathyscope wading in an upstream direction over a length of c. 200 m of river bed at each site. Each location was subject to an intensive search which included examination of shingle banks where they occurred for evidence of dead shells. The results of the survey are detailed in **Table 6.3** which presents an overview of each survey location including a description of the aquatic and riparian habitats, and a photograph showing a typical view of the survey area.

No evidence of freshwater pearl mussels was recorded from any of the transect locations surveyed for the Project with the exception of a single dead shell on the Sullane River at a point upstream of the Bardinch Confluence at Site 6, where anecdotal records of mussels having existed in the past were reported by a landowner. A section of the Sullane River c. 500 m downstream of Mahony's Bridge (not within the drainage catchment of the wind farm) was surveyed on the basis of this information though no live mussels were recorded despite the apparent suitability of the habitat.

Table 6.3: Summary results of Stage 1 Freshwater Pearl Mussel survey on watercourses draining the proposed Inchamore Wind Farm

Site number	Grid ref.	Description and Results	Overview Photograph
1	512016 577418	Inchamore Stream W=5-7 m. Cobble and gravel with occasional boulder. Series of mini-cascades and riffles with small pools. Banks open with wet heath and gorse scrub. Subject to spate flows. Accessed by cattle. No FPM recorded and conditions considered unsuitable.	
2	512775 577171	Inchamore Stream W=7-8 m. Boulder, cobble and gravel substrate. Small cascades and pools. Fontinalis abundant. Subject to spate flows. Banks open with rushy grassland and gorse scrub. Accessed by cattle. No FPM recorded and conditions considered unsuitable.	
3	513612 577141	Inchamore tributary W=1.5-2 m. Small boulders, cobble and gravel. Numerous small cascades. Banks steep and heavily tunnelled with overhanging vegetation including willow, gorse, bracken and ruderals. No FPM recorded and conditions considered unsuitable.	

Site number	Grid ref.	Description and Results	Overview Photograph
4	513741 576826	Inchamore Stream W=7-8 m. Small boulders, cobble and gravel, with occasional exposed bedrock. Pools, glides and occasional small cascade. Banks with boulder reinforcement along road, heavily vegetated with willow dominated scrub. No FPM recorded but conditions considered potentially suitable in pockets.	
5	513972 576138	Bardinch River W=10 m. Cobble and boulders with pockets of gravels. Layer of fine silt on substrate. Riffles with small cascades and occasional pools. Myriophyllum beds occasional. No FPM recorded but conditions considered potentially suitable.	
6	514901 575718	Sullane River W=12 m. Sands, gravels and occasional cobbles with silt layer. Pool and gentle glide. Ranunculus, Myriophyllum and Callitriche occasional. Banks tree-lined with adjacent grassland pasture. One dead mussel shell recovered. Potentially suitable habitat and anecdotal records from landowner of mussels present in the past.	

Site number	Grid ref.	Description and Results	Overview Photograph
7	514976 575894	Bardinch River W=20 m. Cobbles with pockets of gravel. Riffle and glide habitat, with evidence of channel being artificially straightened. Algae on substrate. Banks with low scrub fringe and adjacent improved pasture. No FPM recorded but potentially suitable habitat.	
8	516148 575963	Sullane River W=15-25 m. Boulder, cobbles and pockets of gravel / sands. Fontinalis and Ranunculus frequent. Series of cascades with large boulders transforming to deep pool conditions with soft substrates downstream. Banks with woodland cover, subject to active clearance on the east of the river downstream of Milleeny Bridge. No FPM recorded but potentially suitable habitat.	

6.3.1.2 *Biotic Index (Q Value) Macro-invertebrate Assessment*

Water quality was assessed using the Q Value biotic index system at the eight locations sampled for electro-fishing (see **Figure 6.1**) on each of the watercourses draining the Site The results are presented in **Table 6.4** which gives their Q Value and corresponding Water Framework Directive status (see **Table 6.1** above).

The most recent EPA data available for the Sullane River at Milleeny Bridge near Coolea (Site 8 of the FPM survey) is from 2017 when the river was given a Q4-5 equating to high quality. The river maintained its high quality status downstream as far as Macroom where a Q4 (good status) was recorded.

All watercourse sampled were in High status with good macroinvertebrate diversity and no evidence of algal cover or excessive macrophyte growth. The watercourses are all high energy reflecting the topography and high levels of rainfall within the catchments.

Table 6.4: Water Quality Assessment of Watercourses (Q Value and WFD Ecological Status)

Site No.	Q Value	WFD Ecological Status	Comments
1	4-5	High	1.5 m width, 0.1 m to 0.4 m depth, banks 1.0 m and 3.0 m. Riffle, glide and pool with boulder cascade reaches. Substrate boulder and cobble dominated with pockets of gravels. No macrophytes. Macroinvertebrate diversity good with abundant flattened mayfly, stonefly and cased cadis.
2	4-5	High	1.5 m to 2.0 m width, depth 0.1 m to 0.3 m, bank heights 1.5 m. High energy channel with dry boulder and cobble bars indicating higher winter flows, forming series of pools with riffle sections. Substrate boulder and cobble dominated with frequent pockets of gravels, and moderate silt deposition in pools. No macrophytes. Macroinvertebrate diversity good with abundant flattened mayfly, frequent stonefly, cased cadis and blackfly.
3	4-5	High	1.0 m width, depth 0.1 m to 0.2 m, bank height 2.0 m to 2.5 m. High energy channel with boulder cascade reaches and riffle, glide and pool sequence. Substrate boulder and cobble dominated with pockets of gravels. No macrophytes. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly, cased cadis, beetle and blackfly.
4	4-5	High	1.0 – 1.5 m width, depth 0.2 m, bank heights 1.0 m to 1.5 m. High energy channel with boulder cascade and riffle, glide, pool sequence. Substrate dominated by boulder and cobble with pockets of gravels. No macrophytes. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly and cased cadis.
5	4-5	High	4.0 m width, depth 0.3 m, bank heights 1.0 m to 1.5 m. Historically straightened channel adjacent road but with good semi-natural profile and riffle, glide, pool sequence. Substrate exposed bedrock, large boulders and cobbles with pockets of gravels. No macrophytes but frequent willow moss. Macroinvertebrate diversity high with abundant flattened mayfly, stonefly, cased cadis, blackfly and beetle larvae.
6	4-5	High	6.0 m width, depth 0.3 m to 0.8 m, bank heights 1.0 m to 1.5 m. Moderate energy channel with exposed bedrock, large boulders and cobbles, and pockets of gravels. Riffle, glide and pool sequence. Occasional water milfoil and willow moss. Macroinvertebrate diversity good with abundant flattened mayfly, frequent stonefly, cased cadis, water louse, beetle larvae and molluscs.

6.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

A more in-depth discussion of water quality is provided in **Chapter 9: Hydrology and Hydrogeology**. The focus in this section is on the effects on aquatic species and ecology. Groundwater pathways are not considered an issue for the Development on account of the underlying geology (Devonian sandstones) and the area is mapped as low vulnerability by the EPA (EPA Maps).

6.4.1 The 'Do-Nothing' Impact

If the Development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'do-nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices.

6.4.2 Construction Phase Potential Effects

A full description of the Project is given in **Chapter 2: Project Description**. A summary of potential sources of direct impacts on aquatic ecology during the construction and decommissioning stage include:

- Clearance of vegetation, soil and rock for widening and construction of access roads, hardstand and turbine bases with associated impacts on the drainage network and site run-off on water quality within the watercourses onsite and downstream;
- Clear-fell of approximately 26.43 ha coniferous forestry mostly consisting of Sitka Spruce or Lodgepole Pine with potential effects of felling on water quality as a result of sediment and nutrient release;
- Crossing of watercourses within the proposed site and along the grid connection route;
- Placement and storage of material arising from infrastructure works;
- Access by construction equipment, including access away from the proposed infrastructure location (compaction and other damage);
- Potential for accidental spillage of hydrocarbons and other pollutants including concrete laitance;
- Potential of peat slippage or failure, and,
- Removal of infrastructure at decommissioning stage.

All construction activities have the potential to cause negative effects to receiving watercourses and aquatic species and habitats as a result of the release of suspended solids, concrete and hydrocarbons in run-off. The potential for increased silt loads could negatively impact on water quality, salmonid spawning habitat and Freshwater Pearl Mussel

(FPM) populations in the downstream reaches, with the scale of impact being proportionate to the scale and duration of siltation.

Wind Farm Site

The principal potential construction phase effects of the development relate to the release of sediments into the drainage network arising from all construction related site works including the access road network, turbine bases and associated hardstands, drainage network, sub-station building, borrow pits and repository areas, and the grid connection route. The Turbine Delivery Route will utilise the existing road network with no modifications of watercourses or potential impacts on any watercourses along its entire length. There is a minor risk of nutrient release as a result of the clear-fell of conifers (26.43 ha) required for the proposed development though this is of a minor scale in comparison to the normal forestry activities taking place at the Site due to the limited scale proposed. The most pertinent potential sources of impact on the aquatic environment are considered to be:

- The construction of three watercourse crossings within the site.
- Water quality degradation in surface and groundwater from siltation or other forms of pollutants associated with the construction phase including tree felling.

The three watercourse crossings on the proposed road network within the site are all on minor headwater streams which do not support fish stocks due to their elevation and gradients on downstream sections preventing access. All three watercourses will none-the-less be crossed with clear-span structures avoiding any requirements for channel modification or instream works. While the construction of these presents risks of sediment or other pollutants entering the watercourses and affecting water quality downstream, the structures themselves will not result in any significant loss of instream habitat or impede the movement of fish or other aquatic biota, including otter.

All turbine locations are located a minimum of 65 m from the nearest watercourse, while the borrow pit location is over 500 m from the nearest watercourse. No works will take place within a 65 m buffer zone of watercourses except for the three clear-span watercourse crossings on the proposed access track network.

Grid Connection Route

The connection of the wind farm to the national electricity grid, will be via 38 kV underground cable connection to the existing Ballyvouskill 220 kV Substation. Approximately 15.7 km of the route will be located along the route of an existing forestry road which runs parallel to the Clydagh River and entails the crossing of numerous small tributaries of the river. The

Clydagh River is within the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC.

For most of the watercourse crossings along the Grid Connection Route, as shown on planning drawings 05934-DR-201-210, there is sufficient depth over existing culverts to accommodate trenching of the cable within the road structure. This operation will result in no instream works and presents a low risk of generating suspended solids or other pollutants, which are readily controlled by mitigation. There are three water crossings along the Grid Connection Route which do not have sufficient depth of material on the existing culverts. To avoid instream works, these will be crossed by means of directional drilling technology. Details of the directional drilling procedure are outlined in **Chapter 2: Project Description (Section 2.9.5.2)**. This methodology addresses the potential risks of siltation or other pollutants entering the watercourses during the construction phase.

There are in addition, a number of minor ditches running under the existing road, which are either dry or have minimal flows, that will be crossed by damming the ditch upstream and over-pumping (if necessary) during the trenching operation. Without mitigation, these crossings present a temporary minor risk of sediment release and of other pollutants entering the Clydagh River downstream. To mitigate this risk, the trenching and laying of the grid connection pipe at these open crossings will be undertaken as a single operation which will be completed in a number of days. These works will be confined to dry periods during the summer months.

Freshwater Pearl Mussel

The nearest records of Freshwater Pearl Mussel (FPM) to the wind farm site are on the River Sullane at Coolea approximately 6 km downstream of the site. While the population of FPM are not within a Special Area of Conservation, in view of their Annex II Listed status, their unfavourable conservation assessment (NPWS, 2013) and being listed as critically endangered in the Republic of Ireland (Moorkens 2006), they are considered of international importance.

FPM also occur on the River Flesk (the lower reaches of the Clydagh River) and are a qualifying interest for the Killarney National Park, Macgillycuddy's Reeks and Caragh River Catchment SAC which extends to include the Clydagh River. The construction of the Grid Connection Route parallels the Clydagh River where it runs along an existing forestry track.

Fine sediment can affect adult FPM, as it interferes with filter feeding. It can also dramatically change the nature of a river bed where juveniles require water movement through gravel beds to obtain oxygen. Even short-term sedimentation is likely to kill all juveniles present (DAFM, 2018). In addition, nutrient-rich sediment may enter watercourses following felling, while the decomposition of harvest residue onsite can lead to the release of phosphorous for several years after harvesting.

Any impact on FPM as a result of construction phase activities is considered a medium term significant negative effect at the international scale. In view of the existing threats to water quality in the lower reaches of the Sullane River, effects on the FPM populations from siltation or other pollutants, may last longer than the impact-causing activity.

Salmonids

Salmonid species require very high levels of water quality in order to complete their life cycles. High levels of suspended solid concentrations in waterbodies can affect the feeding and health of individual species through increased turbidity (inhibiting respiration through gills) and increased siltation affecting composition of riverbed substrate (reducing fry survival) as well as affecting spawning beds. Suspended solids often hold nutrients such as phosphorus that can result in eutrophication and reduced oxygen levels, which can affect all life stages of Atlantic salmon. Aquatic invertebrate communities and aquatic macrophytes can also be affected by sediment loading which reduces both the biotic diversity and the food resource for fish populations through direct toxicity to fish and invertebrates, and also indirectly effecting top predators such as otter and kingfisher in downstream reaches through a reduction in prey availability.

Watercourse Crossings within the Wind Farm Site

Direct effects on watercourses within the wind farm site are limited to the crossing points of the road access network which will entail three separate watercourse crossings as shown in **Figure 6.4**. All watercourse crossings are on minor headwater streams at locations that are of limited fishery value on account of their small size and variable flow rates. Some also have potential barriers to fish movement in their lower reaches. The new proposed watercourse crossings have been designed on a bespoke basis in consultation with Inland Fisheries Ireland (IFI) (design calculations are presented in **Appendix 2.1** of the EIAR). The following approach and guidance were used in the sizing of the proposed watercourse crossings:

- Detailed mapping of drainage paths across the wind farm site has been undertaken; utilising topographical surveys, contour mapping and aerial photography.

- Hydrological assessments made using a number of methods including *Flood Estimation Handbook* (Statistical Analysis) and *Flood Studies Report* (FSR) where appropriate to determine the design flow.
- CIRIA *Culvert Design and Operation Guide* (C689).
- Inland Fisheries Ireland (2016) *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.*
- In addition, where planning consent is received a Section 50 Application will be submitted to Office of Public Works (OPW) for approval prior to works commencing on site (required to ensure unimpeded conveyance and storage capacities of channels and floodplains). It should be noted that the Section 50 application will be based on the details proposed in this application, subject to compliance with any conditions relating to the permitted development.

Without appropriate design and construction methodologies, the crossings would result in a loss of aquatic habitat or interfere with the connectivity of the watercourses. In addition, the construction works for the crossings would have the potential to give rise to water quality effects which would extend downstream to stretches with higher fisheries value and supporting freshwater pearl mussel populations. Pollutants entering the watercourses could result in direct mortality of aquatic biota with the scale and extent dependant on the volumes and toxicity of the pollutant. The potential for release of sediment, fine concrete particles and the spillage of hydrocarbons is primarily associated with the construction of watercourse crossings due to the set-backs of other infrastructure from the watercourses. The potential impact of sediment release in the absence of mitigation is therefore considered **short term but significant negative at the local scale**.

The three water crossings within the wind farm site will be clear span structures (as shown on **Planning Drawing No. 6226-PL-WC1 to 6226-PL-WC3** with the following design criteria:

- The clear span design is a segmented precast arch or similar and will avoid disruption to the stream bed and banks, protecting fishery habitats.
- The crossing direction will be perpendicular to the stream direction, therefore minimising the length of stream affected.
- The crossing detailed design allows for the passage of out-of-bank flood flows within the clear span.
- The crossing locations have been informed by the hydrological analysis and identification of constraints to:
  - Ensure location in an area where bank slopes are shallow, thus reducing the potential for runoff to carry sediment into the watercourse.

- Avoid locations with any incoming tributary streams.

- The structure shall include ledges or areas of undisturbed riverbank to allow for the free passage of otters.

The clear span design of the crossings will not affect instream aquatic habitat or interfere with the passage of fish or other aquatic fauna.

A number of existing minor drains along the existing Site Access Road network within the site will require upgrading to accommodate the increased width of the road. These are minor surface drains which are mainly dry and receive flows only following heavy rainfall events. However, due to their connectivity to the more important lower reaches in the catchment, appropriate mitigation measures as detailed in Section 6.5 below will be required during the track upgrade stage to avoid siltation or other pollutants entering the drainage network. The existing drainage network is shown on **Figure 9.2 (a) Surface Water Network Wind Farm.**

Invasive Alien Species

Machinery required for construction activities also poses a risk as a vector for the introduction and spread of invasive non-native species (e.g., Himalayan balsam, Japanese knotweed) to watercourses, which would have negative effects on aquatic ecology and riparian habitats. There are no records or evidence of any invasive plant species recorded from the Site or its surrounds.

Peat Slippage

The risk of peat failure or slippage occurring on the Site during the construction phase has been analysed by RSK Group as part of the hydrogeological assessment (**Chapter 9**). The depth of peat has informed the layout of the Site and all areas of deep peat have been avoided. The risk of peat failure is therefore considered to be very low to low due to the overall shallow nature of the peat deposits in the works zone.

Summary Assessment

In the absence of mitigation, potential impacts on the aquatic environment are classified as being **medium term significant negative** at the international scale on account of the sensitive freshwater pearl mussel populations in the downstream catchments and the value of the lower reaches of the watercourses for salmonids.

6.4.3 Operational Phase Potential Effects

There is potential for effects on watercourses within the wind farm site during the operational phase due to ongoing activities and maintenance of permanent site drainage. The risk to watercourses during the operational phase of the wind farm is considered slight and would primarily arise from the use of oils and lubricants for infrastructure maintenance either through accidental spillage or inappropriate disposal. These effects are already described for the construction phase of the development in **Section 6.4.2** above. Impacts on water quality and aquatic habitats occurring during the operational phase are not considered likely in view of the distance between the turbines and substation and watercourses (>65 m) and the measures detailed in Section 6.5.3 below. Site maintenance activities such as road repair and drainage network maintenance may give rise to a localised risk of sediment release, but again, this risk is considered to be very unlikely in view of the infrequency and limited scale of such operations.

Taking this into account, the potential for secondary effects on watercourses resulting from the unmitigated operational phase of the wind farm site is considered to be imperceptible. There will be no operational effects from the Grid Connection Route once the cable laying process is complete, though any repairs or maintenance would be required to adopt the same approach and mitigation as for the construction phase.

6.4.4 Decommissioning Phase Potential Effects

The decommissioning phase of the Site (as described in in **Chapter 2: Project Description**, Section 2.9 and the Decommissioning Plan, which is included as part of the CEMP in **Appendix 2.1**) poses a similar suite of potential risks with less likelihood of potential effects on the aquatic environment as the construction phase, though in view of the presence of the road network and associated infrastructure, the resultant scale of impact is considered to be much lower. In the absence of mitigation, the potential impact on the aquatic environment is considered to be a moderate short-term negative impact at the local scale.

6.5 MITIGATION MEASURES

6.5.1 Embedded Mitigation

The entire development proposal incorporates embedded mitigation aimed at minimising the potential impacts during the design phase. This includes the design principle of maintaining set-backs of 65 m for turbines and associated infrastructure from watercourses and utilising existing forestry access tracks, rather than constructing new tracks, where feasible.

6.5.2 Construction Phase Mitigation

6.5.2.1 Mitigation by Avoidance

The greatest risk of negative impacts on the aquatic environment will occur during the construction phase of the development. Key to minimising this risk has been the siting of all works, including turbine locations and other key infrastructure at a minimum set-back from watercourses (65 m). In designing the layout of the access roads, careful consideration has been given to minimise the numbers of watercourse crossings and in choosing locations where crossing design can readily achieve the objective of maintaining the potential for unimpeded fish pass and ecological connectivity. The layout (as assessed in **Chapter 9: Hydrology and Hydrogeology**) has also avoided any interference with existing hydrology on the Site and along the proposed Grid Connection Route and Turbine Delivery Route, and maintains surface water flow networks through the use of cross drains on access roads.

6.5.2.2 Mitigation by Design

A comprehensive suite of drainage measures has been developed to protect all receiving waters from potential impacts during the construction of the development in the catchment of the Site and along the proposed Grid Connection Route and Turbine Delivery Route, and are outlined in full in **Chapter 9: Hydrology and Hydrogeology**. These measures are aimed at preventing sediments or other pollutants from entering watercourses through the containment and treatment of all surface water run-off from areas of works and the diversion of upstream flows away from works areas. An Ecological Clerk of Works (ECoW) will be appointed to ensure compliance during the construction stage with all mitigation measures and legislative requirements related to aquatic ecology.

The mitigation measures have been incorporated into a Construction and Environmental Management Plant (CEMP) (**Appendix 2.1**) for the Development which includes Construction Method Statements for key works. The CEMP includes a Surface Water Management Plan (SWMP), a Water Quality Management Plan (WQMP), a Waste Management Plan (WMP), a Peat and Spoil Management Plan (PSMP) and an Emergency Response Plan (ERP). The CEMP and associated plans will require mandatory adherence by all parties involved in the construction of the Development (including any sub-contractors) in order to protect aquatic conservation interests within the study area. The development of the mitigation measures and all method statements for watercourse crossings follows all relevant guidance and current best practice as detailed in:

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.

- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney & Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Southern Regional Fisheries Board.
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. Eastern Regional Fisheries Board.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- SNH (2019). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

The use of Sustainable Drainage Systems (SuDS) on site will eliminate risk to watercourses from sedimentation during the construction, operational and decommissioning phases of the proposed development. SuDS adopts the following design principles to drainage:

Minimise → Intercept → Treat → Disperse → Dilute

All surface water management measures will be put in place concurrently during the development of the road network. The measures entail the following key elements which are described in detail within the Surface Water Management Plan:

- Open Constructed drains for development run-off collection and treatment;
- Collection Drains for upslope "clean" water collection and dispersion;
- Filtration Check Dams to reduce velocities along sections of road which run perpendicular to contours;
- Settlement Ponds, Settlement Lagoons and Buffered Outfalls to control and store development runoff to encourage settlement prior to discharge at Greenfield runoff rates as illustrated on planning drawings 6226-PL-100-108.

There will be no direct site run-off to watercourses during the construction phase with all outflows from drainage via settlement ponds from which treated surface water is released by

diffuse overland flow at appropriate locations. To reduce the amount of silt laden water to be treated, clean water drains will be created upstream of the works area to divert water away from construction areas, thereby lessening the volume of water to be treated onsite.

De-watering of excavations where required, will be through filtered 'silt socks' / dewatering bags or a 'Siltbuster' or similar system, prior to discharge. Excavations will be kept to the absolute minimum for the specific task and undertaken on a 'just in time' basis to minimise the extent of silty water generated and requiring treatment prior to discharge.

The three watercourse crossings along the access road network are all designed as clear span structures with abutments set back from the river banks to avoid any modification to the stream channel in accordance with the requirements of IFI. The method statements prepared for the construction of the bridges and associated works in Section 4 of the WQMP (Appendix 2.1) detail the sequencing of works required to avoid the risk of silt or other pollutants entering the watercourses. The construction of the watercourse crossings will be undertaken during the period 1st July to 30th September as required by IFI Guidance (2016) to avoid accidental damage or siltation of spawning beds, unless otherwise specified by IFI during consultations in advance of works. There will be no instream works undertaken and no tracking of machinery across any watercourse. Temporary crossings will be undertaken by Bailey bridge (a type of portable, pre-fabricated, truss bridge) or similar if required. All machinery will stay within designated routes (working corridor) within the development Site Boundary for the windfarm and Grid Connection Route. This will include preparatory work in the vicinity of all watercourses and all river bank works. All bank-sides in the vicinity of the new crossings will be fully reinstated with vegetation cover as quickly as possible using only native species appropriate to the existing environment.

The directional drilling of the three watercourses on the grid connection route will be undertaken by either Horizontal Directional Drilling (HDD) or Auger Bore method in accordance with the method statements provided in **Appendix 2.3: Grid Connection Route Details**. These methods detail the potential risks of pollutants or contaminants arising during the works and provide specific measures to neutralise the risks.

A Slope Stability Risk Assessment was carried out and indicates that the risk of significant mass movement of soils or landslides occurring is Very Low to Low within the footprint of the Development. However, an assessment of the peat quality indicates that there remains the potential for peat stability issues to arise at a localised scale, for example, point locations associated with deeper peat and/or steeper inclines and/or close proximity to sensitive

receptors. In accordance with the requirements of IFI, the CEMP contains a contingency plan to deal with the scenario of a peat movement occurring on the Site which includes measures to control silt in such a scenario, and measures to be put in place at the initial stages of construction to off-set this risk. Specific measures are detailed in **Chapter 9: Hydrogeology and Hydrology (Section 9.5.2.10 Emergency Response)** to be implemented in the unlikely eventuality a peat failure or some other form of failure or over-loading of the drainage and attenuation design.

6.5.2.3 Mitigation by Reduction

The specified measures detailed below are aimed at protection of instream aquatic biota within the vicinity of any proposed works at watercourses effected by the Development of the windfarm site and Grid Connection Route but equally with regards to the protection of the downstream population of Freshwater pearl mussel and salmonids. No mitigation is required for the Turbine Delivery Route. These measures are a summary of the principal requirements with full detail being presented in **Chapter 9: Hydrogeology and Hydrology**, which are transposed into the Construction Environmental Management Plan (see **Appendix 2.1: CEMP**).

- During the construction phase the appointed Contractor(s) will ensure that the following mitigation is adhered to in line with IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters:
- No works will take place within the 65 m buffer zone of watercourses except for the clear span bridges, road development and drainage measures as detailed.
- Site compounds and Soil storage areas will be located at a minimum distance of 65 m from any watercourse. All drainage from these facilities will be directed through a settlement pond with appropriate capacity and measures to provide spill containment.
- All site drainage, as described in the surface water management plan and shown on associated drawings, will be directed through either sediment traps, settlement ponds and / or buffered drainage outfalls to ensure that total suspended solid levels in all waters discharging to any watercourse will not exceed 25 mg/L (IFI, 2016). All construction site run-off will be channelled through a stilling process to allow suspended solids to settle out and through a spill-containment facility prior to discharge. Discharge outside of surface water buffer zones will be by buffered outfall to vegetated areas. Within the surface water buffer zones, discharges will be directed through the use of stilling ponds, in line check dams and provided with erosion control to the receiving drain or surface water feature. No discharges will occur in areas identified as high-risk landslide areas.
- Daily monitoring of all sediment traps and settlement ponds will be undertaken by the Environmental Manager or Ecological Clerk of Works to ensure satisfactory operation

and/or maintenance requirements. A full specification for the water quality monitoring is presented in the WQMP (provided as part of **Appendix 2.1**).

- The storage of oils, hydraulic fluids, etc., will be undertaken in accordance with current best practice for oil storage (Enterprise Ireland, BPGCS005).
- All machinery operating on the windfarm site and on the Grid Connection Route will be fully maintained and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken at a discrete "fuel station" within the temporary site compound and will be designated for the purpose of safe fuel storage and fuel transfer to vehicles.
- Any extensions to existing drainage culverts on the site roads will be undertaken in dry conditions and in low flow conditions on drains that do not run dry.
- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc., will be completed in the dry to avoid pollution of the freshwater environment (see **Chapter 9** for further details). There will be no batching or storage of cement allowed in the vicinity of any watercourse crossing construction area.
- Procedures (as detailed in **Chapter 9**) will be put in place to ensure the full control of raw or uncured waste concrete to ensure that watercourses will not be impacted.
- Should there be any incidents of pollution to watercourses, immediate steps as specified in the Emergency Response Plan (CEMP-Management Plan 1) will be undertaken to resolve the cause of the pollution and where feasible, mitigate against the impact of pollution.
- Re-seeding / re-vegetation of all areas of bare ground or the placement of Geo-jute (or similar) matting will take place prior to the start of the operational phase to prevent silt-laden run-off. The seed mix will contain only suitable native species of plant.
- Silt traps erected during the construction phase within roadside and artificial drainage will be replaced with stone check dams for the lifetime of the project. These stone check dams will only be placed within artificial drainage systems such as roadside drains and not in natural streams or drainage lines.

A full review of construction stage temporary drainage will be undertaken by the Developer (in conjunction with the Project Hydrologist/ Site Engineer and the Project Ecologist) following the completion of construction.

6.5.3 Operational Phase Mitigation

The following measures will be implemented during the operational phase to ensure the ongoing protection of watercourses and water quality at the Site and in downstream reaches:

- The temporary Site compound / office will house all potential pollutants within a secure bunded COSSH store for the operational phase of the project.

6.5.4 Decommissioning Phase Mitigation

Decommissioning will be scheduled to take place after the proposed 35-year lifespan of the Project. Decommissioning phase impacts for the Project are likely to be broadly similar to construction phase impacts, in terms of potential surface water quality impacts from ground disturbance, refuelling and the storage of potentially hazardous materials onsite. The implementation of all mitigation measures detailed for the construction phase will be adopted in full during the decommissioning phase to ensure all such impacts are avoided. A Decommissioning Plan has been included in **Appendix 2.1**.

When the final Decommissioning Plan is prepared prior to decommissioning, all drainage management measures, which will include maintenance of the operational drainage measures, will be included in that document. However, it should be noted that by the time decommissioning is undertaken after the planned 35-year lifespan of the Development, the areas within the Site will have revegetated resulting in a resumption of the natural drainage management that will have existed prior to any construction. It is not anticipated that the decommissioning phase will interrupt this restored drainage regime in any way with the works proposed. As a minimum measure, areas where freshly placed soil is placed as part of turbine foundation reinstatement work will be surrounded by silt fencing if deemed necessary until the area has naturally revegetated.

Restoration of the Site following decommissioning of infrastructure will require the prior establishment of the new baseline conditions at the site which will have developed over the intervening 35 years life of the Project. These studies will inform any modification or additional sensitivities that may need to be factored in restoration and site-specific measures.

6.6 RESIDUAL EFFECTS OF THE DEVELOPMENT

The three watercourse crossings along the site access road network are clear-span structures which will require no channel modification and result in no loss of instream habitat. The design of the crossings will ensure no impediment to movement of fish or other aquatic biota.

The approach to the development design, the use of SuDS drainage and the suite of comprehensive measures to avoid, reduce or remedy all potential impacts on water quality will ensure that the receiving water bodies in the catchment of the development do not suffer any deterioration in water quality, either during construction, operation, or decommissioning. The

populations of Freshwater Pearl Mussel in the lower catchments of the Development and along the Grid Connection Route will not be negatively affected by the Project.

There is expected to be no negative residual impact on any aquatic species, habitat or on water quality at a local or catchment level as a result of the Development.

6.7 MONITORING

In order to verify the efficacy of pollution prevention and mitigation works during construction, Water Quality Monitoring will be undertaken prior to, during and post completion of construction works in accordance with the parameters and schedules as set out in the in the **Chapter 9: Hydrogeology and Hydrology** and in the **Water Quality Management Plan (Appendix 2.1 CEMP, Management Plan 2)**. Monitoring will be undertaken in all watercourses within the catchment of the construction area. During both the construction and operational phases of the project watercourse crossings will be monitored frequently (daily during construction and intermittently during operational phase i.e., weekly / monthly inspections initially and reduced gradually in line with observed stability and confidence in longer term data obtained. The water course crossings will be monitored in terms of structural integrity and in terms of their impact on respective watercourses.

Site water runoff quality at all surface water monitoring locations will be monitored on a continuous basis during the construction phase of the Project. Monitoring will continue into the operational phase until such time that the Site and water quality have stabilised (stable conditions in line with baseline conditions for e.g., eight (8 No.) consecutive quarterly monitoring events). This monitoring will be carried out at the downstream surface water baseline sampling location (**Appendix 9.6**)

Continuous monitoring systems will be in place, particularly in principal surface water features draining the site using telemetric turbidity monitoring sensors.

Monitoring will be overseen by an independent Environmental Consultant and undertaken by the Environmental Manager or by the Ecological Clerk of Works qualified and experienced on the required monitoring methods and the use, calibration and maintenance of all monitoring equipment used).

Baseline monitoring undertaken at the Site as part of this study will be repeated periodically i.e., before, during and after construction phase, to measure any deviations from baseline hydrochemistry that occur at the Site, including discharge rates. The construction monitoring programme for the Inchamore site will include the following:

- During the construction phase daily inspection of silt traps, settlement ponds, buffered outfalls and drainage channels will be undertaken. Routine measurement of total suspended solids, electrical conductivity, pH and water temperature at selected water monitoring locations at the Site will be carried out. Monitoring of locations where excavations are being dewatered (likely high in solids) will be done in real time.
- During the construction phase of the Project, the Development areas will be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system so that it does not become blocked, eroded or damaged during the construction process.

6.7.1 Post-construction phase monitoring

On completion of the construction phase, post construction monitoring will be agreed with Cork County Council and undertaken using the suite of parameters as detailed in the WQMP which is included as part of **Appendix 2.1**. During the operational phase and post decommissioning of the project, the stilling ponds and buffered outfalls will be periodically inspected during maintenance visits to the Site.

6.8 SUMMARY OF SIGNIFICANT EFFECTS

The Development will entail the crossing of three small watercourses along the access track network. The watercourses are all minor headwater tributaries with limited fisheries value, though the downstream catchments are of significant value for salmonids as well as supporting populations of the Annex II listed Freshwater Pearl Mussel. All watercourses will be crossed by clear-span structures with the abutments set back from the river banks, ensuring no impediment to movement of fish or other aquatic biota. These and other construction works however, present a risk of impacting on water quality within the streams with potential for impacts extending downstream to affect salmonid and Freshwater Pearl Mussel populations. An extensive suite of mitigation measures is prescribed through all phases of the Project to prevent deterioration of surface waters within and downstream of the Site. The mitigation will ensure there are no significant effects on water quality within any receiving waters and on their associated biota.

The construction of the Grid Connection Route parallels the Clydagh River where it runs along an existing forestry track. The Clydagh also supports a population of Freshwater pearl mussel as well as being an important salmonid river. There are numerous feeder tributaries crossed by existing culverts along the track, the majority of which have sufficient depth of over-lying material to accommodate the burying of the Grid Connection Route across the culvert.

There are three watercourses which do not have culverts and these will be directionally drilled thereby minimising risks of silt or other pollutants entering the watercourse, with all frack arising from the drilling contained and disposed of appropriately. A small number of un-culverted drains will be crossed by open-cut but these do not support perennial flows and the works will be undertaken in the dry to avoid siltation. Subject to the adoption of the prescribed measures in **Section 6.5** above, the laying of the grid connection does not pose a risk of giving rise to any effects on water quality within the Clydagh River.

The mitigation measures as described in this chapter and within the CEMP and WQMP are aimed at avoiding any deterioration in water quality during the construction phase. Subject to their successful implementation, there is considered to be no significant risk of a deterioration in water quality in any receiving waters associated with the Development.

The operational phase of the Development is considered not to present any significant risk of affecting water quality within the catchment. Decommissioning will be scheduled to take place after the proposed 35 year lifespan of the Project. Decommissioning phase impacts are likely to be broadly similar to construction phase impacts and the implementation of all mitigation measures detailed for the construction phase will be adopted in full during the decommissioning phase to ensure all such impacts are avoided.

6.9 STATEMENT OF SIGNIFICANCE

It is considered that with the proposed mitigation successfully implemented, the Development will result in an overall negligible to low significance residual impact upon the aquatic ecological features that lie within the Zone of Influence.

7 ORNITHOLOGY

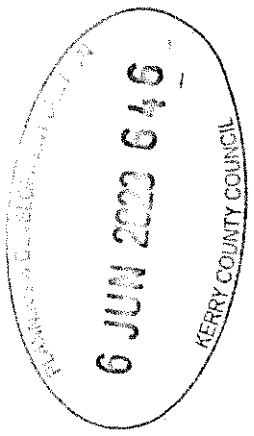
7.1 INTRODUCTION

This Chapter considers the potential effects of the Project (see **Figure 1.2 in Chapter 1: Introduction**) on ornithology. It details the methods used to establish the bird species and populations present, together with the process used to determine their Nature Conservation Importance. The ways in which birds might be affected (directly or indirectly) by the construction, operation and decommissioning of the Project are explained and an assessment is made with regards the significance of these effects.

The Development refers to all elements of the application for the construction of Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Development:

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

Common acronyms used throughout this EIAR can be found in **Appendix 1.2.** 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 7.1 -** VP Summer 2017 - Survey Details
- **APPENDIX 7.2 -** VP Winter 2017/2018 - Survey Details
- **APPENDIX 7.3 -** Bird Survey VP Flight Line Data, 2017-2018
- **APPENDIX 7.4 -** VP Summer 2018 - Survey Details
- **APPENDIX 7.5 -** VP Winter 2018/2019 - Survey Details
- **APPENDIX 7.6 -** Bird Survey VP Flight Line Data, 2018-2019
- **APPENDIX 7.7 -** Additional Bird Survey Data, 2018 - 2019
- **APPENDIX 7.8 -** VP Summer 2020 - Survey Details
- **APPENDIX 7.9 -** VP Winter 2020/21 - Survey Details
- **APPENDIX 7.10 –** Bird Survey VP Flight Line Data, Summer 2020 & Winter 20/21
- **APPENDIX 7.11 -** Hinterland Survey Data, 2020 / 2021
- **APPENDIX 7.12 -** VP Summer 2021 - Survey Details
- **APPENDIX 7.13 –** Bird Survey VP Flight Line Data, Summer 2021
- **APPENDIX 7.14 -** Hinterland Survey Data, Summer 2021

- **APPENDIX 7.15 -** List of Birds recorded within Inchamore site during Surveys 2017-2021
- **APPENDIX 7.16 –** Vantage Point Flight Line Maps for Surveys 2017 - 2021
- **APPENDIX 7.17** – Collision Risk Modelling Report
- **APPENDIX 7.18 –** First Year Ornithological Surveys – Inchamore/Gortyrahilly Wind Farm Summer 2017 and Winter 2017 / 18. Prepared by Fehily Timoney & Company
- **APPENDIX 7.19** – Second Year of Ornithological Surveys – Inchamore/Gortyrahilly Wind Farm Summer 2018 and Winter 2018 / 19. Prepared by Fehily Timoney & Company
- **APPENDIX 7.20 –** Baseline Ornithological Surveys – Inchamore Wind Farm Summer 2020 and Winter 2020/21. Prepared by Fehily Timoney & Company

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. The CEMP includes an emergency spillage plan, a peat and spoil management plan, a surface water management plan, a traffic management plan and a waste management plan. The CEMP includes all of the construction phase mitigation proposed within the EIAR. A summary of the mitigation measures is included in **Appendix 17.1**.

7.1.1 Site Description

The Site is situated on the border of Counties Cork and Kerry and is approximately 5.9 km west of Ballyvourney. It is located within the Derrynasaggart Mountains and situated within a landscape dominated by agricultural land (mainly used for stock grazing), commercial forestry and bog and heath of varying quality.

The altitude of the site ranges from approximately 300 m to 460 m AOD, with the local peak of Knockbwee at 461 m AOD. The primary soil type across the site is blanket peat, with some outcropping bedrock. The topography of the site varies, ranging from mostly gently to occasional steep inclinations. The Site is located within the Lee, Cork Harbour and Youghal Bay catchment. The site lies entirely within the Inchamore Stream sub-catchment. The natural streams within the Site are small 1st order tributaries which have high gradients and do not provide suitable habitat for fish or larger aquatic organisms.

The Grid Connection Route runs in an east to north-easterly direction from the Inchamore site to the existing Ballyvouskill 220kV substation (see **Figure 1.2 in Chapter 1: Introduction**).

Ecologically, the Site can be described as being dominated by conifer plantation (WD4 of Fossitt 2000). The unplanted area of the site is mostly wet heath (HH3), with areas of

upland blanket bog (PB2) and cutover bog (PB4). Other habitats represented within the Site are dry siliceous heath (HH1), exposed siliceous rock (ER1) and eroding/upland rivers (FW1). The grid connection route is almost entirely along forest tracks.

A full description of the Habitats, Flora and Fauna associated with the project site is presented in **Chapter 5: Biodiversity**.

7.1.2 Details of the Project

Permission is being sought by the Developer for the construction of 5 No. Wind Turbines, an on-site substation and all ancillary works and works along the turbine delivery route. Details of the Project are given in **Chapter 2: Project Description**.

7.1.3 Purpose of this Chapter

- To describe the baseline data collection and assessment methods used;
- To summarise the baseline ecological conditions;
- To identify and describe all potentially significant ecological effects associated with the proposed development;
- To set out the design, mitigation and compensation measures required to ensure compliance with nature conservation legislation and to address any potentially significant ecological effects;
- To identify how mitigation measures will be delivered;
- To provide an assessment of the significance of any residual effects in relation to the effects on biodiversity and the legal and policy implications;
- To identify appropriate enhancement measures and how these will be delivered; and
- To set out the requirements for post-construction monitoring.

7.1.4 Project Team

The chapter has been prepared by Dr Brian Madden of BioSphere Environmental Services. The baseline ornithology surveys between 2017 and 2020 were carried out by Fehily Timoney ecologists. Baseline surveys in April and May 2021 were carried out by BioSphere Environmental Services.

Brian Madden BA (Mod.), Ph.D, MCIEEM 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 then, he has carried out botanical surveys and habitat assessments for most terrestrial habitats which occur on the island of Ireland. Brian is an experienced ornithologist, with particular interests in birds of prey and wetland birds. Brian is the principal ecologist with BioSphere Environmental

Services. The consultancy specialises in energy related developments, including wind farms, solar farms, overhead power lines and substations.

Joe Adamson B.Sc., M.Sc., MCIEEM is a consultant senior ornithologist with BioSphere Environmental Services. He is highly experienced, having worked in the field of ornithology and ecology since 1988 and has extensive knowledge of Irish birds and their habitats. Joe has been involved in baseline bird surveys on the Bord na Móna cutaway bogs since 2014 and carries out winter and summer bird surveys. Joe carried out baseline ornithological surveys for the project.

Aidan Duggan has more than 30 years of bird surveying experience in Ireland and abroad and is an active member of the Cork branch of Birdwatch Ireland. Aidan has worked on a variety of projects throughout Ireland and is proficient in Vantage Point surveys, Transect Surveys, Hinterland surveys, merlin surveys and red grouse surveys. Clients include Fehily Timoney & Co. Consultants, BioSphere Environmental Services, and Kelleher Ecology Services. Aidan carried out baseline ornithological surveys for the project.

7.2 METHODS

7.2.1 Study area

The principal study area was the actual Redline boundary for the site of the Development. However, this extended to a distance of approximately 10 km from the Site Boundary for the hinterland surveys.

The study area for the assessment of collision risk is the 'flight activity survey area' or 'FASA' which refers to a polygon around the outermost turbines plus an additional 500 m strip around that polygon.

The study area also included the route for the underground grid connection cable though site surveys were not carried out along this route.

7.2.2 Field Surveys

Baseline field surveys reported here were carried out between April 2017 and June 2021. A detailed methodology for all surveys is provided in **Appendices 7.18 & 7.19 and** is briefly summarised here. The surveys carried out comprised the following:

- Flight Activity (Vantage Point) Surveys
- Breeding Moorland/Wader Survey;
- Breeding & Winter Bird Transect Survey;

- Hinterland Survey;
- Merlin Survey
- Red grouse Survey

Flight activity (vantage point) surveys

Flight activity surveys were carried out by Fehily Timoney & Company over a 24-month period from April 2017 to March 2019 following the methods described in NatureScot 2017 Guidelines (formerly SNH). Further Vantage Point surveys were carried out at the proposed Development site during the period May 2020 to May 2021.

The locations of the vantage points used (no. 3) are given in **Table 7.1**, with the locations and viewsheds shown in **Figure 7.1.**

Table 7.1: Grid References for VP locations used at the proposed Inchamore Wind Farm

Vantage Point	Location (ITM)
VP1	512600 578973
VP2	512393 578592
VP3	514385 579799

The main purposes of vantage point survey watches are to collect data on *target species* that will enable estimates to be made of:

a. The time spent flying over the defined survey area;
b. The relative use of different parts of the defined survey area; and
c. The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and rotor hub height.

In line with recommended best practice (Scottish Natural Heritage 2017, Band *et al*. 2007), viewshed analysis was undertaken using ARCMAP 10.3, to calculate a theoretical zone of visibility from each vantage point.

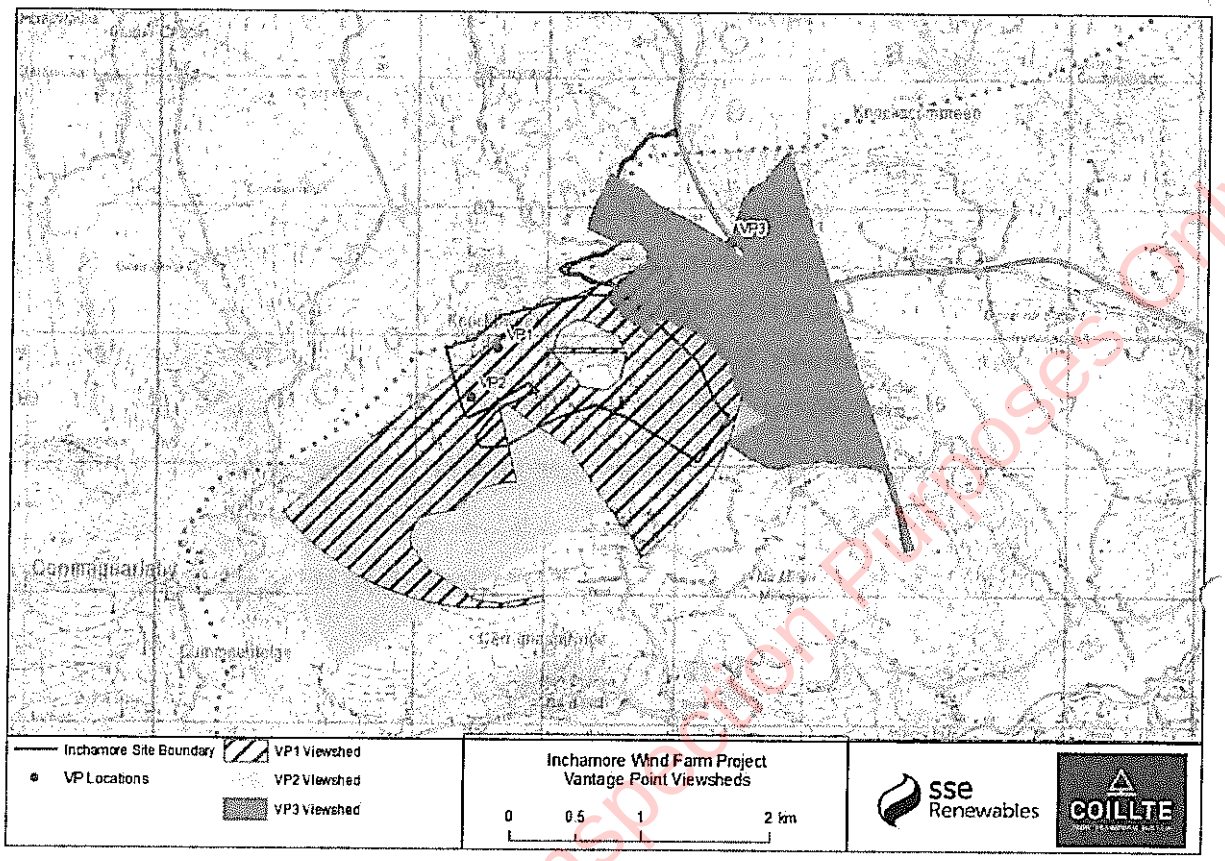


Figure 7.1: Locations of Vantage Points and associated viewsheds.

Following Scottish Natural Heritage guidance, watches were conducted to sample diurnal, crepuscular and nocturnal activity of target species. The method of observing was via constant search effort mostly through binoculars and/or a telescope. Data recorded included flight activity of target species (flight height, duration, directionality) in addition to metrics such as flock size and time of observation. Flight activity was annotated onto field maps.

As per Scottish Natural Heritage guidance (2017) thirty-six hours of vantage point effort was carried out at each vantage point during each winter period and each breeding period from April 2017 to March 2019 inclusive. The watches comprised 2 x 3 hour sessions at each VP every month. The proportion of survey time that activity was recorded inside and outside (up to 2 km) the Site Boundary was used as part of the overall analysis and assessment of target species usage of the study area. Surveys were conducted during suitable weather conditions and a proportion of surveys spanned dawn and dusk periods.

Breeding Wader Surveys

Survey transects to assess the presence of moorland breeding bird species, and especially waders, were completed in 2017 (May-July), 2018 (May-June) and 2021 (April-May). Breeding birds were surveyed using methodology of the breeding wader survey and breeding moorland survey, following Bibby *et al.* (2000) and Gilbert *et al.* (1998). A series of transects were carried out from east to west within the open bog habitats of the site and adjoining area (see **Figure 7.2**).

All species encountered (seen or heard) on the transect were recorded and their abundance noted. Survey details are given in **Appendices 7.18 & 7.19.**

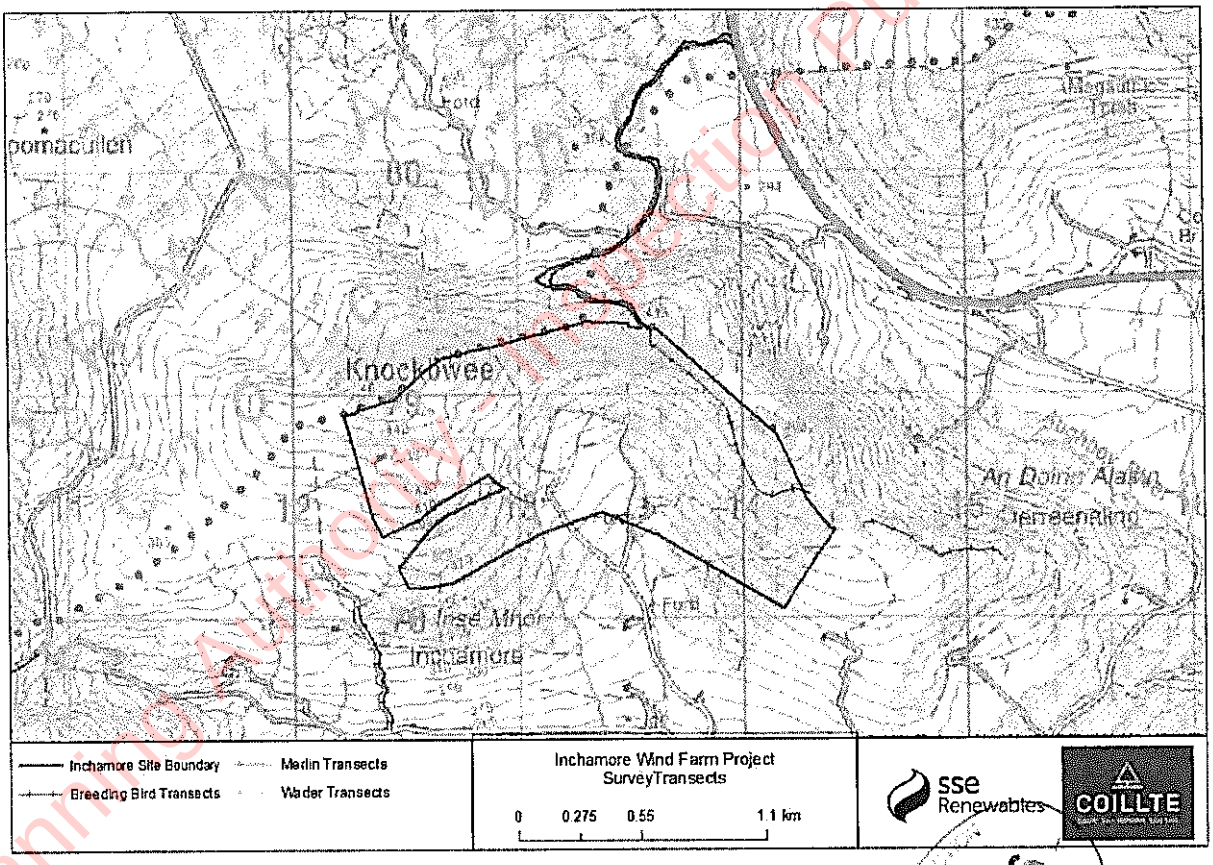


Figure 7.2: Locations of breeding bird, wader and merlin transects.

Hinterland Surveys

Hinterland surveys were undertaken to establish populations of target species that could potentially cross the Site of the proposed wind farm whilst moving to and from roosting and feeding grounds. Target species included raptors, waders, geese, swans and wildfowl. Survey methodology followed that of Bibby *et al.* (2000). Surveys were carried out in suitable wetland habitats over a distance of approximately 10 km radius from the Site.

Surveys were carried out from October 2017 to March 2019 and from May 2020 to May 2021. The sites surveyed are listed below, with locations of sites shown in **Figure 7.3.**

- Lough Nabuddoga
- Inchigeelagh
- Grousemount
- Gearagh
- Lough Allua
- Sillahertane Windfarm entrance
- Lee Valley
- Ballyvourney North
- Ballyvourney South
- Gortyrahilly
- Gougane Barra
- Kilgarvan North
- Roughty River
- Toon Valley/Killeens

Hinterland I-WeBS style surveys were carried out following a 'look-see' methodology as outlined in BirdWatch Ireland/NPWS's counter manual[1]. Full details of the surveys are given in **Appendices 7.18 & 7.19.**

Breeding and Wintering Bird Transect Surveys

Breeding bird transect surveys were carried out in 2017, 2018 and 2020. The method utilised was based on the British Trust for Ornithology Breeding Bird Survey (Bibby *et al.*, 2000). A total of 3 no. c. 1 kilometre transects were selected and centred on different habitats present within the subject site or in adjoining areas (within 500 m of site Redline boundary) (see **Figure 7.2**). Birds were counted over two visits, each timed to coincide with the early part of the breeding season (April to mid-May) and later part of the season (mid-May to late June) with visits at least four weeks apart. Surveyors recorded all birds seen or heard as they walked methodically along the transect routes. Birds were noted in four distance categories, measured at right angles to the transect line (within 25 m, between 25m-100m and over 100m from the transect line) and those seen in flight only. Recording birds in distance bands gives a measure of bird detectability and allows relative population

[1] https://birdwatchireland.ie/app/uploads/2019/03/IWeBS-Counter-Manual.pdf. Accessed 26/06/2021.

*Location approximate – hen harrier roost counts conducted at numerous points in vicinity – locations withheld due to sensitivity.

densities to be estimated if required (BTO, 2018). Full details of the breeding bird transect surveys are presented in **Appendices 7.18, 7.19 & 7.20**.

The winter transect survey followed the same routes as the breeding surveys, with details given in **Appendices 7.18, 7.19 & 7.20.**

Merlin Survey

Merlin *Falco columbarius* surveys were carried out in order to assess the presence of the species within the proposed development site. Survey methods followed Gilbert *et al.* (1998), with use of transects. Four visits of potential merlin habitat were completed between May and July 2017, while three visits were completed between May and July 2018, and two in April and May 2021. Potential habitat types included areas of moorland, forestry plantation edges and young conifer plantation. Within all suitable areas within the subject site, signs of presence of merlin were recorded. **Figure 7.2** displays the location of the merlin survey transect, with details of surveys in **Appendices 7.18 & 7.19**.

Red Grouse Survey

A Red grouse (*Lagopus lagopus)* survey was carried out in February 2019 (under licence no. 27/2019). This followed standard methodology (Bibby, C. J. *et al.*, 2000; BWI, 2007; Cummins, S. *et al.*, 2010), using the line transect method with tape lures across sample each 1 km^2 survey squares. The survey locations and transects for the red grouse surveys are shown in **Figure 7.4**. Survey details are presented in **Appendix 7.19**.

7.2.3 Assessment Approach

The impact assessment and ecological evaluation approach used in this report is based on "Guidelines on the information to be contained in Environmental Impact Assessment Reports" (EPA, 2022) and "Guidelines for Ecological Impact Assessment in the UK and Ireland" (CIEEM, 2018).

7.2.4 Sensitivity of Receptors

In line with the recommendations of CIEEM guidelines, only ornithological receptors that are considered to be important, *i.e.,* Valued Ornithological Receptors (VORs) and potentially affected by the project were subject to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to project impacts and would remain viable and sustainable.

Ornithological receptors were considered within a defined geographical context and for this project the following geographic frame of reference is used (following NRA Guidance, 2009):

- International;
- National
- County
- Local (higher value / lower value).

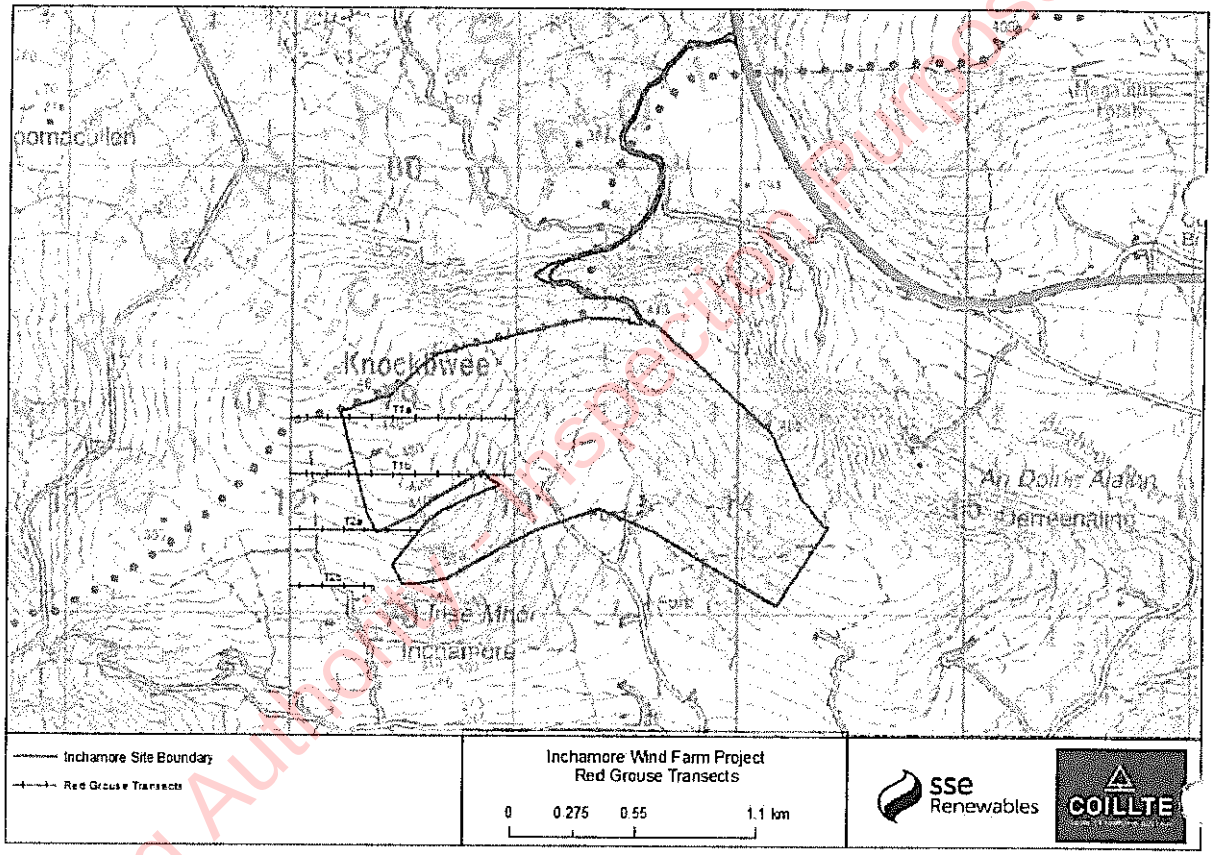


Figure 7.4: Locations of Red Grouse transects.

For designated sites, importance reflected the geographical context of the designation. For example, an SPA is considered internationally important while a Natural Heritage Area (NHA) is considered nationally important.

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 Annex I of the Birds Directive); and
- species Red-listed[2] in Ireland under the relevant lists of Birds of Conservation Concern Ireland (BoCCI), *e.g.* Gilbert *et al.* 2021.

Where appropriate, the value of species populations has been determined using the standard '1% criterion' method (*e.g.* Holt *et al.* 2012). Using this, the presence of >1% of the international population of a species is considered internationally important; >1% of the national population is considered nationally important; etc.

7.2.4.1 Assessing Impacts and the Significance of Effects

The terms impact and effect are defined by CIEEM (2018) as:

- Impact – Actions resulting in changes to an ecological feature. For example, the construction activities of a development removing a hedgerow (CIEEM, 2018).
- Effect – Outcome to an ecological feature from an impact. For example, the effects on a dormouse population from loss of a hedgerow (CIEEM, 2018).

CIEEM (2018) guidelines state that when describing ecological impacts and effects, reference should be made to the following characteristics as required: positive or negative; extent; magnitude; duration; frequency and timing and reversibility.

Following the characterisation of impacts, an assessment of the ecological significance of their effects is made. The guidelines promote a transparent approach in which a beneficial or adverse effect is determined to be significant or not, in ecological terms, in relation to the integrity of the defined site or ecosystem(s) and/or the conservation status of habitats or species within a given geographical area, which relates to the level at which it has been valued. The decision about whether an effect is significant or not, is independent of the value of the ecological feature; the value of any feature that will be significantly affected is then used to determine the implications, in terms of legislation and / or policy (CIEEM, 2018).

Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of this assessment, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological

[2] As per current NatureScot (SNH, 2017) guidance, care has been exercised when considering red-listed species for inclusion as a VORs. For example, it is generally considered that passerines are not significantly impacted by wind farms and so red-listed passerines are not considered as significant VORs here.

features'. A significant effect is simply an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. The EcIA guidelines (CIEEM, 2018) state that "*A significant effect does not necessarily equate to an effect so severe that consent for the project should be refused planning permission. For example, many projects with significant negative ecological effects can be lawfully permitted following EIA procedures as long as the mitigation hierarchy has been applied effectively as part of the decision-making process*". The assessment of significance is based on professional judgement.

7.3 BASELINE CONDITIONS

7.3.1 Data Presentation

There follows a summary of observations from the various surveys between 2017 and 2021. Data for the species recorded during the surveys are presented in **Appendices 7.1 – 7.14**. Flight lines are shown for each target species recorded during vantage point surveys in **Appendix 7.16**.

An overview of the status on site for each species of conservation importance based on the surveys from 2017 to 2021 is then presented.

7.3.2 Flight Activity Surveys - Breeding Season

Kestrel was the most frequently recorded target species during the summer surveys. There were concentrations of observations in the south-west sector of the site and to the north-east (most outside of Redline boundary). The majority of records were of single birds hunting or flying and involved both male and female birds. While there was no evidence of nesting within the site, the frequency of records, including several of two birds together, suggests breeding territories to the west and east of the site (outside of the Red-line boundary).

Sparrowhawk was a relatively scarce species during the surveys, with records in summers 2017, 2020 and 2021. All observations were of single birds most of which were engaged in hunting. Several of the records were off-site, with some close to VP 3 location at c.700 m from the Redline Boundary. There was no evidence of breeding behaviour within the Site.

On 20th July 2018, a sighting of a **merlin** was made from VP 3 over forestry approximately 500 m to the east of the Redline Boundary. This was the only sighting during the vantage point surveys.

Single **peregrines** were observed on 19th April 2017 and on 11th September 2018. Both records were in the western sector of the site. There are no known peregrine breeding territories within the vicinity of the proposed wind farm. [It is noted that a pair of peregrines was recorded over site on 28th February 2021 – as peregrine is an early breeder, this would have been an active pair]

There was one record of **hen harrier** from within the south-western sector of the site on 27th September 2018. The bird (a ringtail) was observed flying in an eastward direction over

bog and forestry. Also, a male hen harrier had been recorded approximately 2 km southwest of the Redline Boundary of the site on 6th July 2018. There was no evidence of breeding by hen harrier within at least a 2 km distance of the site.

Buzzard was recorded on one occasion, on 27th September 2018. The record involved a bird flying south-eastwards over the western sector of the site. Buzzard is considered a scarce species in the area.

7.3.3 Flight Activity Surveys – Non-Breeding Season

Kestrel was recorded both on and off site in each of the three winter survey periods. The species is expected to be resident in the area and at times hunts within the study site.

Sparrowhawk was observed in winter 2017/18 and 2020/21. Both records involved single birds hunting off-site (near VP3 location).

Merlin was recorded on one occasion in winter 2017/18 – a bird flew over open ground to the south of VP3 location (off-site) on 15th November 2017.

A pair of **peregrines** was observed flying westwards from the area of the VP1 location on 28th February 2021. In addition, a peregrine was recorded approximately 1.5 km south-west of the Redline boundary of the Site on 17th October 2018.

Hen harrier was recorded within and around the site as follows:

- In winter 2017/18, there were six records though only one flightline was partly within the site (over bog/heath in westernmost sector). The other records were within a distance of approximately 500 m of the Redline boundary of the site. It is certain that at least two birds were involved (male and a ringtail) though possibly more. The records were between the 22nd January and 21st March 2018. In addition, single birds were observed approximately 3.5 km to the southwest of the site on 20th November 2017 and 1 km south of the site and on 22nd January 2018.
- In winter 2018/19, there were three records of single birds involving a male and female between 11th October 2018 and 16th January 2019. Two of the records within the western sector of the site and the third less than 500 m north-east of the Redline boundary.

From the pattern of records, it is considered that Hen Harrier is an occasional winter visitor to the site and its environs. There was no evidence to indicate that Hen Harriers roost within the site or within at least a 1 km distance of the Redline boundary.,.

There was a single observation of **white-tailed eagle** during each of the 2017/18 and 2018/19 winters. Whilst neither record was from within the Red-line boundary of the project, both were within a 1 km distance, as follows:

- On 22nd January 2018, a juvenile was observed circling approximately 500 m west of the Redline boundary of the Site.
- On 18th December 2018, a juvenile with a wing tag was observed approximately 1 km to the west of the Redline boundary of the site.

The observers considered that both records may have been of the same individual. No observations within or surrounding the redline boundary have been recorded in the surveys completed since 2018.

Golden plover was recorded from within the site in each of the three winter surveys. The records were largely from over the bog and heath habitats in the western sector of the site and over the area of bog to the west of that.

- In winter 2017/18 there was a total of 36 observations, with flock size ranging up to 40 birds. Most of the records were of birds in flight, though some involved birds roosting on the open bog and heath.
- In winter 2018/19, there was a similar pattern with a total of 17 observations and flock size ranging up to 49 birds. Again, birds were observed roosting on the open bog and heath on some occasions.
- In winter 2020/21, there were two records as well as a bird heard but not seen. The records were of a single bird and a flock of 25, and were from the north-west sector of the site.

7.3.4 Breeding Wader Surveys

There were no wader species recorded breeding on the Development site during the various moorland surveys (see **Appendix 7.7**).

7.3.5 Merlin Surveys

Signs of **merlin** presence were recorded on 25th May 2017 during a merlin transect survey (see **Table 7.2**) – these involved the recording of droppings and feathers from within the site and of pellets at a location approximately 500 m from the Redline boundary. In July 2017, a possible record of a bird calling from forestry near VP 1 was made. While no sightings were made of birds in 2017, the evidence indicate an active territory was present.

On 30th April 2018, a merlin was sighted over open bog/heath in the western sector of the site during a moorland transect survey. On 20th July 2018, a sighting of a merlin was made over forestry approximately 500 m to the east of the Redline boundary of the site. Earlier in July, there were two sightings of merlin approximately 2 km to the south-west of the site. As in 2017, it would appear that there was an active merlin territory in the vicinity of the site during the 2018 season.

There was no evidence of the presence of breeding merlin in the area during the (albeit limited) surveys in 2020 and 2021.

Table 7.2 Merlin Transect Survey, 25th May 2017 – Indicator signs.

Date	Sign	Location	Notes
25/05/2017	Pellet	51.9483744, -9.2809656	Pellets found at location & several more nearby
25/05/2017	Feathers	51.9539560 -9.2648599	Feathers found
25/05/2017	Droppings	51.9528344 -9.2666969	Droppings on rocks

7.3.6 Red Grouse Surveys

The red grouse survey in February 2019 recorded flying birds, a calling bird and feathers (see **Appendix 7.7**). This confirms the presence of at least one territory on the unplanted bog and heath in the western sector of the Site. In addition, grouse were flushed from within the site during the habitat surveys.

7.3.7 Transect Surveys

The results of the transect surveys at Inchamore for the period summer 2017 to winter 2020 are presented in **Appendices 7.18, 7.19 and 7.20.**

Meadow pipit (Red list) was a widespread breeding species on the bog and heath habitats within the Site. The species was also present in winter though in lower numbers. A further Red-listed species, grey wagtail, was considered to be breeding on the larger watercourses within the site.

Amber-listed species recorded during the breeding surveys were goldcrest, skylark, swallow, wheatear, willow warbler, starling and linnet. These species are expected to breed on site or at least in the surrounding areas and use the Site for feeding.

The site is relatively quiet in winter, though the Red-listed species meadow pipit and snipe were recorded in the bog and heath habitats. Other species recorded during winter included goldcrest and linnet.

7.3.8 Hinterland Breeding Bird Searches

For site-specific hinterland survey results see **Appendices 7.7, 7.11 and 7.14.**

During the summer season, 52 bird species were recorded in total across hinterland surveys including 23 target species. Of the target species recorded, three are Red-listed (dunlin, kestrel, and snipe). Little egret, peregrine, ruff and whooper swan, which are listed on Annex I of the Birds Directive, were also recorded.

White-tailed eagle was recorded on five occasions during hinterland surveys. These observations, all in 2018, were noted at the Sillahertane Wind Farm and Grousemount area. Three of the five observations concerned a sub-adult in its primary moulting stage. These observations occurred on 11th July, 22nd August and 13th September 2018. The remaining two observations consisted of a single individual being mobbed on the 10th & 24th May 2018. These observations show that while white-tailed eagle is rare in the vicinity of the Inchamore Site and has not been recorded since 2018, the species has a presence in the wider area.

The target species were recorded at three principal hinterland sites: the Gearagh, Gougane Barra and Lough Allua.

7.3.9 Swan and Goose Feeding Distribution Surveys

Winter hinterland surveys were carried out from October 2020 to March 2021. These surveys were for wintering target species. Species recorded during the winter surveys are listed in **Appendices 7.7, 7.11 and 7.14.**

During the winter season, 65 bird species in total were recorded including 31 target species. Of these target species seven are Red-listed, namely curlew, dunlin, golden plover, kestrel, lapwing, snipe and woodcock. Barnacle goose, golden plover, hen harrier, little egret, merlin, peregrine and whooper swan, which are listed on Annex I of the Birds Directive, were also recorded.

Whooper swan was observed during the months of November, February and March across three of the hinterland survey sites (The Gearagh, Lough Allua and Lee Valley). Observations of whooper swan, an Annex I listed species, were typically joined by those of greylag goose and mute swan during hinterland surveys.

7.3.10 Evaluation of Ornithological Receptors

The following species, which were recorded in the on-site surveys, are species of European conservation importance (as listed on Annex I of the Birds Directive) and/or are species of national conservation importance (Red- or Amber-listed after Gilbert *et al.* 2021). Also included are sparrowhawk and buzzard (Green-listed), as these species are potentially sensitive to wind energy projects. A summary of the status of each species follows.

Table 7.3: Conservation status of species recorded within the area of the proposed Inchamore Wind Farm.

Species	Annex I	Red list	Amber list	Green list
White-tailed eagle	Y	Y		
Hen harrier	Y		Y	
Sparrowhawk				Y
Buzzard				Y
Kestrel		Y		
Merlin	Y		Y	
Peregrine	Y			Y
Red grouse		Y		
Golden plover	Y	Y		
Snipe		Y		
Woodcock		Y		
Lesser black-backed gull			Y	
Goldcrest			Y	
Skylark			Y	
Swallow			Y	
Willow warbler			Y	
Starling			Y	
Wheatear			Y	
Grey wagtail		Y		
Meadow pipit		Y		
Linnet			Y	

Red grouse – Red List

Red grouse is resident on site. Suitable habitat for grouse occurs in western sector of the Redline boundary and continues westwards.

White-tailed eagle – Red List; Annex I

White-tailed eagle was observed on two occasions in the area to the west of the Redline Boundary (within 1 km of Site).

There was also a series of off-site records in the hinterland area. Most of these (listed below) were recorded from the Sillahertane/Grousemount area, c.7 km south-west of Inchamore:

April 2017: one c.6 km south-west of site (south of The Coom)
January 2018: adult flew west of Grousemount towards Sillahertane
February 2018: one feeding on dead sheep c.6 km southwest of site
March 2018: adult flew east from Lough Nabuddoga towards Sillahertane
10th May 2018: one in Sillahertane/Grousemount area
24th May 2018: one in Sillahertane/Grousemount area (probably same as previous)
11th July 2018: sub-adult in primary moult stage, Sillahertane/Grousemount area
22nd August 2018: sub-adult in primary moult stage, Sillahertane/Grousemount area
13th September 2018: sub-adult in primary moult stage, Sillahertane/Grousemount area.

From the pattern of records, it is considered that while white-tailed eagle has a presence in the wider area, however it is rare within the immediate Site area.

Hen harrier – Amber List; Annex 1

Hen harrier was recorded on-site at Inchamore and in the surrounding area during the winter survey periods (October-March). Both sexes, as well as ringtails (immatures) were observed, with birds either foraging or merely flying. There was no evidence of winter-roosting on site or in surrounding areas.

From the pattern of records, it is considered that hen harrier is an occasional winter visitor to the Site. The presence of hunting birds in winter in areas such as the Site is consistent with their dispersal from breeding areas (possibly though not necessarily from the Mullaghanish to Musheramore Mountains SPA).

Sparrowhawk – Green List

Sparrowhawk, a Green-listed species in Ireland, was observed in both summer and winter. Habitats suitable for breeding and foraging occur within the Site and in surrounding areas.

Buzzard – Green List

Buzzard, a Green-listed species in Ireland, was observed on only one occasion during the surveys and it is considered that this species is rare in the study area.

Kestrel – Red List

Kestrel was the most frequently encountered bird of prey, both in summer and winter, with individuals observed hunting regularly within the site.

The level of activity recorded for this species is indicative of a breeding territory in the vicinity (likely 1-2 km distance) of the Site.

Merlin – Amber List; Annex I

Merlin had a presence in the area during summers 2017 and 2018, with local breeding considered likely. However, there were no sightings at all in the 2020-21 surveys.

From the pattern of records, it is considered that a merlin territory overlaps with the western sector of the Site.

Peregrine – Green List; Annex I

The sightings of single birds as well as an interacting pair in the immediate area of the Site indicates that the Site is likely to be within a territory of a pair of peregrines.

Golden plover – Red List; Annex I

This Red-listed and Annex I species was noted primarily during winter surveys in 2017/18 and 2018/19. Records were concentrated in the western sector of the Site.

From the pattern of records, it is considered that Golden Plover is a visitor to the Site in winter and at times of spring and autumn migrations.

Snipe – Red List

Snipe was recorded on site in small numbers during winter. While there was no evidence of snipe breeding within the site, much of the bog and wet heath habitat is considered suitable for supporting breeding snipe.

Woodcock – Red List

Woodcock was recorded on one occasion in winter 2017/18. While there was no evidence of woodcock breeding within the site.

Grey Wagtail - Red List

Regular on site and considered to breed along streams downstream of the site.

Meadow Pipit – Red List

A widespread species on heath, bog and grassland habitats. Breeds on site and also present in winter (though scarcer then). Post-breeding flocks often seen in late summer and autumn.

Goldcrest – Amber List

A widespread breeding species within the conifer plantations on site. Scarce in winter.

Skylark – Amber List

A widespread breeding species of the open heath, bog and grassland habitats. Largely absent in winter.

Swallow – Amber List

Recorded feeding over site regularly in summer. Expected to nest in local farm buildings.

Willow Warbler - Amber List

A widespread breeding species within the conifer plantations on site and in areas of scrub.

Wheatear – Amber List

Passage migrant, mainly in spring. May breed locally.

Starling – Amber List

Observed mainly in winter. May breed in local farm buildings.

Linnet – Amber List

May breed on site. Scarce in winter.

7.3.11 Overview of conservation importance of the Site for birds

The Site supports a number of bird species characteristic of peatland habitats.

Merlin, an Annex I species, appears to have had a breeding territory which overlapped with the site area in both 2017 and 2018 and used the resources of the site for breeding. Although it was not recorded in summer surveys in 2020 or 2021, it is noted that merlin is a particularly difficult species to census and may be under-recorded using traditional survey methods (Lusby *et al.* 2011).

Hen harrier (Annex I species) is an occasional winter visitor to the site, with suitable foraging habitat available within the site and the surrounding areas. While the origin of the birds is unknown, it is possible that the birds may be associated with the breeding population in the Mullaghanish to Musheramore Mountains SPA. The population in the SPA had undergone a serious decline (1-2 pairs in 2015-2019 period) until a recovery in 2020 (5 confirmed pairs fledging 10 young). In 2021, there were three confirmed and one possible breeding pairs recorded within the SPA (Hen Harrier Project Monitoring Report, 2021).

White-tailed eagle (Red list & Annex I) was recorded within a kilometre distance of the site on two dates and has a scarce presence within the hinterland of the site.

Two Red-listed species, red grouse and meadow pipit, are resident in the western peatland sector of the site. A further Red-listed species, kestrel, utilises the site for hunting, while golden plover (Red listed & Annex I species) occurs within the site (peatland habitats) at times in winter and when on passage. Snipe and woodcock (both Red-listed) were recorded on site during winter.

A range of Amber-listed species breed within the site, including skylark, willow warbler and linnet.

Overall, on the basis of providing breeding, foraging and roosting habitat for several Annex I listed and Red-listed species, the bog and heath component of the site is rated as of County Importance for birds (following NRA 2009 Guidance). The afforested area of the site is of low importance for birds and is rated as Local Importance (low value).

7.4 ASSESSMENT OF EFFECTS

7.4.1 Do Nothing Impact

Without the Project proceeding, it is expected that the existing main land uses on site, namely forestry and livestock grazing, will continue.

The value of the site for birds would be expected to remain fairly similar as at present though any increase in grazing pressure could be detrimental to the quality of peatland habitats on site which could affect species such as red grouse. Also, any further afforestation on heath and bog habitats would be highly detrimental to peatland bird species, including red grouse, merlin, meadow pipit and skylark.

7.4.2 Construction Phase Potential Effects

7.4.2.1 Habitat loss

The permanent loss of habitat to facilitate the construction of the project is approximately 30.75 ha. The largest component of this is conifer plantation (26.13 ha). Whilst some birds of conservation importance which were recorded in the study area utilise conifer plantation, including merlin (if tree-nesting) and woodcock, there will still be an abundance of conifer plantation within the site and surrounding areas. From the perspective of birds, the effect by the loss of conifer plantation is rated as Not Significant.

The construction of T1 and T3 will result in the permanent loss of approximately 2.5 ha of wet heath and blanket bog habitat, with a further loss of 1.63 ha of cutover bog as a result of the construction of T3. These peatland habitats are utilised by bird species such as red grouse, merlin, kestrel, golden plover and meadow pipit (all Red-listed).

However, as wet heath, blanket bog and cutover bog are widespread habitats within the local area and in upland areas throughout much of the south-west region, the significance of the effect on birds by the loss of 4.1 ha of peatland habitat is considered to be a Moderate Adverse Effect of Long-term duration. It is expected that viable populations of the bird species which were recorded during the baseline surveys will remain on site after the project is complete.

The difference in dimensions within the Turbine Range will not result in a likely increased magnitude of impact on setting that would result in changes to predicted effects.

7.4.2.2 Disturbance to Breeding Birds During Construction

The construction phase for the Project is anticipated to last approximately 21 months, with commissioning taking a further 3 months. In this period, on-site activities, including tree felling, civil works and turbine erection works, have potential to cause significant disturbance effects on birds of conservation importance in adjoining areas.

In 2022 NatureScot published "*Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species*" (NatureScot Research Report 1283) prepared by Goodship and Furness. The 2022 publication included 65 bird species.

It is noted that passerine species, such as meadow pipit and skylark, are not perceived as being prone to disturbance by wind farm construction (SNH 2017) and indeed Pearce

Higgins *et al.* (2012) found that densities of skylarks and stonechats increased on wind farms during construction.

Of the bird species which are identified as Important Ecological Features (IEFs) at the Development site, two were recorded breeding within 500 m of where construction works will occur – these are merlin and red grouse and potential disturbance effects are considered below. In addition, works for the laying of the grid connection cable will be within 500 m of suitable hen harrier breeding habitat.

As it is noted that potentially suitable breeding habitat occurs within or around the site for a number of species which have a presence in the area (as shown by the baseline surveys), namely sparrowhawk and kestrel and snipe, focused pre-construction surveys will be undertaken for these species to establish if the breeding status has changed by the time of construction. Pre-construction surveys will include search for breeding woodcock.

Should pre-construction surveys indicate a requirement for protection from construction-related disturbance of any relevant species, appropriate measures (as described in **section 7.5.2.3**) will be taken to comply with all relevant legislation and best practice guidance available at the time.

The baseline surveys carried out from 2017 to 2021 indicated that further target species may occur as non-breeding species within 500 m of where construction works will occur and could be affected by disturbance – these are white-tailed eagle and golden plover.

White-tailed eagle

White-tailed eagle is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'high sensitivity' to disturbance, with a buffer zone of 250-500 m suggested for both breeding and wintering birds.

While the species was recorded within the study area on two occasions, both off-site but within 500 m to 1,000 m distance of the redline boundary, there is no evidence to show that the site is within a regularly used feeding or roosting area by the birds (and there are no known nesting sites within at least a 5 km distance of the site).

On this basis, it is considered unlikely that construction works would have significant effects on foraging birds which may pass through the study area - significance of potential effect rated as Not significant.

Hen harrier

Hen harrier is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'medium sensitivity' to disturbance, with a buffer zone of 300-750 m suggested for both breeding and wintering birds.

A section of the grid connection route is located along the route of an existing forestry road which runs north of the Mullaghanish to Musheramore Mountain SPA. The closest distance between the cable route corridor and the SPA boundary is 170 m (chainage 9,600 m). Construction works carried out during the breeding season could cause significant disturbance to displaying, nesting and/or foraging hen harriers (Special Conservation Interest) within the sector of the SPA closest to the work area. In absence of mitigation, the potential disturbance effect on breeding hen harrier is considered to be a Significant Adverse Effect of Short-term duration.

While hen harriers were recorded during winter within the site for the wind farm and in surrounding areas, there was no evidence of a winter roost within at least a 2 km distance of the Redline boundary of the Site. It is considered unlikely that construction works would have significant effects on foraging birds which may pass through the study area during winter - significance of potential effect rated as Not significant.

Merlin

The habitats in the study area, *i.e.* bog/heath and conifer plantation, are suitable for supporting breeding merlin, with evidence of a merlin territory overlapping with the Redline Boundary in 2017 and 2018.

As merlin is a particularly difficult species to census and the traditionally used methods may not provide a true indication of the abundance, densities or distribution of the species (Lusby *et al.* 2011), it is possible that merlin may also have been present in summers 2020 and 2021.

Merlin is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'medium sensitivity' to disturbance, with a buffer zone of 300-500 m from construction works (including felling) suggested for breeding birds. For disturbance by forestry operations, Currie & Elliot (1997) gave a distance range of 200 m to 400 m for merlin.

Should merlin breed in future years within or close to the development area for the proposed wind farm, it is considered that the construction of the wind farm would likely have a potential disturbance effect on breeding birds within a distance of possibly up to 500 m from the construction area – this is rated as an Adverse Significant Effect of Short-term duration. Due to the high conservation status of merlin, pre-construction survey will take place in all suitable breeding habitat within the site and for a distance of at least 500 m from work areas. As required, mitigation will be undertaken to reduce the significance of this potential effect on breeding birds (see **section 7.5.2.3**).

It is considered unlikely that construction works would have effects on birds passing through the site in winter or during migration seasons as in these seasons the birds are highly mobile and tend to have large hunting ranges – significance of potential effect rated as Imperceptible or Not significant.

Red grouse

Habitat suitable for supporting red grouse occurs in the western sector of the site and continues westwards of the Redline boundary. The species was recorded breeding within the Site (though numbers of territories not established).

Red grouse is not considered in the NatureScot (2022) review of disturbance distances in birds. In a review of monitoring data from wind farms located on enclosed upland habitats in the UK, Pearce-Higgins et al. (2012) reported that densities of red grouse were significantly reduced at wind farms during construction but that the densities had recovered by the first-year post-construction. Owing to the high conservation status of red grouse and their sensitivity to disturbance, a precautionary buffer zone of 500 m is suggested. At the site for the Development, construction works, and especially works associated with T1, will take place within habitat which supports breeding red grouse.

From the above analysis, it is considered that the construction of the wind farm would likely have a potential disturbance effect on breeding red grouse within a distance of possibly up to 500 m from the site boundary – this is rated as an Adverse Significant Effect of Short-term duration. Due to the high conservation status of red grouse, a pre-construction survey will be carried out in all suitable breeding habitat within and adjoining the site and as required, mitigation will be undertaken to reduce the significance of this potential effect on breeding red grouse (see Section 7.5.2.3).

Golden plover

Golden plover is a winter / passage visitor to the study site. The birds were recorded within the western sector of the Site. Most of the records were of birds flying though some were of roosting birds on bog/heath.

Golden plover is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'medium sensitivity' to disturbance, with a buffer zone of 200-500 m suggested for both breeding and non-breeding birds.

It is considered unlikely that construction works would have a Significant adverse effect on birds landing on the bog in winter or during migration seasons as in these seasons the birds are highly mobile and tend to settle only for short periods in any one particular location – significance of potential adverse effect is rated as Slight.

7.4.2.3 Nest Damage or Destruction

Damage to, or destruction of, active nests during the construction phase, including tree felling, could contravene Section 22 of the Wildlife Acts 1976 to 2022 as amended.

The effects of loss of nests is rated as a potentially Significant Adverse Effect of Short-term Duration.

Mitigation will be implemented to ensure that loss of nests is avoided or minimised.

7.4.3 Operational Phase Potential Effects

The principal potential impacts on birds by the operation of a wind energy project are:

1. collision,
2. displacement,
3. barrier effects,

Disturbance from secondary operations, such as road maintenance, are also considered.

7.4.3.1 Collision

Collision risk posed to bird species is one of the main environmental concerns associated with wind energy developments (Drewitt & Langston 2006, Band et al. 2007, Drewitt & Langston 2008). However, bird species differ widely in their susceptibility to collision mortality. Essentially, birds are at risk of collision only when their flight path overlaps with the rotor blade sweep area of a turbine. It follows that birds whose flight heights coincide with the height of the turbine rotor sweep are most at risk. The assessment of potential

impacts considers all scenarios within the range of turbine parameters proposed for the Development as shown in **Table 7.4** below.

Table 7.4: Turbine Parameters

Turbine Parameter	Assessment Envelope
Turbine Blade Tip Height	177 m to 185 m
Rotor Diameter	149 m to 155 m
Hub Height	102.5 m to 110.5 m

Collision Risk Modelling (CRM) is a method to estimate the number of birds likely to collide with turbines at the Site. This method uses vantage point data to calculate the risk of collision. In this case, the vantage point data collected over the two years 2017-2019 (two breeding seasons and two winter seasons) at the Site was used. There are three potential turbine models which may be used at the proposed wind farm, where appropriate calculations were run separately for each of the three models. Two stages are involved in the model:

Stage 1: Vantage point observations of birds flying within the study area are used to calculate the number of birds likely to fly through areas swept by the proposed turbine blades.

Stage 2: Calculation of the probability of a bird strike occurring.

Full details of the collision risk modelling carried out for the project are given in **Appendix 7.17**.

At the Site, the following species recorded flights within the rotor sweep height and inside the 2 km arc of the selected vantage points during the Vantage Point surveys:

Hen harrier
Buzzard
Kestrel
Peregrine
Golden plover

Other species of conservation concern were recorded in the vantage point surveys but were excluded from consideration in the collision risk analysis due to the following reasons:

White-tailed eagle – recorded within the potential collision risk height bands from VPs 1 & 2. However, the total flight time of these recordings did not exceed 70 seconds. Therefore, this species has been excluded from the analyses due to the low level of flight activity recorded.

Sparrowhawk – not recorded flying within the collision risk height band. Thus, for this species, the collision risk can be assumed to be effectively zero and the species is excluded from further consideration.

Merlin – recorded flying within the collision risk height band from VP 3. VP 3 has been excluded from the analysis as the viewshed does not include any of the proposed turbine locations. Since there are no turbines located within the viewshed, the predicted number of collisions is zero.

The mean number of collisions predicted for the five species subject to analyses (with the application of avoidance rates) is summarised in Table 7.5.

Table 7.5: Summary of estimated mean number of collisions (with avoidance rates) predicted for key ornithological receptors over the lifetime of the project.

Species	Mean no. of predicted collisions over lifetime of project (30 years)	Mean number of predicted collisions per year	One bird collision every 'x' years
Hen Harrier	0.046 birds	0.002	500 years
Buzzard	0.019 birds	0.006	166.6 years
Kestrel	6.25 birds	0.209	4.8 years
Peregrine	0.923 birds	0.031	32.6 years
Golden plover	688 birds	22.9	0.04 years

For hen harrier, buzzard and peregrine, the predicted number of collisions over the lifetime of the project is less than one bird, which is an effect rated as Imperceptible.

Two species are predicted to have more than one collision over the lifetime of the project – kestrel and, particularly, golden plover. The effect on these two species is considered further.

Kestrel

For kestrel, the collision risk modelling has calculated a rate of 6.25 collisions over the lifetime of the Project or 0.209 casualties per year. While these rates are negligible in the context of the estimated national population of 13,500 birds (Lewis *et al.* 2019), it is noted that kestrel, as well as lesser kestrel (*Falco naumanni*) and American kestrel (*Falco sparverius*), is a genus that is prone to collision (see for instance Barrios & Redrigues 2004, Hotker *et al.* 2006, Hotker 2008, Lucas *et al.* 2008, Marques *et al.* 2014). This is expected to be due to the hovering behaviour of the species. While birds are hunting and focusing on ground prey, they may be unaware of the turbine position or may suddenly change their position due to a gust of wind. The hovering height level is often within the rotor sweep of the turbines. Of eight casualties recorded at a wind farm in Cadiz Province, Spain, all were juveniles.

Taking into account the high conservation status (Red list) of the species and the known susceptibility of the genus to collision, the significance of collision risk for kestrel is rated as a Long-term Moderate Adverse effect.

Golden plover

Golden plover is a winter and passage visitor to the Site, with birds typically observed flying over the bog and heath habitats in the western sector of the site. The collision risk modelling has predicted a rate of 22.9 collisions and 688 over the lifetime of the project.

Golden plover is an Annex I listed species and a Red-listed species in Ireland. Burke *et al.* (2019) gave the All-Ireland wintering population at 92,060 birds for period 2011-12 to 2015/16, which is a 43.6% decline since the 1994/95-1988/99 period.

Hotker *et al.* (2006) cited four golden plover casualties (Netherlands, Sweden, Germany) in their review of all bird casualties at wind farms in Europe up to July 2004. In a study of collisions with turbines on the German island of Fehmarn, Grunkorn (2010) recorded 3 golden plover casualties during autumn 2009.

While the predicted collision rates are relatively low in the context of the estimated All-Ireland wintering population (92,060, Burke *et al.* 2019), the significance of the effect of the collision risk is rated as Long-term Adverse Effect of Moderate Significance due to the high conservation importance of the species and the recent significant long-term decline in the wintering population.

7.4.3.2 Displacement effect due to turbines

Displacement of birds from otherwise suitable habitat as a result of the presence of wind turbines has been reported as a potential impact of wind turbines (Drewitt & Langston 2006, de Lucas *et al.* 2007, Pearce-Higgins *et al.* 2009). The displacement occurs as a result of behavioural responses that prevent or decrease the use of an area for activities such as nesting or foraging. However, the results of studies on potential displacement have varied widely and in an overall review of the literature Madders & Whitfield (2006) concluded that displacement effects of wind turbines on raptors, including hen harrier, are negligible for the most part. Further evidence that hen harrier may not be displaced by the presence of turbines is from a study at the Derrybrien Wind Farm, Co. Galway (Madden & Porter 2007), where birds were observed flying close to wind turbines (<50 m) and on one occasion within 10 m of the base.

It is noted that passerine species, including species such as meadow pipit, are not perceived as being prone to displacement as a result of the presence of wind turbines (SNH 2017).

Consideration of potential for displacement is given for the following species which were recorded within the study area, and which mostly have a high conservation status:

Sparrowhawk

The baseline surveys showed that sparrowhawk is regular at the Development Site. While not proven during the baseline surveys, breeding is likely to occur in the local area.

There appears to be no data to show whether sparrowhawk is displaced from an area around turbines, though in the review of upland raptors and wind farms, for sharp-shinned hawk (*Accipiter striatus*) (same genus as sparrowhawk) Madders and Whitfield (2006) tentatively rated this North American hawk as having a 'low' sensitivity to displacement.

As sparrowhawk is a woodland species that nests in woodland and hunts largely along woodland margins and over scrub, it is expected that the species will not be displaced from suitable habitat in the vicinity of turbines at the Development Site - significance of potential effect rated as Imperceptible or Not significant.

Merlin

The evidence from the baseline surveys showed that there was a merlin breeding territory within the area of the site in 2017 and 2018.

There appears to be no data to show whether merlin is displaced from an area around turbines, though in the review of upland raptors and wind farms, for prairie falcon (*Falco mexicanus*) (same genus as merlin) Madders and Whitfield (2006) tentatively rated this North American falcon as having a 'low' sensitivity to displacement.

As merlin is a species that nests in trees or on open bog and hunts close to ground level, it is expected that the species will not be displaced from suitable habitat in the vicinity of turbines at the Development site - significance of potential effect rated as Not significant.

Kestrel

Kestrel was recorded regularly during the baseline surveys, with breeding expected to occur in the local area. At the least, the species uses the survey area for hunting purposes.

In the review of upland raptors and wind farms, Madders and Whitfield (2006) rated kestrel as having a 'low' sensitivity to displacement. The related American kestrel (*Falco sparverius*) was also given a rating of 'low' sensitivity. Pearce-Higgins *et al.* (2009) found equivocal evidence for weak avoidance of turbines by kestrel.

For kestrel, the significance of a potential displacement effect is rated as Not significant.

Hen harrier

The baseline survey data showed that hen harrier is an occasional winter visitor at the proposed wind farm site but there was no evidence of winter roosts.

There appears to be no data to show whether wintering hen harriers are displaced from an area around turbines, though for breeding birds Madders and Whitfield (2006) tentatively rated foraging hen harriers as having a 'low-medium' sensitivity to displacement.

As hen harrier is at most an occasional visitor to the Site for the Development site, it is expected that birds would still pass through the area when the turbines are in operation and that the potential for disturbance to foraging birds is low – this effect is rated as Not Significant.

Snipe

Snipe was not recorded breeding on site in the baseline surveys. In winter, snipe is expected to be a widespread species in bog and heath habitat in the vicinity of the proposed Development Site area.

It is considered unlikely that the presence of the Development would have adverse effects on snipe utilising the bog and heath outside of the breeding season, as snipe is a particularly widespread species during winter and may often occur in active agricultural lands - significance of potential effect on wintering birds rated as Not significant.

Red grouse

The baseline surveys showed that red grouse is resident in the western sector of the site.

Pearce-Higgins *et al.* (2009) found no evidence of turbine avoidance by red grouse and, indeed, the occurrence of red grouse was found to be greater close to the tracks. Reasons for the association between grouse and wind farm tracks are likely to include (i) supplies of grit on tracks which the birds need to ingest to aid digestion, and (ii) good growth of heather which often may be observed along the drier bog strips alongside the tracks. The present author has also observed grouse dust bathing on a dry track within a wind farm.

From the available information, it is considered that for red grouse the potential displacement effect is Not significant, and the presence of the Development is likely to be a Neutral or even Positive effect of Moderate Significance in the Long-term.

Golden plover

The baseline survey data showed that golden plover is a winter visitor and passage migrant in the western sector of the site.

There appears to be no data to show whether wintering golden plover are displaced from an area around turbines, though for breeding birds Pearce-Higgins *et al.* (2009) found that golden plover showed significant avoidance of turbines but that the avoidance was largely restricted to a distance of 200m.

It is considered unlikely that the presence of the wind farm would have adverse effects on golden plover landing on the local bog in winter or during migration seasons as in these seasons the birds are highly mobile and tend to settle only for short periods in any one particular location – significance of potential effect rated as Imperceptible or Not significant.

7.4.3.3 *Barrier effect due to turbines*

The potential impact of lines of wind turbines creating a barrier effect to passing birds is mostly relevant to locations where migratory species pass regularly. Rees (2012) cites eight published studies of flight behaviour which reported changes in flightlines for swans or geese initially seen heading towards turbines, at distances ranging from a few hundred metres to 5 km (the larger distances were by birds on migration); 50-100% of individuals/ groups avoided entering the area between turbines, but in some cases the sample sizes were small.

As the Development Site has not been identified through the baseline surveys or desk review as being along a migration route for birds, such as wetland species (swans, geese etc.) or birds of prey, there is not likely to be a barrier effect. Furthermore, the Development is of only five turbines which are not in proximity to any other group of turbines so there cannot be a barrier effect in combination with other projects.

7.4.3.4 *Other wind farm activities impact*

Other wind farm activities during the operational phase include turbine servicing are the maintenance and periodic upgrading of access tracks and substation inspection and maintenance.

Maintenance of access tracks within the wind farm would be an occasional activity and would be relatively minor in terms of construction. It is considered that track maintenance works would not have any measurable effect on the foraging potential of birds within the site, including species of high conservation value such as red grouse and kestrel.

Maintenance works at the turbines and the wind farm substation would not be expected to have any effects on local bird populations.

7.4.3.5 *Potential effects on Birds of the Hinterland*

While the hinterland surveys recorded a range of species of conservation importance, including wetland birds such as whooper swan at sites such as The Gearagh, Lough Allua and Gougane Barra Lough, none of these species were recorded in the vicinity of the site during the baseline surveys from 2017 to 2021.

It is concluded that the operational phase of the Project, as well as the decommissioning phase, would not have effects, including risk of collision, on birds associated with any of the hinterland sites surveyed.

7.4.4 Decommissioning Phase Potential Effects

During the decommissioning works there is a risk of disturbance and subsequent displacement to sensitive breeding species such as red grouse and merlin. As for the construction phase, appropriate mitigation will be implemented to ensure that disturbance to these species, as well as any other species which may have a high conservation status at the time of decommissioning, is minimised.

7.5 MITIGATION MEASURES

7.5.1 Construction Phase

7.5.1.1 Measures for Loss of Habitat

The implementation of the Habitat Enhancement Plan will enhance blanket bog habitat for bird species associated with peatland habitats, including red grouse, merlin and meadow pipit. The regrowth of ling heather in the eroded blanket bog habitat would be of particular benefit to the local red grouse population.

This Plan, which provides for the enhancement of approximately 10.8 ha of blanket bog habitat, will compensate for the loss of breeding bog and heath habitat for birds.

7.5.1.2 Measures to Prevent Disturbance to Breeding Hen Harriers

A section of the grid connection route is located along the route of an existing forestry road which runs north of the Mullaghanish to Musheramore Mountain SPA, with the closest distance between the cable route corridor and the SPA being 170 m. To prevent any potential disturbance to nesting and/or foraging hen harriers, works will be restricted along the identified section to the period outside of the breeding season (March-August). This will ensure that the breeding hen harrier population within the SPA is not disturbed by the Project.

7.5.1.3 Measures to Minimise Potential Disturbance to Sensitive Bird Species

The present assessment has identified the potential for significant disturbance effects on two breeding species of conservation interest as a result of the construction works (see **Section 7.4.2.2**). These species are merlin and red grouse. Best available evidence has been reviewed and it is suggested that these species could be disturbed by works, including tree felling, at the following distances:

Merlin	500 m
Red grouse	500 m

As noted in section 7.4.2.2, pre-construction breeding surveys for selected species are required on the basis of the following:

1. Suitable breeding habitat exists within and around the Site for sparrowhawk, kestrel and snipe, which were recorded as non-breeding during the baseline surveys but which could breed within the study area in future years;
2. Specific survey for the presence of woodcock in the study area was not carried out as part of the baseline surveys.

Should the pre-construction surveys indicate a requirement for protection from construction-related disturbance, including tree-felling, of any relevant species, appropriate measures will be taken in line with all relevant legislation and best practice guidance available at the time to ensure that breeding attempts are not disturbed by construction related works.

Best available evidence has been reviewed (Currie & Elliot 1997, NatureScot 2022, Pearce-Higgins *et al.* 2012, Scottish Natural Heritage 2016) and it is suggested that the following species could be disturbed by construction works, including tree felling, at the following distances:

Sparrowhawk	200 m
Kestrel	200 m
Snipe	400 m
Woodcock	200 m

Should any of these species be recorded breeding within the given distances of the works area through confirmatory surveys before and/or during construction, a buffer zone (using above distances) shall be established around the expected location of the nest (location identified as far as is possible without causing disturbance to the bird) and all works will be restricted within the zone until it can be demonstrated by an ornithologist that the species has completed the breeding cycle in the identified area. Any restricted area that is required to be set up will be marked clearly using hazard tape fencing and all site staff will be alerted through toolbox talks.

The above mitigation, if needed, will apply from March to August (inclusive) and will ensure that the works will not have an adverse effect on the identified species of conservation importance recorded during the baseline surveys or in pre-construction surveys.

7.5.1.4 Measures to Minimise Potential Disturbance to Nesting Passerine Species

A range of passerine bird species breed within the Site, including the Red-listed meadow pipit and the Amber-listed goldcrest and willow warbler. In compliance with Section 40 of

the Wildlife Acts 1976 as amended, all vegetation required to be cleared to facilitate the works will be done outside of the restricted period from 1st March to 30th August. Should it be necessary to remove vegetation during the breeding season, for instance where bramble and ephemeral plant species have become established on ground cleared earlier, this will be surveyed by an ornithologist up to 10 days before any clearance. Should an active nest be located, the area will be restricted from works by a distance where it is considered that the works would not cause disturbance or abandonment of the nest. Such distances, which will vary according to species and local topography, will be determined by the ornithologist. The restriction will be maintained until it is established that any young birds present have fledged. Should an instance arise where the placement of a restriction would have significant implications for the time frame of the Project, and where no alternative mitigation is available, the ornithologist will prepare a report (to include species, stage of breeding etc.) on the implications of removal of the nest in the context of the Wildlife Acts and consultation will be undertaken within the NPWS.

With the above mitigation implemented, the significance of the effect of disturbance to nesting passerine species can be reduced to a Slight Adverse Effect of Short-term Duration.

7.5.2 Operational Phase

7.5.2.1 Measures for White-Tailed Eagle

The present assessment has shown that the Site is within the known area of distribution for white-tailed eagle, with a bird recorded within 500 m of the Redline boundary.

While white-tailed eagle was excluded from collision risk analysis due to the low level of flight activity recorded, it is a species that is vulnerable to collision with wind turbines. Therefore, as a precautionary measure, mitigation will be implemented to minimise this risk.

It is noted that while the Site does not offer potential nesting sites to eagles, foraging birds could be attracted to the site to feed on carrion (as happened in the past close to Sillahertane Wind Farm where two eagle casualties occurred).

Once operational, a programme will be put in place to remove carcasses (mainly of sheep) from the site. This will involve search of the wind farm infrastructure area by site management for the presence of dead and/or injured animals (mostly lame sheep or animals caught in wire fencing). It is noted that such animals are usually identified by a concentration of corvids (ravens and hooded crows). Searches will be carried out on a weekly basis.

Should a carcass be located, this will be removed at the earliest opportunity by an appointed representative following standard practice for the disposal of carcasses (subject to Health and Safety issues). Injured or trapped animals will be reported to local landowners.

With mitigation in place, the significance of the effect of collision risk to white-tailed eagle as a result of the project is reduced to a Slight, Adverse, Long-term Effect.

7.5.2.2 Measures for Kestrel

Kestrel is regular at the Site, with birds using it for hunting purposes. As discussed in the impact section, kestrel is a species at risk of collision, as birds will be attracted to the ground around the turbines where prey items inhabit the low scrub type vegetation. As kestrel is a Red-list species, mitigation is proposed to avoid collisions.

Should monitoring during operation identify more than one kestrel casualty at a specific turbine(s), proactive measures will be taken to discourage the birds from hunting in the area of the relevant turbine(s).

This will involve clearing rank vegetation from around the relevant turbine(s) to make it less suitable for supporting prey items such as small mammals (mice, shrews, voles) and birds (meadow pipit, skylark etc). Vegetation clearing will be achieved by mowing and/or strimming. This approach has proved highly effective at several wind farms in central-eastern Spain where the number of collisions with lesser kestrel decreased by 75% to 100% after the ground was superficially tilled to a distance of 80m from the turbine base (Pescador *et al.* 2019). [It is noted that the maintenance of a low sward around the turbines during the operational phase is also required as mitigation to minimise bat collision].

With mitigation in place, the significance of the effect of collision risk to kestrel as a result of the project is reduced to a Slight, Adverse, Long-term Effect.

7.5.2.3 Monitoring

Pre-construction phase and construction phase monitoring

During the breeding season (March-August), bird monitoring surveys will take place to a distance of 500 m from the development area. The purpose of the monitoring will be to identify the presence of sensitive breeding species of conservation importance so that mitigation can be taken to avoid adverse effects on the breeding activities from the works.

The key species of concern at this site are red grouse and merlin, but with potential for breeding sparrowhawk, kestrel, snipe and woodcock. The monitoring surveys will be undertaken by a suitably qualified ornithologist.

Should the presence of any of these species be confirmed, the location of the nest will be identified (as far as is possible without causing disturbance to the birds) and a buffer zone of up to 500 m will be observed where works are restricted until the breeding activity is complete.

Post-construction monitoring

Post-construction bird monitoring is required to establish possible effects on bird species as a result of the project. The monitoring programme will comprise the following:

Flight activity surveys

Flight activity surveys will be undertaken using the Vantage Point method (Scottish Natural Heritage 2017). This will use the same 3 no. VPs as used for the baseline EIAR surveys. The surveys will be undertaken monthly in Years 1, 2, 3, 5, 10 and 15 of the life-time of the project (in accordance with Scottish Natural Heritage Guidance 2009). Usage of the site by, hen harrier, sparrowhawk, merlin, kestrel and golden plover will be of particular interest.

Distribution and abundance surveys

Distribution and abundance surveys will be undertaken to monitor short-term and long-term effects on bird populations within the site. Survey methodology will be similar to methods employed for baseline on-site EIAR surveys, which will allow a comparison of data to be made for each monitoring year. For merlin, best practice survey methodology as recommended at the time will be followed. Surveys will be undertaken in the same monitoring years as the vantage point surveys.

Red grouse survey

Repeat of the pre-construction red grouse survey (under licence) in Years 1, 2, 3 and 5 of operation. This will establish whether red grouse maintain a presence on site in the area of the wind farm infrastructure. Surveys will follow the standard methodology as used in the baseline EIAR survey.

Collision searches

The objective of collision monitoring and corpse search is to establish whether bird fatalities are occurring as a result of collision with turbine blades.

Carcass search was traditionally completed by human observers whose efficiency is influenced by several factors including carcass type, environmental conditions and observer competence. Numerous studies have been conducted demonstrating that dogs have a superior ability to detect bird and bat carcasses than humans, particularly with small carcasses or in dense vegetation (see for example Mathews 2013).

A standard plot size will be selected at each turbine location where search will occur. At the start of each survey, data recorded will include meteorological and ground cover information. The locations of any carcasses found will be recorded by GPS and will be photographed in-situ. The state of each carcass will be recorded on a corpse record card, using the following categories (after Johnson 2003):

- Intact - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger
- Scavenged - an entire carcass which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location such as wings, legs, skeletal remains or pieces of skin
- Feather Spot - ten or more feathers at one location indicating predation or scavenging. If only feathers are found, 10 or more total feathers or two or more primaries must be discovered to consider the observation a casualty.

Searcher efficiency and predation tests will be carried out at the commencement of the programme in order to calibrate the results to account for the search dog's ability to find bird corpses and to also account for scavenging of corpses by animals.

The collision searches will be carried out in Years 1, 2, 3, & 5 of the operational phase of the wind farm.

7.5.3 Cumulative Effects

There are 26 wind farms within 20 km[3] of the Inchamore proposed development (an area of 1,256 km^2). **Figure 2.2 in Chapter 2** shows the location of proposed, permitted and operational wind farms within a 20 km radius of the Inchamore site and further information on these wind farms is provided in the EIAR (**Appendix 2.3, Chapter 2**). Of the 26, 18 no.

[3] A distance of 20 km is taken as a precautionary distance for potential in-combination effects to occur – such a distance is beyond the normal foraging range of bird species associated with SPAs.

are operational (175 turbines total), 6 no. are permitted (25 turbines), 1 no. is at pre-planning stage (17 turbines) and 1 no. is proposed (14 turbines).

The nearest operational wind farms to the Inchamore site are Coomagearlaghy, Kilgarvan Wind Farm (15 turbines), which is located 2.7 km to the south-west, and Inchee, Poulbatha & Foilgreana (6 turbines), which is located 3.3 km to the south-west. The permitted Gortnakilla, Clonkeen, Killarney Wind Farm is located 1.87 km to the west of the Inchamore site.

Most of the wind farms are clustered to the north-east, south and south-west of the Inchamore site.

If permitted, the Inchamore project will add a further 5 turbines. Based on the locations of the 26 wind farms, it is expected that most are on heath and/or bog habitats and the construction of such projects would have (or will) caused loss and disturbance of peatland habitats which may support bird species such as red grouse and merlin. The construction of the Development will contribute to an existing and ongoing (unquantified) adverse effect on bird species associated with loss of peatland habitats.

All of the 26 wind farms are within the range of the Kestrel population and present (or will present when built) some risk of collision for this species. The operation of the Project will contribute to an existing collision risk for kestrel. However, with implementation of the mitigation as presented in this report, the risk from the Project is minimised.

All of the 26 wind farms are within the range of the wintering and migratory golden plover population and are likely to present (or will when built) some risk of collision for this species.

The operation of the Project is likely to contribute to an existing collision risk for these two species.

7.6 RESIDUAL EFFECTS OF THE DEVELOPMENT

With mitigation measures as presented in this report implemented in full, and specifically construction phase mitigation for breeding birds of peatland habitats, as well as precautionary measures during operation phase to discourage usage of the Site by white-tailed eagle and the areas close to turbines by kestrel (as required), it is considered that the significance of the predicted adverse effects on birds as a result of the Project will range from Imperceptible to Moderate.

Whilst loss of peatland habitat will reduce the area of suitable breeding habitat available for red grouse, merlin and meadow pipit (species of high conservation importance), it is not expected that this will have a significant adverse residual effect as the loss is a relatively small amount of the available peatland habitat in the local area, *i.e.,* extending westwards from the redline boundary. Also, the Habitat Enhancement Plan will compensate for the loss of peatland habitat. Similarly, the relatively small amount of habitat loss as a result of the Project is not expected to have any residual impact on species which use the site for feeding and/or roosting, including hen harrier, kestrel and golden plover.

The construction phase of the Project may result in disturbance to breeding birds within a distance of up to 500 m of the works boundary. In absence of mitigation, this is expected to have adverse effects on scarce species such as red grouse, merlin and hen harrier (latter along grid connection route). With mitigation in place, comprising the use of work restrictive zones around identified nests areas (if present) and a seasonal restriction on work along the grid connection route where hen harrier occurs, the Project is not expected to have any residual effect on these species.

During the operational phase of the Project, birds may show some avoidance of suitable habitat as a result of the presence of turbines. However, this effect is not likely to be significant.

During the operational phase of the Project, birds will be at some risk of collision with turbines. The significance of residual effects will range from Slight Adverse for kestrel to Moderate Adverse for golden plover.

The baseline surveys did not identify any regular migration routes or local movements of wetland bird species through the site. The project is not expected to have any residual effect on migrating species or local wetland bird populations.

With mitigation in place to prevent disturbance during the construction phase to breeding hen harriers within the Mullaghanish to Musheramore Mountains SPA (as detailed in the Natura Impact Statement), the Project is not expected to have any residual effects on the Special Conservation Interests of this SPA or the SCIs of any other Special Protection Area.

7.7 CONCLUSIONS

An assessment of effects on ornithology has been carried out at the site for the Project. This is based on detailed survey information from 2017 to 2021.

The study site supports species of conservation importance which are associated with peatland habitats – these include breeding merlin, red grouse and wintering golden plover. Overall, the site is rated as of County Importance for birds. The grid connection corridor passes close to the Mullaghanish to Musheramore Mountains SPA, with hen harrier the Special Conservation Interest.

The principal ornithological effects as a result of the proposed wind farm project at Inchamore are as follows:

- Loss of 4.1 ha of peatland habitat, which is rated as a Moderate Adverse Effect of Long-term duration. With compensation by implementation of a Habitat Enhancement Plan, effect reduced to Slight Adverse of Long-term duration.

- Likely construction related disturbance to hen harrier, merlin and red grouse, which is rated as a Significant Adverse Effect of Short-term duration. With mitigation by establishment of buffer zone where works will be restricted during the breeding season, effect reduced to Not Significant.

- Likely construction related disturbance to nests of passerine species, including Red-listed meadow pipit, which is rated as a Significant Adverse Effect of Short-term duration. With mitigation by clearing of vegetation outside of breeding season and ongoing monitoring during construction phase, effect reduced to Slight Significant Adverse Effect of Short-term duration.

- Collision risk to kestrel and golden plover, rated as Adverse Effect of Moderate Significance of Long-term Duration. With mitigation implemented for kestrel by discouraging birds from hunting at turbine locations, significance of effect is reduced to Slight. For white-tailed eagle (recorded within 500 m of Redline boundary of site), a precautionary approach is proposed to discourage birds from feeding in the area of the wind farm, as this species is sensitive to collision.

- The proposed Project includes rigorous ornithological monitoring (in line with best practice guidance) at pre-construction, construction, and operational phases.

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8 SOILS AND GEOLOGY

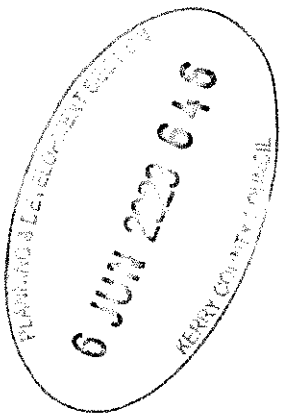
8.1 INTRODUCTION

This chapter assesses the impacts of the Project (**Chapter 1: Introduction**) on soils and geology environment. The Project refers to all elements of the planning application for the construction of Inchamore Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project;
- Operation of the Project, and
- Decommissioning of the Project.

Common acronyms used throughout this EIAR can be found in **Appendix 1.2**. This chapter of the EIAR is supported by the Figures provided in **Volume III** and by the appended documents provided in **Volume IV** of this EIAR:

- **Figure 8.1(a) –** Site Location & Layout Wind Farm
- **Figure 8.1(b) –** Site Location & Layout Grid Connection Route
- **Figure 8.2(a) –** Land Use Wind Farm
- **Figure 8.2(b)** – Land Use Grid Connection Route
- **Figure 8.3(a) –** Geology Wind Farm
- **Figure 8.3(b) –** Geology Grid Connection Route
- **Figure 8.4(a)** – Soils Wind Farm
- **Figure 8.4(b) –** Soils Grid Connection Route
- **Figure 8.5(a)** – Subsoils Wind Farm
- **Figure 8.5(b)** – Subsoils Grid Connection Route
- **Figure 8.6(a)** – Landslide Risk & Events Wind Farm
- **Figure 8.6(b) –** Landslide Risk & Events Grid Connection Route
- **Figure 8.7 –** Geo-Hazards Constraints Map Wind Farm



- **Appendix 8.1** – Site Investigation and Peat Slide Risk Assessment
- **Appendix 8.1 – App A1 –** IWF SI – Peat Depth Overview
- **Appendix 8.1 – App A2 –** IWF SI – Peat Depth – Tile 1
- **Appendix 8.1 – App A2 –** IWF SI – Peat Depth – Tile 2
- **Appendix 8.1 – App B** – Peat Database
- **Appendix 8.1 – App C –** IWF SI – Trial Pit and Borehole Locations
- **Appendix 8.1 – App D** – IWF SI – Trial Pit Logs
- **Appendix 8.1 – App E –** IWF SI – Trial Pit Photos

- **Appendix 8.1 – App F –** IWF SI –Borehole Log
- **Appendix 8.1 – App G** – IWF SI – Subsoil Laboratory Certificate
- **Appendix 8.1 – App H (a)** – IWF SI – Geohazards Overview
- **Appendix 8.1 – App H (b)** – IWF SI – Geohazards W NW
- **Appendix 8.1 – App H (c)** – IWF SI – Geohazards E SE
- **Appendix 8.1 – App I –** IWF SI – Stability Risk Matrices

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1.** This document will be a key construction contract document, which will ensure that the mitigation measures, which are considered necessary to protect the environment are implemented. In the event that planning permission is granted for the Project, any condition(s) relating to a CEMP which will be attached to such a permission, will be implemented in accordance with the requirements of the condition. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

8.1.1 Assessment Structure

In line with the EIA Directive, as amended and Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, May 2022), the structure of this Soils and Geology chapter is as follows:

- Assessment Methodology and Significance Criteria.
- Description of baseline conditions at the Site.
- Identification and assessment of impacts to soils and geology associated with the Project, during the construction, operational and decommissioning phases..
- Mitigation measures to avoid or reduce the impacts identified.
- Identification and assessment of residual impact of the Project considering mitigation measures.
- Identification and assessment of cumulative impacts if and where applicable.

8.1.2 Project Description

The Project (**Figure 9.1a-b**) is described in **Chapter 2: Project Description**.

8.1.3 Statement of Authority

Minerex Environmental Ltd. (MEL), an RSK group company was commissioned to carry out this Chapter of the Environmental Impact Assessment Report. RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at www.rskgroup.ie. The members of the RSK EIA team involved in this assessment include the following persons:

- Sven Klinkenbergh – B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection) – Principal Environmental Consultant, Project Manager and EIA Lead Author with c. 10 years industry experience in the preparation of geological, hydrological and hydrogeological reports.
- Project Scientist: Jayne Stephens - B.Sc. (Environmental Science), PhD (Environmental and Infection Microbiology). Jayne is an Environmental consultant with c. 5 years' experience working in microbiology, water, and environmental disciplines. She graduated with a BSc in Environmental Science from National University of Ireland Galway in 2014, majoring in mammal ecology. Following this, Jayne was the successful Irish applicant to the Tropical Biological Association in Cambridge to complete a field course in tropical biodiversity and conservation in Tanzania. She holds a PhD in environmental microbiology, graduating in 2023. Jayne has worked on a large number of bathing water and surface water monitoring investigations, on project Acclimatize, an EU funded project which aimed to bridge the knowledge gap in relation to at-risk urban and rural bathing waters in Ireland and Wales. During this project, Jayne was team lead for site investigations and has a number of years' experience on microbial contamination and public involvement projects for better water quality.
- Lissa Colleen McClung - B.Sc. Environmental Studies (hons.), M.Sc. Environmental Science (hons.). Current Role: Graduate Project Scientist. Colleen has recently joined RSK Ireland as a Graduate Project Scientist under the Hydrology & Hydrogeology and Land, Soils & Geology Team. After attaining an MSc in Environmental Science, with 1.1 First Class Honours, from Trinity College Dublin in 2021. Since coming on board, Colleen has worked on a variety of projects for urban residential development schemes and renewable energy. As a Project Scientist, Colleen has undertaken technical report writing in many forms, such as: Flood Risk Assessments (Stage 1 and Stage 2) (ROI), Drainage Assessments (NI), Water Framework Directive Assessments, Environmental Impact Assessment Reports (ROI) and Environmental Statements (NI). She has also carried out extensive field work around the country. Key capabilities include preparation of Environmental Impact Assessment Reports and running software such as QGIS, Python and MATLAB coding languages.
- Mairéad Duffy - B.Sc. Environmental Management, M.Sc. Climate Change. Current Role: Graduate Project Scientist. Mairead has experience in technical report writing and field work surveying of hydrological and geological elements of the environment with associated proposed green energy projects around the country.

8.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

8.2.1 Assessment Methodology

The following calculations and assessments were undertaken in order to evaluate the potential impacts of the Project on the soils, geology and ground stability aspects of the environment at the Inchamore Site:

- Characterise the topographical, geological and geomorphological regime of the Site from the data acquired through desk study and onsite surveys.
- Undertake preliminary materials budget calculations in terms of volumetric peat / subsoil excavation and removal associated with Project design.
- Consider ground stability issues as a result of the Project, its design and methodology of construction.
- Assess the combined data acquired and evaluate any likely impacts on the soils, geology and ground stability aspects of the environment.
- If impacts are identified, consider measures that would mitigate or reduce the identified impact.
- Present and report these findings in a clear and logical format that complies with EIAR reporting requirements.

8.2.1.1 Assessment Principles

Direct impacts or effects on geological attributes or soils themselves are localised in the context of soils and geology (e.g., excavated soils from holes, stored and used as back fill). However, in many instances, these geological impacts give rise to the potential sources of contamination by water run off (i.e., indirect or secondary impacts) to ecological and hydrological receptors. For example: Contamination of soils / peat by cementitious material is considered a localised impact, however if cementitious contamination is intercepted by surface water features or groundwater bodies the impact is potentially regional depending in the environmental circumstances. Therefore, throughout this report references will be made to **Chapter 9: Hydrology and Hydrogeology,** for further detail and clarification on potential effects and mitigation measures of the Project.

8.2.2 Relevant Legislation and Guidance

This assessment complies with the EIA Directive, as amended, which requires Environmental Impact Assessment for certain types of development before development consent is granted. This assessment was undertaken in accordance with the following Irish legislation:

- Planning and Development Act 2000, as amended;
- Planning and Development Regulations 2001, as amended;

- Wildlife Act 1976, as amended;
- EC (Birds and Natural Habitats) Regulations 2011, as amended, and
- Heritage Act 1995, as amended.

The Cork County Development Plan (2022-2028) and Kerry County Development Plan (2022-2028) were also consulted as part of the EIA process.

This assessment has been prepared using, inter alia, the following guidance documents, which take account of the aforementioned legislation and policy:

- BSI (1999) Code of Practice for Site Investigations - BS 5930.
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance (C649).
- Creighton, R. et al. (2006) Landslides of Ireland.
- Department of the Environment, Heritage and Local Government (DEHLG) (2006) Wind Energy Development Guidelines.
- Department of Housing, Planning, Community and Local Government (DHPLG) (2017) Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change.
- Environmental Protection Agency (EPA) (2015) Advice Notes for Preparing Environmental Impact Statements – DRAFT September 2015 (will supersede 2003 version once finalised).
- Environmental Protection Agency (EPA) (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (supersedes 1997 and 2002 versions.)
- Environmental Protection Agency (EPA) (2022) EPA Map Viewer.
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- NPWS (2015) National Peatlands Strategy.
- RSK (2022) Engineer's Quick Reference Guide for Ground Investigation.
- Scottish Forestry Commission (2006) "Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume / Low-Cost Roads Over Peat".
- Scottish Government (2017) Peat Landslide Hazard and Risk Assessment: Best Practice Guide for Proposed Electricity Generation Developments.
- Scottish National Heritage (SNH) (2013) A Handbook on Environmental Impact Assessment.
- Teagasc (2022) Soil Map Viewer.

8.2.3 Desk Study

Desk top study assessments were undertaken (2020-2023) on the soils and geology aspects of the Project before and after field investigations. This involved the following components:

- Acquire and compile all available maps of the Project, November 2022.
- Study and assess the proposed locations of turbines, Site Access Roads relative to available data on Site topography and slope gradients, November 2022.
- Study and assess the proposed locations of turbines, Turbine Delivery Route and an assessment of the Grid Connection Route, connecting the Development to the national grid, substation and associated infrastructure (e.g., potential borrow pit locations, typical drainage infrastructure) relative to available data on Site soils, subsoil and bedrock geology, November 2022 – March 2023.
- Overlay Ordnance Survey of Ireland (OSI) 1:250,000, 1:50,000 and 1:10,560 (6") maps with AutoCAD plan drawings, November 2022.
- Overlay Geological Survey of Ireland (GSI) Geology maps (1:100,000) to determine Site bedrock geology and the presence of any major faults or other anomalies, November 2022.
- Overlay Geological Survey of Ireland (GSI) Groundwater Resources (Aquifers), Groundwater Vulnerability, and Groundwater Recharge maps to determine Site sensitivity in terms of groundwater, November 2022.

- Overlay Geological Survey of Ireland (GSI) Landslide Susceptibility maps to determine Site landslide susceptibility risk classification, November 2022.
- Overlay Environmental Protection Agency (EPA) and Teagasc (Agricultural Agriculture & Food Authority) Soils and Subsoil maps (1:50,000) to determine categories of soils and subsoil and indirectly the geochemical origin for the study area, November 2022.
- Search of the GSI databases and publications in relation to geological extractive resources and mineral localities in the region, November 2022.
- Search of the GSI landslide database for records of landslide mass movement events at and near the study area, November 2022.
- Search of the GSI karst database for records of karst features at and near the study area, November 2022.
- Search of the GSI wells and springs database for records of wells or springs at and near the study area, November 2022.
- Search of National Parks and Wildlife Service designated sites in the region, November 2022.

8.2.4 Field Work

8.2.4.1 Field Work Preliminary Geotechnical Investigations, Site Walk Over and Observations

EIA team personnel (Sven Klinkenbergh – Project Manager), carried out field investigations at the Site of the Project between January and February 2019, as well as September 2020 and November 2022. These works consisted of the following:

- Bedrock and mineral subsoil outcrop logging and characterisation.
- Confirm if peat is present at or near any Project locations.
- Peat depth probing if peat is present (depth to bedrock and/or competent subsoil).
- Gouge coring if peat is present (peat and subsoil characterisation to BS 5930 and Von Post Humification scale).
- Trial holes in mineral soil to validate desk study findings.
- Borehole in bedrock to validate to desk study findings.
- Slope measurements at proposed turbine locations to determine slope gradient.
- Recording of GPS co-ordinates for all investigation and monitoring points in the study.
- Digital photography of significant features.

Initial Site walk overs were carried out to assess general ground conditions including topographical characteristics, and to observe the existing Site including visual assessment of the receiving environment in terms of impacts arising from the existing infrastructure and practices at the Site.

8.2.5 Evaluation of Potential Effects

8.2.5.1 Sensitivity

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed development.[1] Potential affects arising by a proposed development in terms of soils and geology will be limited to a localised scale, and therefore in describing the sensitivity of soils and geology it is appropriate to rate such while considering the value of the receiving environment or site attributes.

The following table presents rated categories and criteria for rating site attributes.[2]

Table 8.1: Criteria for Rating Site Attributes – Soils and Geology Specific

Importance	Criteria
Extremely High	Attribute has a high quality or value on an international scale.
Very High	Attribute has a high quality, significance or value on a regional or national scale.
High	Attribute has a high quality, significance or value on a local scale.
Medium	Attribute has a medium quality, significance or value on a local scale.
Low	Attribute has a low quality, significance or value on a local scale.

Considering the above categories of rating importance and associated criteria, the following table presents rated sensitivity categories.[3]

Table 8.2: Criteria for Rating Site Sensitivity – Landscape Character Specific

Importance	Criteria
High Sensitivity	Key characteristics and features which contribute significantly to the distinctiveness and character of the landscape character type. Designated landscapes e.g., National Parks, Natural Heritage Areas (NHAs) and Special Areas of Conservation (SACs) and landscapes identified as having low capacity to accommodate proposed form of change, that is, sites with attributes of **Very High Importance**.
Medium Sensitivity	Other characteristics or features of the landscape that contribute to the character of the landscape locally. Locally valued landscapes which are not designated. Landscapes identified as having some tolerance of the proposed change subject to design and mitigation etc., that is, sites with attributes of **Medium to High Importance.**
Low Sensitivity	Landscape characteristics and features that do not make a significant contribution to landscape character or distinctiveness locally, or which are untypical or uncharacteristic of the landscape type. Landscapes identified as being generally tolerant of the proposed change subject to design and mitigation etc, that is, sites with attributes of **Low Importance**.

[1] Environmental Protection Agency (EPA) (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (supersedes 1997 and 2002 versions)
[2] NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1
[3] Scottish National Heritage (SNH) (2013) A handbook on environmental impact assessment

8.2.5.2 *Magnitude*

The magnitude of potential impacts arising as a product of the Project are defined in accordance with the criteria provided by the EPA, as presented in the following table. [4]

Table 8.3: Describing the Magnitude of Impacts

Magnitude of Impact	Description
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration or intensity, alters a sensitive aspect of the environment.
Very Significant Effects	An effect which, by its character, magnitude, duration or intensity, significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics.

In terms of soils and geology, magnitude is qualified in line with relevant guidance, as presented in **Table 8.4**. [5]

Table 8.4: Qualifying the Magnitude of Impact on Soil and Geological Attributes

Magnitude of Impact	Description	Example
Large Adverse	Results in a loss of attribute.	Removal of the majority (>50%) of geological heritage feature.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Removal of part (15-50%) of geological heritage feature.
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Removal of small part (<15%) of geological heritage feature.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	No measurable changes in attributes.
Minor Beneficial	Results in minor improvement of attribute quality.	Minor enhancement of geological heritage feature.
Moderate Beneficial	Results in moderate improvement of attribute quality.	Moderate enhancement of geological heritage feature.
Major Beneficial	Results in major improvement of attribute quality.	Major enhancement of geological heritage feature.

[4] Environmental Protection Agency (EPA) (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports

[5] NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1

8.2.5.3 Significance Criteria

Considering the above definitions and rating structures associated with sensitivity, attribute importance, and magnitude of potential impacts, rating of significant environmental impacts is done in accordance with relevant guidance as presented in the Table below.[6] This matrix qualifies the magnitude of potential effects based on weighting same depending on the importance and/or sensitivity of the receiving environment. In terms of Hydrology and Hydrogeology, the general terms for describing potential effects (**Table 8.3: Describing the Magnitude of Impacts**) are linked directly with the Project specific terms for qualifying potential impacts (**Table 8.4: Qualifying the Magnitude of Impact on Geological Attributes**) therefore, qualifying terms (**Table 8.5**) are used in describing potential impacts of the Project. This is largely driven by the likely far reaching impact which is characteristic of potential effects arising as a product of the Project in terms of the Geological and Soil environment. Far reaching impacts in terms of geology include impacts on the receiving surface water or groundwater bodies where impacts can occur downstream of the site, including at a catchment scale (**EIAR Chapter 9: Hydrology & Hydrogeology**).

Table 8.5: Sensitivity (Importance of Attribute) & Magnitude of Impact Matrix

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Negligible (Imperceptible)	Small Adverse (Slight)	Moderate Adverse (Moderate)	Large Adverse (Significant to Profound)
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

8.2.5.4 Consultation

A full list of scoping responses is set out in **Appendix 1.1: Consultation Responses**. A Scoping Report Consultation was made to Inland Fisheries Ireland in November 2020 in regards to contaminated site run-off and subsequent polluting of surface waters. Consultations were also undertaken at the same time with the Geological Survey Ireland in relation to geohazards and peat stability. Proposed mitigation measures in response to these potentials impacts are outlined in **Section 8.5** of this Chapter.

[6] NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1

8.3 BASELINE DESCRIPTION

8.3.1 Introduction

An investigation of the existing land, soils and geology characteristics of the Study Area was conducted by undertaking a desk study (as set out in **Section 8.3),** consultation with relevant authorities(as set out in **Appendix 1.1** and **Section 8.2.5.2),** and Site-based fieldwork surveys(as set out in **Section 8.6**). All data collected has been interpreted to establish the baseline conditions within the Study Area and the significance of potential adverse effects have been assessed. These elements are discussed in detail in the following sections.

8.3.2 Site Description

The Site is located 5.9 km west of Ballyvourney, Co. Cork and shares the county boundary between Cork and Kerry. It is 54 km west of Cork City, and 23 km north-east of Kenmare, Co. Kerry. The Project is located within the townlands of Inchamore, Mileeny Derryreag and Derreenaling. The Site is characterised by relatively complex (hilly) topography with associated elevations ranging between 460 metres Above Ordnance Datum (m AOD) in the north-western side of the Site to 350 m AOD towards the eastern side of the Site. The Project is in contrast to on-going Site practices. The Site is characterised as being rural agricultural land generally, however there are a number of established wind farms in the region including Coomagearlahy Wind Farm, Coolknoohil Kilgarvan Wind Farm, Glanlee Wind Farm and Grousemount Wind Farm c. 2.7 km, 4.4 km 4.9 km, and 7.5 km southwest of the Site, respectively (**Appendix 2.3: Wind Farms within 20 km of Proposed Turbines**).

The Site extends to approximately 170 ha of which (c. 145.4 ha) largely consists of low yielding, commercial forestry owned by Coillte. The remaining land (24.6 ha) is third party property and the principal land use in the general area consists of a mix of agricultural sheep and cattle grazing, farmland, residential properties, agricultural structures and open mountain heath.

8.3.3 Land Use

Mapped land uses for the Wind Farm, Underground Cable Route and Turbine Delivery Route are presented in **Figure 8.2 a-b.**Error! Reference source not found.

Consultation with Corine (2018) Land Use maps (EPA) determined that the Site is mainly comprised of combination of '*Coniferous forests*' and '*Transitional woodland scrub*'. The Site is otherwise comprised of '*Land principally occupied by agriculture with significant areas of natural vegetation*' and '*Peat bogs*'. While the Site is principally used for

commercial forestry along with areas of peat bogs, these spaces have been noted as being significantly impacted by agricultural practices including extensive land improvement works involving drainage and excavation and manipulation of natural soil profiles or horizons. For further information on extent of drainage see **Chapter 9: Hydrology and Hydrogeology**.

The Grid Connection Route traverses land principally classified as '*Forest and semi-natural areas*' along with '*Land principally occupied by agriculture and areas of natural vegetation*', within the Site redline boundary (c. 1.3 km). The remaining 18.6 km is located off-road and in third-party lands mapped as '*Conifer forests*', **(Figure 8.2b)** (Corine, 2018).

The Turbine Delivery Route from its origin in Ringaskiddy Port to the Project site crosses countless land uses, including: seaports, industrial and commercial units and discontinuous urban fabric near Cork city and transitions to pastures, arable land, stream courses, heterogeneous agricultural areas, coniferous forests and woodland scrub upon nearing the Project site.

8.3.4 Bedrock Geology

Mapped geology is presented in **Figure 8.3 (a).**Error! Reference source not found.

The mapped (GSI, Bedrock 100 k[7]) geological formation underlying the Site is classified as the Gun Point Formation (DUGNPT) – which is comprised of Green-grey sandstone & Purple siltstone.

Ranges of unconfined compressive strength of rock[8]:

- Sandstone is usually within the range of Weak (5-25 MPa) to Medium Strong (25-50 Mpa)
- Siltstone is usually within the range of Very Weak (1-5 Mpa) to Weak (5-25 Mpa).

Rock strength is strongly correlated to grain size but is affected by other characteristics such as layering and weathering. Sandstone is considered a relatively fine-grained rock; siltstone is comprised of finer constituents than sandstone.

There are a number of recorded faults associated with the underlying geological formation, however none of these faults are mapped as underlying the redline boundary of the Site.

[7] Geological Survey of Ireland (GSI) Spatial Resources. Online: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228. Accessed: May 2021
[8] Norbury D. (2010) *Soil and Rock Description in Engineering Practice.* Whittles Publishing, Scotland, UK.

Similarly, there are several strikes and dips of structural bedding with 'way up unknown'. Consultation with GSI Geotechnical database indicates there is no available data for the underlying formations or in the general area of the Project.

Site investigation data, including drill logs are presented in **Appendix 8.1 IWF SI Report - Stability and Geotechnical Assessment.** Summary of bedrock data taken from **Appendix F 3188-A1 IWF SI – Borehole Log** is presented in **Table 8.6**. It is noted that the bedrock underlying the Site (Siltstone) is comprised by mainly silt sized particles (0.002 - 0.063 mm) (BS 5930).

Table 8.6: Summary Borehole Data

Parameter	(Ref. / Unit)	BH01
Geology	*Drill Log*	Red moderately weak SILTSTONE
Weathering	*Drill Log*	Relatively unweathered
UCS Results	*Kn*	56.7
UCS Results	*MPa*	12.57
Rock Strength (UCS MPa)	*BS EN ISO 14689*	Weak

8.3.5 Seismic Activity

The island of Ireland does experience, monitor and record seismic activity, although the magnitude of such occurrences is generally low and do not generally pose as a risk to infrastructure or human health. Seismic activity is monitored on an ongoing basis by the Irish National Seismic Network (INSN). Since 1980, a low number of earthquakes of <M5.0 (Richter magnitude scale (M)) have been detected in the Atlantic close to Ireland. Some relatively recent earthquakes detected on or near the mainland of Ireland include:

- An M2.4 earthquake which occurred on 07/04/19, the epicentre for which was located within Donegal Bay, and at a depth of 4 km.
- An M2.0 earthquake which occurred on 29/04/19, the epicentre for which was located approximately midway between Donegal Town and Lough Derg, and at 16 km depth.
- An M0.9 earthquake that occurred 20/08/21, the epicentre of which was located near the townlands of Lambstown at a depth of 8 km.

Although earthquakes are considered a triggering mechanism for landslides, given the low magnitude experienced in Ireland earthquakes are not considered an important triggering factor in terms of stability risks.[9]

8.3.6 Soils and Subsoils

Consultation with available soil maps (SIS, EPA, Teagasc) indicate the primary soil type across the Site is that of 'Blanket Peat' while smaller areas of the Site are classified as 'Peaty Gleys - Acid Poorly Drained Mineral Soils with Peaty Topsoil'; 'Acid Brown Earths / Brown Podzolics - Acid Deep Well Drained Mineral'; and 'Podzols (Peaty), Lithosols, Peats with some outcropping rock – Acid Shallow, lithosolic or podzolic type soils potentially with peaty topsoil' (**Figure 8.4a**).

Consultation with available subsoil maps (GSI) indicate that subsoil types across the Site include mainly 'Blanket Peat' with small-scale portions of Sandstone Till and areas of Bedrock at or near the surface (**Figure 8.5a**). Soils and subsoils across the entire Grid Connection Route are those of Blanket Peat, **Figure 8.4b** and **Figure 8.5b.** The Turbine Delivery Route traverses various soil types from the port in Ringaskiddy, however where works will be carried out **(Figure 8.4a Figure 8.5a),** soils and subsoils have been mapped as 'Blanket Peat'.

Several rocky outcrops have been mapped by the GSI, particularly at higher elevations - i.e., the north-western corner of the Site boundary and along the norther and eastern boundary of the Site. Furthermore, many minor rocky outcrops were also observed across the Site during Site walkovers. Thin peat and exposed rock were observed at existing cut and fill locations, in particular along the existing Site Access Roads associated with agricultural and forestry practices in the area **(Appendix 9.2 -** Error! Reference source not found.**IWF Photographs).**

Site investigation data, including Peat depths, trial pit logs and photographs are presented in the SI Report in **Appendix 8.1**. Summary of peat depths (refer to **Appendix A**) and subsoil particle size distribution (PSD) data (refer to **Appendix G**) are presented in **Table 8.8** and **Table 8.9,** respectively.

[9] Creighton, R., Doyle, A., Farrell, E. R., Fealy, R., Gavin, K., Henry, T., Johnston, T., Long, M., McKeown, C., Pellicer, X., Verbruggen, K. (2006) "Landslides in Ireland" *Geological Survey Ireland: Irish Landslides Working Group.*

Table 8.7: Reported Subsoil Description (Appendix G 3188-A1 IWF SI- Subsoils Lab Certs).

Sample ID	Reported Description (PSD)
TP03-A2 (SS1)	Very clayey very sandy GRAVEL
TP08-A2 (SS1)	Slightly sandy gravelly CLAY
TP11-A2 (SS1)	Very clayey very sandy GRAVEL

8.3.6.1 Peat Depth

The results of the Peat Depth Probing and Gouge Coring surveys are presented in the SI Report of **Appendix 8.1** as well as **Appendix A** and **Appendix B**.

Peat depths at survey points (150 No.) range from 0.00 m to >3.00 m. Peat depths were generally shallow. Isolated minor areas of moderately deep peat were observed at some locations, particularly in the northwest corner of the Site near the proposed location of T1.

Peat depths have been mapped by category (**Table 8.9**) and presented in **Appendix A.** Certain peat depths are associated with particular hazards and constraining characteristics in terms of infrastructure construction methodology. Peat depth of 2.0 m or greater is considered '*deep*' or '*deeper*' peat, and in extensive areas of peat which is >2.0 m depth excavation and construction activities become greatly more complicated and present greater risk.

Table 8.8: Peat Depth Distribution by Peat Depth Category (Appendix A-1 to A-5: 3188-A1 IWF SI - Peat Depth)

Peat Depth Category	No.	%
A - Rock (0.00 - 0.01 m)	16	11%
B - Very Shallow (0.01 - 0.5 m)	80	53%
C - Shallow (0.5 - 2.0 m)	42	28%
D - Moderately Deep (2.0 - 3.5 m)	11	7%
E - Deep (3.5 - 5.0 m)	1	1%
F - Very Deep (>5.0 m)	0	0%
Total	150	

8.3.7 Geological Resource Importance

Consultation with available maps (GSI) indicates that there are no recorded 'Geoheritage' sites located within the redline boundary of the Site or within the near vicinity. Furthermore, the GSI database does not indicate any Mineral Localities or Quarries within or near the vicinity of the Site.

8.3.8 Landslide Susceptibility

Peat, subsoil and slope stability assessments for the Site including the Wind Farm and Underground Cable Route are presented in **Figures 8.6 (a - b) Landslide Risk and Events**. The majority of the Turbine Delivery Route (TDR), traverses existing national and regional roads and is generally mapped as 'Low' risk to landslide susceptibility. The area of proposed works along the Turbine Delivery Route, involving approximately 1,870 m^2 of upgrading off the N22, is mapped over areas of 'Moderately High' and 'Moderately Low' Landslide susceptibility as mapped by the GSI (2023) (**Figure 8.6a**).

Geo-Hazards in relation to the Project are detailed in **Appendix 8.1** and presented in **Appendix 8.1 - Appendix H (a - c) as well as Figure 8.7.** Conclusions are summarised in the following sections.

8.3.9 Peat Slide Risk Assessment

Conclusions made here are drawn with reference to Error! Reference source not found.**Appendix A** and **Appendix I**. For further information and context in regard to methodology and definitions, refer to **Section 2** of **Appendix 8.1**.

Peat depth across the Site is generally shallow with the exception of minor isolated areas of deeper peat delineated by shallow subsoils and/or bedrock at or near the surface (**Appendix A of Appendix 8.1**). There was no very deep peat observed at the Site (>5.0 m). Considering this, there remains a residual risk at the Site, it is also important to distinguish between types of landslides, the material in question and associated receptor. With reference to **Appendix 8.1**, the risk of significant peat landslide events occurring at the Site is low given the depth of peat at the Site. However, the Site also possesses a degree of elevated risk in terms of subsoil stability . Subsoil, or till landslide events are generally characterised as relatively isolated, see **Plate 1** below, in comparison to the fluid nature of peat landslides. Nonetheless, a significant movement of subsoils at the Site, if intercepted by the downgradient surface water network at the Site can have similarly devastating consequences to that of a significant peat landslide.

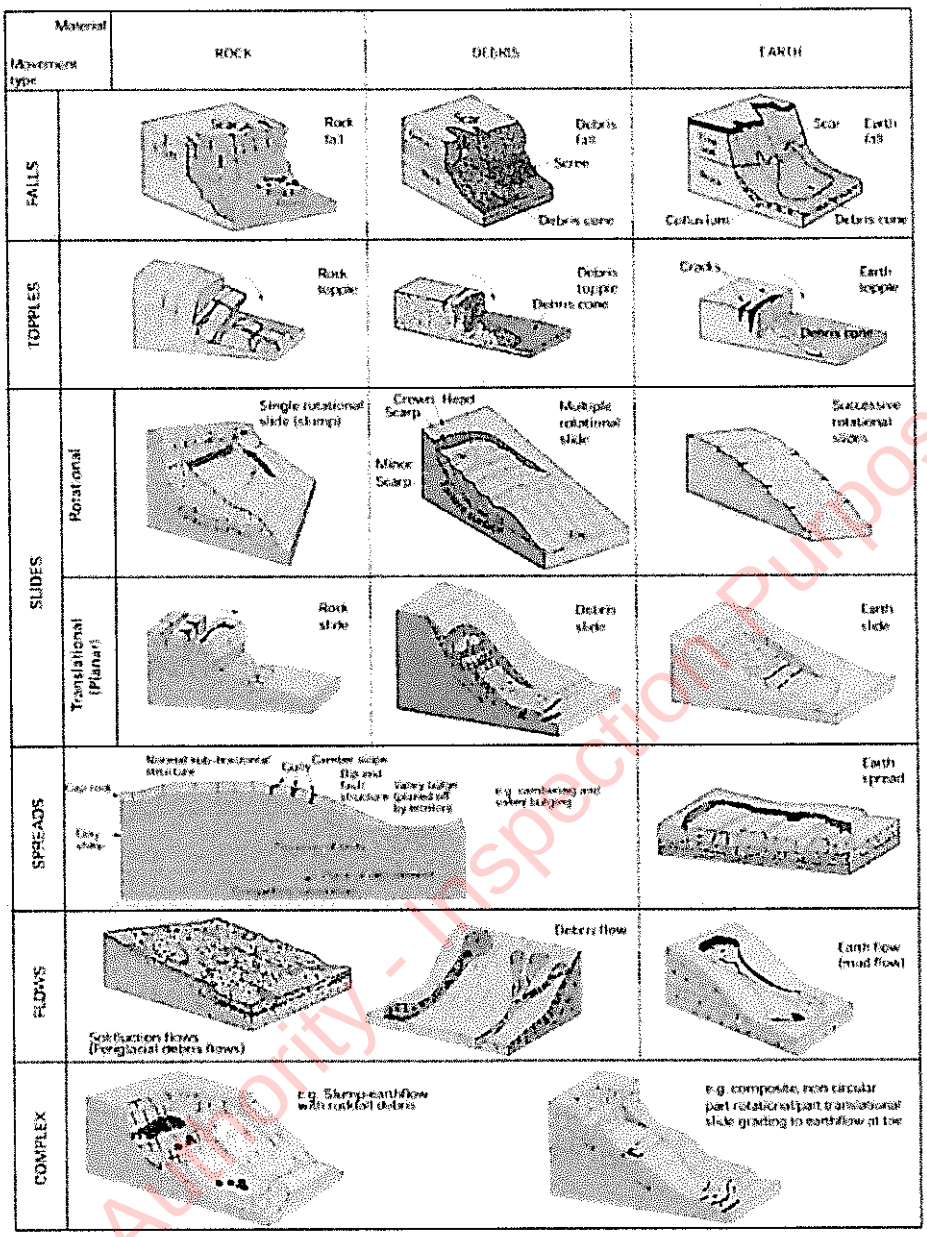

Plate 1: Illustration classifying types of landslides. Image from Razin, 2012.[10]

The Factor of Safety (Adjusted) (Conservative approach*: Scenario B i.e., +1 m surcharge relative to baseline conditions, or Scenario A) at peat probe locations is generally Acceptable with the exception of one marginally stable point location associated with deeper peat and/or steeper inclines.

* This conservative approach, in combination with conservative values used in the stability risk assessment (e.g., conservative values for moisture content, shear strength etc)

[10] Bazin, S. (2012) "SafeLand guidelines for landslide monitoring and early warning systems in Europe- Design and required technology" *ResearchGate.*

(**Appendix 8.1, Section 2.2.5**) is highly sensitive to and bias towards worst case environmental conditions in terms of peat or slope stability. This gives added confidence in sample locations which are classified as acceptable, and marginally stable or unacceptable stability sample points can be identified, interrogated and further risk assessed.

The Risk Ranking (Distance) Scenario B i.e., +1 m surcharge) at peat probe locations is generally Very Low to Low with the exception of Moderate or High-risk point locations associated with deeper peat and/or steeper inclines and/or close proximity (within a receptor buffer zone) to sensitive receptors.

Refer to **Appendix 8.1 – Stability & Geotechnical Assessment – Section 4** for full risk assessment results.

Factor of Safety (FoS) at all trial pit locations are 'Acceptable'. Note: Trial pit locations are limited relative to extent of Project footprint. Subsoil stability is considered to be acceptable across the Site with the exception of areas with all or a combination of the following factors: steep incline, deep till deposits, iron pan, high risk landslide susceptibility, potential for impacted hydrogeological conditions. These Geo-Hazards are identified in the following table/s and a register of Geo-Hazards is presented in **Appendix H (a – c)**. The term "Inferred" which accompanies some risk assessment conclusions is associated with areas with limited data due to access (excavator carrying out trial pits) or inferring hazards such as the presence of iron pan in subsoils from near adjoining trial pits (**Appendix H**). This is in line with the interpretation of survey and available site investigation (SI) data, particularly in preliminary SI phases (**Appendix 8.1**).

8.3.10 Subsoil Slide Risk Assessment

With reference to **Appendix 8.1, Table 15 and Table16** and **Appendix 8.1 – App B Peat Database,** subsoils underlying the Site are characterized generally as 'Clayey, silty, sandy, GRAVEL (or TILL) with cobbles and boulders'.

The Factor of Safety (Adjusted) (Scenario B i.e., 1 m surcharge) at trial pit locations is generally 'Acceptable' with two recorded marginally stable point locations at TP04 near the proposed location of T4, and TP11 near the proposed location of T2, **Plate 7 – Appendix 8.1.**

The Risk Ranking (Distance) (Scenario B i.e., 1 m surcharge) at trial pit locations is generally Very Low to Low with the exception of two Moderate risk point locations at TP10 and TP11, near the proposed location of T2, **Plate 7 – Appendix 8.1.**

Refer to **Appendix 8.1 – Stability & Geotechnical Assessment – Section 4** for full risk assessment results. **SI Appendix H (a – c),** details elevated risk identified (inferred) in areas possessing deeper tills and steep inclines, particularly in areas with potential for iron pan and hydrogeological impacts. Iron pan formations are associated with impervious layers within the subsoil profile. Where water would normally freely drain, percolating to groundwater, upon encountering an iron pan formation, would then either be deflected laterally or have the potential to develop a perched or high-water table.[11] [12]

8.3.11 Designated & Protected Areas

The Project is not within any designated or protected areas (**Figure 9.11a**). Any potential impacts to Soils or Geology are not considered to have direct impacts to downgradient designated sites, however entrainment of soils in runoff is a potential impact of the Project covered under **EIAR Chapter 9: Hydrology and Hydrology.** Stockpiling of material along the proposed Grid Connection Route will require particular attention in terms of the placement and management of runoff and construction water, as the route runs parallel to the designated Natural Heritage Areas (NHA) and Special Areas of Conservation (SAC) of Killarney National Park, approximately 40 m from proposed works in some areas (**Figure 9.11b**).

8.4 ASSESSMENT OF POTENTIAL EFFECTS

8.4.1 Significance Rating

Given the condition of the Site in terms of land use practices, peat and soil quality, bedrock quality etc., Land, Soils and Geology as environmental attributes at the Site are considered to be of Medium Importance i.e., *Attribute has a medium quality, significance or value on a local scale* (**Section 8.3.5**). The Grid Connection Route (GCR) and Turbine Delivery Route (TDR) are similar; however, these features generally follow existing or proposed roads / tracks.

[11] Teagasc (1982) "Some Relationships of Drainage Problems in Ireland to Solid and Glacial Geology, Geomorphology and Soil Types", *The Agriculture and Food Development Authority*.
[12] Waddington, J., Rotenberg, P. and Warren, F. (2001) "Peat CO2 production in a natural and cutover peatland: Implications for restoration", *Biogeochemistry* 54, pp. 115–130.

With reference to **Section 8.2.5** of this report and as summarised in **Table 8.9: Weighted Rating of Significant Environmental Impacts – Within the Footprint of the Site**, the geological attributes within the Site are considered to be of **Low to Medium Importance** and **Low to Medium Sensitivity**, and therefore classification of any potential impacts associated with the Project will be limited to Magnitudes associated with **Medium Importance**, where by the Site attributes (Land, Soils and Geology) are considered to be of "*medium quality, significance or value on a local scale*".

Table 8.9: Weighted Rating of Significant Environmental Impacts – Within the Footprint of the Site

Sensitivity (Importance of Attribute)	Magnitude of Impact			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

In terms of determining and assessing the magnitude of impacts, categories of magnitude relate to the scale of the attribute, that is the attribute/s driving the classification of sensitivity is the area of the Site, and therefore scale is relative to the area of the Site itself. That is, the area of the Site is approximately 170 ha, and the area of the footprint of the Development is approximately 31 ha(approximately 17.1%) of the area of the Site. This means that the land take associated with the Project is considered a negative, Moderate Adverse magnitude (Moderate (15- 50% area) impact on attribute with Medium importance), localised impact of the Project.

8.4.2 Do Nothing Impact

Site investigations of the baseline geological and geotechnical conditions of the Site indicate the following:

The Site has already experienced impacts to baseline conditions due to the land use practices **(Figure 8.2a** and **Appendix 9.2)** including agricultural (pastures, extensive drainage) and commercial afforestation activities (**Section 8.4).**

- There is no indication that current land use practices have had adverse impacts in terms of ground stability, with the exception of enhanced erosion in underlying tills at a localised scale.
- The cumulative impact of afforestation on the Site appears to be the excavation of soil to construct drainage ditches and localised drainage of the soil, and varying degrees of

soil erosion due to constructed roads and tracks, constructed drainage, vehicular movements, livestock movements etc.

Should the Project not proceed, the existing land-use practices will continue with associated modification of the existing environment.

8.4.3 Construction Phase Potential Effects

8.4.3.1 Typical Sequence of Events in Wind Farm Construction on the Receiving Environment

The following sections outline and summarise the general stages and elements of construction related to the Project. Detailed assessment of effects follow in the subsequent headings.

8.4.3.1.1 Activities – Premitigation

1. Site Investigation

2. Site Preparation:
   - Install Surface Water Monitoring Equipment.
   - Install Silt Screens, Interceptor Drains, and SuDS.
   - Prepare construction areas for compounds and facilities.
   - Clear Vegetation and Topsoil.
   - Excavate and grade the area for the construction of access tracks, hardstand areas, foundations, and other significant infrastructure units.

3. Access Track and Hardstand Areas:
   - Install silt screens, interceptor drains, and SuDS
   - Clear vegetation and excavate topsoil, subsoil, and bedrock.
   - Temporarily stockpile arisings.
   - Install drainage structures and erosion control measures, such as culverts and SuDS
   - Construct the road base and hardstand using suitable materials, such as crushed rock or concrete.
   - Construct hardstand areas for the installation and maintenance of wind turbines.
   - Use designated temporary stockpile areas and segregation of materials for different types of material, including materials arising at the Site, and being imported to the Site.

4. Drainage & Sustainable Drainage Systems (SuDS):
    - Install drainage and Sustainable Drainage Systems (SuDS)
    - SuDS maintenance, including during construction phase.

5. Watercourse crossings and culverts:
    - Design and plan the culvert to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
    - Install silt screens and sediment traps upstream of the construction area to intercept, manage, and divert runoff, reduce entrainment of solids and capture sediment, and prevent it from entering the watercourse.
    - Excavate the area for the culvert installation.
    - Construct the culvert.
    - Backfill the area around the culvert
    - Install headwalls or other associated infrastructure.
    - Restore the natural watercourse flow.

6. Clear Span Bridges:
    - Design and plan the clear span bridge to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
    - Prepare the area for the bridge construction.
    - Construct the bridge abutments and piers using suitable materials.
    - Install the bridge beams or arches using suitable materials.
    - Backfill the areas around the abutments and piers with suitable materials.
    - Restore the area.

7. Foundations:
    - Excavate and Backfill: To construct the wind turbine foundation, the area will be excavated to the required depth and diameter. Turbine foundation locations will be excavated to dimensions: 2.8 m to 3.2 m depth, 22 m to 25.5 m diameter The area around and above the Turbine Foundation will be backfilled with compacted stone or crushed rock.
    - Form and Pour Foundation: Shuttering and membranes are used to form the foundation pour structure, and foundation reinforcement steel rebar is installed and formed. Concrete is then poured into the foundation structure.

8. Other Significant Infrastructure Units:
    - Construct Infrastructure Units: Other significant infrastructure units, such as substation buildings, electrical cabling, and meteorological masts, will be constructed using suitable materials such as concrete or steel. Temporary infrastructure units such as temporary stockpile areas are also included here.
    - Install Drainage Structures and Erosion Control Measures: As with access track and hardstand areas, drainage structures and erosion control measures such as culverts and erosion control blankets will be installed for other significant infrastructure units.

9. Site Restoration:
    - Backfilling: Excavation areas, such as those where wind turbine foundations were installed, will be backfilled with suitable materials.
    - Soil and Vegetation: Topsoil that was removed during the Site preparation phase will be redistributed.
    - Waste Management: Waste arising from construction activities, including general construction waste and/or excess soils will be removed from site to a licenced waste management facility. The nearest licenced waste facility is over 20 km south-east of the Site in Codrum, Macroom, Co. Cork (Civic Amenity Services).

8.4.3.2 Land Take

Land take will be required during the construction and operation of the wind farm. This will be required for the construction of site access roads, turbine foundations, the onsite substation and the meteorological mast. Temporary land take will be required to facilitate the laying of grid connection cable ducting both on and off the Site. Long-term land take associated with the Wind Farm Development are covered in **Section 8.5.4 Operational Phase Potential Effects**.

8.4.3.2.1 Land Take Turbine Delivery Route

Land take will be required for the Turbine Delivery Route, although a majority of the Turbine Delivery Route will traverse already existing roadways (i.e., existing access tracks, public and local road networks from Ringaskiddy.

Works are required for road strengthening and widening along the Turbine Delivery Route at the existing forest road off the N22 and the temporary access road off the N22 to facilitate a 180-degree turning manoeuvre. Typical widening and strengthening work generally involve digging out road verges to c. 0.4 m and replacing them with compact stone to

support heavy plant machinery. Topsoil will be used to dress the top of stone upon completion of construction deliveries.

Considering the scale of disturbance (relatively small area and shallow excavation along with superficial paving) at the N22 turning point location and Site Entrance, the effect is considered to be **small-scaled, direct, adverse, slight, localised, and permanent but reversible.** The probability of this effect occurring is **unavoidable** during the construction phase but conforms to baseline conditions e.g. existing public roads. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

Land take associated with the Turbine Delivery Route and Grid Connection Route will be limited to the Construction Phase of the Project.

8.4.3.2.2 Land Take Grid Connection Route

Minimal land take is required for the Grid Connection Route considering the line will principally be buried in or directly adjacent to existing roadways, totalling 19.9 km. The proposed grid route will follow the old route of the N22 before following forestry tracks to the existing Ballyvouskill Substation. Any potential effects are described similarly to general land take, however considering the small scale of disturbance, shallow cable trench (c. 1.22 mbGL by 600 mm wide), the effect is considered to be **small-scaled, direct, adverse, localised, permanent but reversible and slight**. The probability of this effect occurring is **unavoidable** during the construction phase but conforms to Baseline conditions e.g., existing public roads and services. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.3 Clear Fell of Afforested Areas

Felling of forestry at the Site will be necessary for areas of the Project in afforested sections within the Redline Boundary. This is an **unavoidable** consequence of the Project during the construction phase. The Site contains 145.4 ha of commercial forestry. Turbines T2, T3, T4 and T5 are within afforested areas. Subsequently, tree felling will be required as part of the Project To facilitate the construction of access roads, civil works, site compounds, borrow pits and Turbine Hardstands, 25.68 ha coniferous forestry will need to be clear-felled. The likely felled area of approximately 25.68 ha will represent approximately 15.11% of the proposed Site area (170 ha). In a spatial or land use context this is considered a **slight** to **moderate** scale impact, limited to the extent of the Project footprint and turbine buffer felling zones.

The clear fell of afforested areas is **in line with baseline conditions** and future activities as part of Do-Nothing impact. Therefore, in the context of the Project, the clear fell of forestry overall is considered **neutral**, however there is a range of potential **direct, adverse** impacts associated with the activity which will require management and mitigation. Potential effects include:

1. Soil erosion, compaction and degradation: The removal of trees and underbrush during clear-felling can expose soils to wind and water erosion, leading to soil loss, compaction and degradation. This is mainly caused by vehicular movements (**Section 8.4.3.8 Vehicular Movements**).
2. Geology: Clear-felling can cause changes in the geology of an area, leading to soil instability, landslides, and other geological hazards (**Section 8.4.3.6 Ground Stability** .
3. Hydrology & Hydrogeology: The removal of trees and vegetation can lead to changes in hydrological processes, causing changes in water flow rates and patterns, such as the lowering of water tables (**Chapter 9: Hydrology and Hydrogeology)**.
4. Water quality: Clear-felling can cause increased sediment runoff and nutrient pollution in waterways, which can impact water quality, negatively affecting aquatic ecosystems and downstream water users.
5. Soil nutrient loss and nutrient loading of receiving waters: Clear-felling removes vegetation and leaves soil bare, exposing it to weathering, which can cause the entrainment of solids and/or the loss of soil nutrients, essential for plant growth. This in turn will lead to an increase in nutrients i.e., Nitrogen and Phosphorous compounds, dissolved organic carbon, potassium etc. in receiving waters flowing from the Site, which is considered a negative impact of the Project (this is discussed in greater detail in **Chapter 9: Hydrology and Hydrogeology**).

Mechanism/s:

- Construction activities; Excavation, handling/transport, temporary storage of soils / subsoils / bedrock, vehicle tracking.
- Erosion in areas impacted by construction activities.
- Erosion in areas with newly formed preferential pathways for water runoff.
- Peat / slope stability, significant or localised.
- Reinstatement activities; similar to construction.

Impact

- Erosion of soils and release of suspended solids entrained in runoff, intercepted by surface water network.

	• Compaction of soils, potentially reducing recharge capacity etc.
Receptor/s:	• Soil and subsoil structure and lithology. • Surface Water. Surface water quality, ecological sensitivities and WFD status.

The overall potential effects here are considered to be of **moderate** significance, **permanent but reversible**, and **adverse**, though this is of a minor scale in comparison to the normal forestry activities taking place at the Site (i.e., small-scale felling proposed). If the Project does not take place, it is likely that the forestry at the Site will eventually either be clear felled or felled in larger volumes than the amount proposed as a function of this Project. Therefore, the resulting incremental felling of the afforested area will benefit the receiving environment, namely the receiving surface water network by means of reducing the potential magnitude of impacts, namely erosion, solids entrainment, and shock nutrient and sediment loading. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4 Subsoil and Bedrock Removal

Subsoil and bedrock removal will occur during construction excavations and is an **unavoidable** consequence of the Project for turbine bases or other foundations, as well as the removal of bedrock material from the Site borrow pit. Removal of the soil and bedrock is considered to be a **permanent** effect if breaking into competent bedrock.

The removal of soils and bedrock has the potential to result in the release of contaminants, particularly suspended solids to the receiving environment during the construction phase of the project, and to a lesser extent during the operational phase relative to baseline conditions. No further subsoil or bedrock removal will be required during operation. However, to note this effect conforms to baseline conditions in terms of the development of forestry track operations.

The amounts of subsoil and bedrock to be removed are laid out in construction and excavation plans, specified in **EIAR Chapter 2: Project Description** and **Appendix 2.1: Construction Environmental Management Plan (CEMP), Management Plan 4.** The volume of excavated material which is to be stored in the on-site borrow pit is 81,215 m³ and considered to be **large-scale** when considering the footprint of the Development.

Although there is the potential for **direct, adverse, slight to moderate** significance effects on the local geology, there are a number of indirect or secondary effects including the

potential for entrainment of suspended solids in runoff and increasing groundwater vulnerability by decreasing the depth to the water table. These effects are discussed further under **EIAR Chapter 9: Hydrology and Hydrogeology.**

Subsoils and weathered bedrock, when segregated and managed, will be reinstated similar to baseline conditions, and therefore effects are **temporary**, however breaking of competent bedrock cannot be reinstated to baseline conditions.

Worst case scenarios include the triggering of a significant localised peat-landslide or mass movement event, a potentially profound if in close proximity to receptors, and permanent adverse impact, refer to **Appendix 8.1: Site Investigation & Stability Risk Assessment Report.**

The approach and methodology in which excavation of in-situ earth materials is undertaken is very important for ground stability in any environment. Excavation has the potential to cause slippage or mass failure under certain geotechnical and hydrological conditions, for example excavating in deep saturated peat on, above or below steep inclines in peatland areas during periods of extensive rainfall.[13] The proposed location of turbines avoids areas with steep to severe inclines. **(Appendix H)**. Nonetheless, the degree of slope steepness will be considered when excavating material i.e., cut and fill, sidewalls of open excavations, movement and management of material etc. Refer to **Appendix I** and **Appendix 2.1: CEMP, Management Plan 4 Peat and Spoil Management Plan.**

Mitigative and reductive measures with regard to materials budget handling and potential indirect impact on water quality from mineral subsoil and bedrock excavation activities are outlined in the mitigation section of this report. With these applied mitigation measures, planning and management this effect and disturbance can be minimised.

Mechanism/s:

- Construction activities; Excavation, handling/transport, temporary storage of soils / subsoils / bedrock, vehicle tracking.
- Erosion in areas impacted by construction activities.
- Erosion in areas with newly formed preferential pathways for water runoff.

[13] Feehan, J. and O'Donovan, G. (1996) "The bod of Ireland: an introduction to the natural, cultural and industrial heritage of Irish peatland" *University College Dublin – The Environmental Institute.*

	• Peat / slope stability, significant or localised. • Reinstatement activities; similar to construction.
Impact	• Erosion of soils and release of suspended solids entrained in runoff, intercepted by surface water network. • Compaction of soils, potentially reducing recharge capacity etc.
Receptor/s:	• Soil, subsoil and bedrock structure and lithology. • Surface Water. Surface water quality, ecological sensitivities and Water Framework Directive status.

8.4.3.4.1 Excavations

Excavations will be required for most aspects of the Project including for turbines, Turbine Hardstands, Site Access Roads, works along the turning point (off the N22), temporary construction compound, cable trenches, Met Mast, and Grid Connection Route. Estimates of excavation volumes are presented in **Table 2.5 and Table 2.6 of EIAR Chapter 2: Project Description**.

Increased excavation and peat / soil / subsoil / bedrock removal activity will be concentrated to particular locations of the Project during the construction phase, including the site entrance, load bearing portions of turbine hardstands, turbine foundations, site borrow pit, and works associated with the improvement or construction of watercourse crossings and culverts. All the above combined are considered to be **moderate to large in scale**, however, conforms to baseline conditions at the Site with forestry operations.

The excavation and removal of soils and bedrock to facilitate construction is a **direct, unavoidable, adverse, slight to moderate significance, localised** impact of the Project, and is considered **permanent but reversible,** in instances where reinstatement is proposed (i.e., Borrow pit location). However it is important to note that excavation activities, in particular spoil management / temporary or permanent stockpiles, and vehicular movements can trigger indirect or secondary impacts such as localised stability issues and / or impacts on the receiving surface water or drainage network, leading to a **potentially profound**, and **permanent adverse** impact, refer to **Appendix 8.1 – SI Report, Appendix H (a – c) IWF SI Geo-Hazards,** and **Appendix I (a – c) Peat and Subsoil Stability Risk Assessments**. These impacts are discussed in the following sections. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.2 Site Access Roads

Site Access Roads are required to accommodate the construction works and to provide access to the turbine locations for the whole life cycle of the wind farm. According to **Table 2.3** of **EIAR Chapter 2: Project Description**, 3,102 m of the existing Site Access Road will be upgraded during the construction phase, involving widening the roads to cater for larger vehicles and loads. Upgraded Site Access Roads will be approximately 6,203 m^2 in surface area and will require approximately 1,400 m^3 of crushed stone material.

There will also be 3,555 m of new Site Access Roads required for the Project. These will be constructed to provide a width of 4.5 m and 5.5 m at bends and will cover an area of 15,998 m^2 and require 1,700 m^3 of crushed rock. In total the construction of Site Access Roads is considered to be **moderate to large scale** effect.

These roads will be excavated to a level where the underlying soil or rock that can bear the weight of traffic without shifting or compressing. They will be constructed using rock from the on-site borrow pits and capping stone from nearby quarries listed in section. All imported stone to the Site will undergo appropriate quality testing. When weathered, the stone will not contain any constituents which may be harmful to the environment, surface and groundwater in particular. Permeable geotextile will be placed at the base of access tracks, as part of their design.

The formation of Site Access Roads will have a **slight to moderate, adverse, direct, permanent but reversible** effect of the Project This effect will be limited to the footprint of the Project and is considered **unavoidable**, while conforming to baseline conditions of forestry operations. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.3 Turbine Foundations and Turbine Hardstands

The material encountered at each turbine and infrastructure location is considered to be mostly shallow peat overlying bedrock, with some moderately deep peat near the proposed T1 location, **Appendix 8.1 - App A1**. Minor areas of glacial till may also be encountered locally, as presented in **Figure 8.4a**. It is likely that excavations for the majority of infrastructure will be taken down to bedrock; the depth of the excavation required for the Turbine Foundations will range from 2.8 m to 3.2 mbGL).

Excavations will require granular fill material to upfill the excavation to the levels required for construction. It is proposed that the granular fill material will be obtained from the Borrow Pit i.e., maintaining local geo and hydro chemistry. Ground investigations in the form of peat

probing and gouge coring has been carried out along the proposed Turbine Hardstand locations to inform the depth of excavation and upfill required. As set out in **Table 2.6** of **EIAR Chapter 2: Project Description,** approximately 7,250 m^3 of material will be excavated for turbine foundations. Of this 1,562 m^3 will be peat, 3,083 m^3 will be subsoils and 2,605 m^3 will be bedrock.

Excavated rock will be reused as hardcore at hardstanding areas and Site access tracks. Subsoils facilitate the construction of soil berms and reinstating the Borrow Pit post construction and peat will be used as backfill to foundations and to reinstate the borrow pit post construction.

Any imported material, if necessary, will be fully tested in accordance with industry standards. Only verified clean, inert material will used.

The Temporary Construction Compound and Electrical Sub-Station will measure approximately 9,907 m^3 and will require similar foundations to those of Turbine Hardstands. Substation southern portion of the Development. Of this excavated material approximately 1,385 m^3 will be peat and 8,522 m^3 will be subsoils.

The likely effects associated with excavations at hardstand areas are considered to be **direct, slight to moderate, adverse** (in terms of overall project scale), **permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.4 Borrow Pit

One borrow pit will be constructed as part of the Project . The proposed borrow pit is located c. 20 m to the east of T5 hardstand and will measure 38,674 m^2. The borrow pit will provide 50,276 m^3 excavated material to be used as fill for roads, hardstands, backfill for foundations and the temporary compound.

The borrow pit will be excavated only as required to reduce the need to transport material to the Site. Where rock and fill material are available from the excavation of Turbine Foundations this hardcore material will be used first.

The likely effects associated with the removal and replacement of subsoil and bedrock at excavations for the on-site Borrow Pit are considered to be **unavoidable**, **direct, adverse** and **moderate to large** (in terms of overall project scale), **slight to moderate**

significance, permanent and **reversible** in terms of geology e.g., replacing competent bedrock, but impacts to ground levels will be **reversible** through reinstatement with fill. This effect is considered to be limited to the footprint of the Project and with appropriate mitigation measures, planning and management the effect and disturbance can be minimised.

8.4.3.4.5 Site Cable Trenches

There will be circa 4,743 m of internal cabling. Cable trenches throughout the Site will be excavated to an anticipated depth of approximately 1.220 mm and will contain the electrical and fibre-optic cables running from the turbines to the substation compound within the Site Roads and/or their verges. Excavation of peat, bedrock and inferred locally glacial till will be required. Granular fill, from the Borrow Pit, will be used to surround the cables, however the majority of the excavated soils will be used for backfilling with the potential for minor amounts being removed and used elsewhere for example, berm landscaping.

The likely effects associated with shallow excavations for Site Cable trenches are considered to be **unavoidable, direct, adverse** and **small to moderate** (in terms of overall project scale), **slight significance, permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. This effect is considered to be limited to the Project and conforms to existing Baseline (e.g., public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.6 Turbine Delivery Route

The Turbine Delivery Route will use existing roadways between Ringaskiddy Port and the Site. Works at an entrance to an existing forest road off the N22 will include the widening of the road and creation of a splayed entrance. Additionally, the construction of a temporary access road off the N22 in the townland of Cummeenavrick to facilitate 180 degrees turning manoeuvre by construction vehicles is also proposed. The Turbine Delivery Route will require an area of upgrading totalling 1,870 m^2.

The likely impacts associated with excavations on the Turbine Delivery Route are considered to be relatively **small** in scale, **direct, localised, slight significance, adverse, long term to permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. This effect is considered to be localised and conforms to Baseline (e.g., public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.7 Grid Connection Cable

The overall length of the grid connection between the substation and the existing 220 kV GIS substation is 19.9 km, following the old route of the N22 for a short distance (c.0.469 km) before following forestry tracks to the existing Ballyvouskill Substation. Grid Connection trenches will be excavated along the Grid Connection route, predominantly within tracks and verges, to the Ballyvouskill Substation.

The 38 kV cable trenches will be excavated to an anticipated depth of approximately 1.22 m, and to a width of 0.6 m. Depending on the detailed design and excavation of road aggregates, peat, bedrock and inferred local glacial till will be required. The trenches will be backfilled using granular material. The excavated material will be disposed of offsite as inert landfill at a licenced facility or recycled for use elsewhere.

Joint Bays are pre-cast concrete chambers along the Grid Connection Route where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay will be 6 m long x 2.5 m x 2.3 m deep. A reinforced concreted slab will be constructed on top of the bay.

The impacts associated with excavations for cable trenches are considered to be **unavoidable**, **direct, adverse, moderate** in scale, **slight in significance, permanent** and reversible through reinstatement during the decommissioning phase of the Project **and adverse.** This effect is considered to be localised and conforms to Baseline (e.g., public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.4.8 Total Volume to be Excavated

Indicative total volumes of material to be excavated are presented in **Table 2.6 of EIAR Chapter 2: Project Description**.

8.4.3.5 Storage of Stockpiles

8.4.3.5.1 Overview

The majority of spoil generated on Site will be peat and subsoils with some rock excavated at Turbine and Sub-Station Foundations.

It is expected that the majority of rock will be reused for the construction of Site Access Tracks and/or Turbine Hardstands.

Material to be temporarily stored for a period during the construction phase will be placed adjacent to excavation areas, at a distance of at least 20 m from any drainage feature. These short-term temporary stockpiles, if located near T1 (i.e., Moderately Deep peat), **Appendix 8.1 – App A – Peat Depth Overview,** will be limited to 1 m in height. This material will be used for later reinstatement of the Borrow Pit.

Once the required rock has been extracted from the borrow pit, it will be reinstated using any surplus inert material from the Site, that way the size of the Temporary Spoil storage areas is minimised. As a worst case, stockpiling of peat can give rise to increased pore pressures and the possibility of a bog burst or peat slide. Careful management of the spoil and ongoing landslide risk assessments will minimise the possibility of a landslide or stability issue occurring.

8.4.3.5.2 Spoil Management

Increased excavation and peat / soil / subsoil / bedrock removal activity will be concentrated to particular locations of the Project, including the site entrance, load bearing portions of turbine hardstands, turbine foundations, site borrow pit, and works associated with the improvement or construction of watercourse crossings and culverts, works along the Turbine Delivery Route and proposed works along the Grid Connection Route.

Therefore, of significance, during the construction phase of the Project, is the management of excavated materials handling, storage and re-use. There is potential for **direct, negative** impact on localised ground stability particularly in the vicinity of ongoing excavation works. For example, loading or surcharging of ground in proximity to open excavations is considered in good practices and health and safety procedures associated with excavation works, as presented in **Plate 2.** Direct and indirect negative impacts on surface water quality can also occur **(EIAR Chapter 9: Hydrology & Hydrogeology**). However, such impacts are considered temporary and reversible.

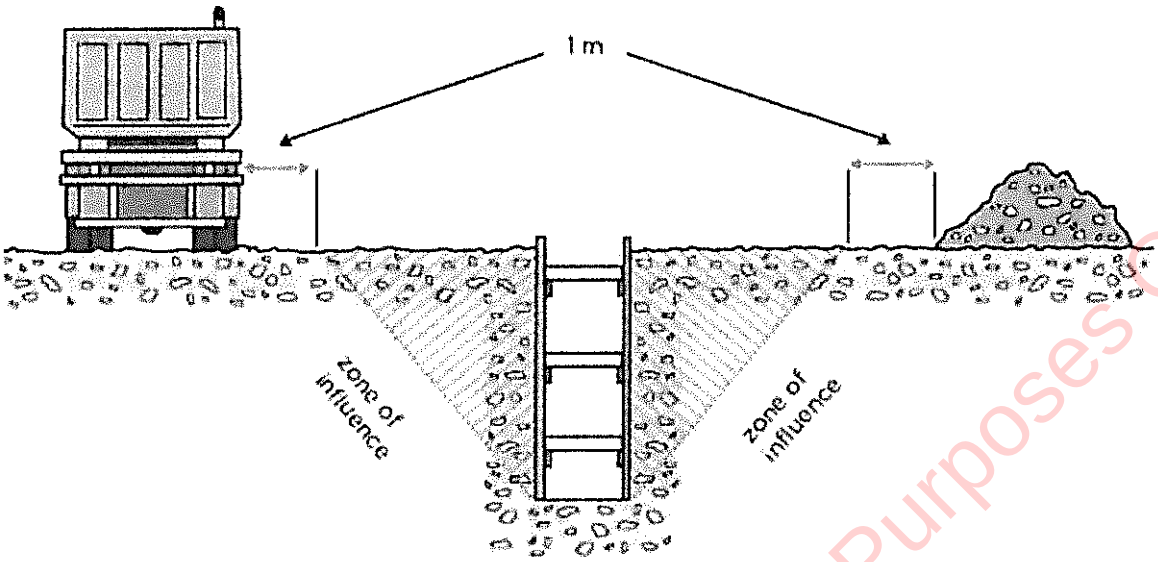

Plate 2: Examples impact of loading or surcharge on ground in proximity to open excavations.[14]

The potential impact by construction works activity on water quality is discussed in **Chapter 9: Hydrology and Hydrogeology**.

The handling, management and re-use of excavated materials are of importance during the construction phase of the Project. It is envisaged that excavated material (i.e., soils, subsoils and peat) totalling 81,215 m^3 will be used as back fill and for reinstatement purposes, that is reused on site as appropriate, and any surplus material will be transported to the on-site borrow pit for reinstatementt and will be capped to a level of 0.8 m above the existing ground level. The management of the above quantities is considered to be on **moderate to large** in scale. Peat will be stockpiled no higher than 2 m and follow the guidelines and recommendations set out by the National Roads Authority (2014), **Section 8.2**. The reinstatement of the borrow pit has been further detailed in **Chapter 2: Project Description and Appendix 2.1: Construction Environmental Management Plan, Management Plan 4: Peat and Spoil Management Plan**.

With relation to excavated material removed during the Grid Connection network installation, any earthen (sod) banks to be excavated will be carefully removed and stored separately, maintained and used during reinstatement. Any surplus excavated material from roadways will be disposed of to a licenced facility.

[14] New Zealand Government (2016) Good Practice Guidelines – Excavation Safety

There is potential for a moderate adverse effect on soil due to erosion of inappropriately handled excavated materials. However, any effects from the handling of excavated materials will be managed through good Site practice.

Organic matter loss can occur when wet peat is excavated and allowed to dry in the open air. Peat material is a major source of carbon, and the loss of organic matter leads to an emission source of carbon dioxide (CO2) and nitrogen dioxide (NO2). Furthermore, excavated forestry material can also contribute to Nutrient Enrichment from historical site practices, refer to **EIAR Chapter 9: Hydrology and Hydrogeology.**

The process of spoil management is expected to have a **likely, direct, slight to moderate, adverse** effect of the Project on the receiving environment and is considered **permanent but reversible**. This effect is considered to be restricted to the footprint of the Project but can have indirect / secondary impacts to the surrounding area (i.e., localised extent). This effect conforms to baseline (e.g., forestry operations, public roads and services). With appropriate mitigation measures, planning and management this effect and disturbance can be minimised. Ground stability on a larger scale is discussed further in the following section.

8.4.3.5.3 Peat Stability and Slope Failure

8.4.3.6 Ground Stability

Ground stability, as discussed in the baseline section of this report, is not considered an impact with significant potential under the footprint of the Project, that is the potential for slope stability issues arising or landslides to occur is generally considered Low. Some areas possess elevated risk on a localised scale (isolated areas of moderately deep peat, high/moderately high risk to landslide susceptibility). Some areas possessing elevated risk on a larger scale within the Project footprint (elevated risk associated with deep till deposits, iron pan and steep inclines; and elevated risk associated with proximity of receptors with varying sensitivity). All proposed turbine hardstand areas are located outside of these elevated risk areas, with the exception of three No. points at T3, and the proposed hardstand area of T5 which unearthed iron pan deposits at TP003, (**Appendix 8.1 – App C).**

The designed Turbine Delivery Route traverses' areas of 'Low' Landslide Susceptibility from the Inchamore Wind Farm to the N22 along the existing third-class road as mapped by GSI (2022), with the exception of the first 1.3 km which traverses moderately high and high risk. The remaining extent of the Turbine Delivery Route, c. 80 km, will utilise pre-existing third-class road infrastructure between the N22 and Ringaskiddy. While this stretch of area varies

in degrees of Landslide Susceptibility ('Low' to 'Moderately High'), it is an existing piece of infrastructure with no planned modifications to alter its design, therefore the risk of a Landslide Event is considered low. Furthermore, there have been no recorded landslide events within the immediate vicinity of the Turbine Delivery Route.

The entire length of the Grid Connection Route (19.9 km) varies in scale of Landslide Susceptibility, ranging from 'Low', 'Moderately Low' to 'Moderately High' with only minor pockets of 'High' risk, relative to the length of the route. Considering works necessary for the cable trenching will consist of slight excavations (1.5 mbGL, with the potential for deeper excavations up to 2.0 mbGL), and that works will be carried out along existing tracks, the risk of ground stability issues arising is considered low. However, it must be noted, there have been seven recorded Landslide Events (OBJECTIDs: 7517, 7518, 7519, 7520, 7521, 7524, 8079) within c. 500 m of the northern portion of the Grid Connection Route, documented by GSI (2022). Each landslide event took place north of the route in both coniferous forests and peat bogs with 'No Apparent Impact'. The appointed ontractor will confirm highlighted work areas with a competent geotechnical engineer ahead of commencing scheduled construction.

The potential for soil stability issues to arise during the construction phase of the Project is largely dependent on vehicular movement and operation during excavation works, or vehicular movements over areas with an increased or severe slope incline, and likely in combination with severe weather conditions. In terms of peat, potential impacts to hydrology can also play a large role in stability issues.

Soil stability issues brought about by excavation or vehicular movement activities on Site have the potential to lead to open excavation side wall collapse, which in turn will potentially compromise ground stability in the vicinity of the works, thus increasing the effective footprint of the Project. This is considered a **likely, direct, adverse, slight to profound significance, small to moderate** in scale, **localised (potentially regional), temporary but reversible** impact. This effect is considered to contrast to Baseline. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

Potential indirect soil stability issues including downgradient of the Project footprint brought about by construction activities are considered to be **unlikely, direct, adverse, significant to profound significance, small to moderate** in scale, **localised (potentially regional), permanent** effect. This effect is considered to contrast to baseline. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.7 Geological Stability

Conclusions made here are drawn with reference to **Appendix 8.1** and associated **Appendices A - I**. For further information and context in regard to methodology and definitions, refer to **Appendix 8.1**.

Geological stability will be limited to the management, excavation and breaking of weathered and competent bedrock and boulders where required. This will include a number of proposed Turbine Hardstand locations as well as the Onsite Substation and Control Building and borrow pit.

Construction activities can give rise to localised stability issues. Localised stability issues arising during construction activities, namely excavation activities include a range of key issues, for example:

- Collapse of excavations, or sidewall collapse. This is particularly prevalent in soils with low cohesive strength and / or high groundwater levels, such as peat.
- Falling or dislodging of material.
- Operatives falling into open excavations.
- Undermining nearby structures, underground and overhead services.
- Inflow of groundwater and surface runoff.
- Damage to nearby trees.

Considering the complex topography at the Site, including steep inclines, some over sensitive receptors including rivers, there is potential for geological stability issues to impact downgradient receptors in terms of the sliding of excavation arisings towards receptors. Worst case scenarios include construction activity and the movement of excavated material triggering landslide events, for example spread or flow of stockpiled material down steep slopes outside of the Project footprint.

When considering the Grid Connection Route, shallow excavations, (c. 1.3 mbGL along the cabling route and 1.75 mbGL at cable joint bay locations), do not raise concern in terms of geological stability, for they are shallow in nature. Furthermore, the Grid Connection Route will follow constructed Site Access Tracks (1.3 km) and pre-existing forestry tracks to the existing Ballyvouskill Substation (18.6 km).

Potential geological stability issues brought about by construction activities are considered to be **unlikely, direct, adverse, slight significance, small to large** in scale, **localised** and **permanent** effects. This effect is considered to contrast to Baseline but with appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.8 Vehicular Movements

8.4.3.8.1 Overview

Vehicle movement will occur primarily during the construction phase of the wind farm. Construction vehicles will include cranes, excavators, dumper trucks, concrete trucks, private cars (construction personnel). During the operation phase, vehicles will be limited to occasional maintenance vehicles only.

8.4.3.8.2 Compact, Erosion and Degradation

Compaction of soils may occur during construction and to a limited extent during operation and Decommissioning. In general, compacted soils will be excavated during construction, and access to soils away from hardstanding areas will be prevented. Ongoing compaction of soils will occur in areas of site access road construction, which will continue during operation and Decommissioning. Compaction effects are considered to be **likely, direct, adverse, slight to moderate significance, moderate to large** in scale, **permanent** and limited to the footprint of the Project. This effect conforms to Baseline (e.g., forestry) and with appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

Erosion and degradation of exposed soils will also occur, primarily during construction, which will potentially lead to loading of runoff with solids and other contaminants. With reference to **Section 8.3.4**, the entrainment of solids in storm or construction water runoff is of particular concern considering the underlying bedrock geology is comprised of (weak) SILTSTONE bedrock, **Appendix 8.1**. Entrainment of soils are further assessed under **EIAR Chapter 9: Hydrology & Hydrogeology.**

8.4.3.8.3 Peat Stability and Slope Failure

As discussed under **Section 8.4.3.4.3** and in the **Appendix 2.1, Management Plan 4:** Peat and Spoil Management Plan, vehicular movements on Site have the potential to trigger soil or slope stability.

8.4.3.8.4 Turbine Delivery Route and Site Access Roads

The delivery and connection routes will utilise existing roadways and infrastructure along the majority of the routes and therefore, the impacts associated with vehicle movements along the Turbine Delivery Route is considered to be **direct, adverse, small** in scale, **not significant to slight, permanent but reversible.** This effect is considered to be localised and conforms to Baseline (e.g., public roads and services) and with appropriate mitigation measures, planning and management this effect and disturbance can be minimised.

8.4.3.9 Soil Contamination

8.4.3.9.1 Overview

Construction activities associated with the Project have the potential to introduce a number of contaminants in a number of ways. Potential causing activities and associated contaminants include:

- Operation of plant vehicles and other petrol / diesel driven equipment - Hydrocarbons e.g., diesel, oil, grease.
- Wastewater sanitation – Sewage
- Construction materials – e.g., concrete or cement, bentonite clay from HDD
- General waste – e.g., plastic

Use of waste materials during construction, operation and decommissioning will be minimised by good site practices and waste management plans. The following sections present the possible impacts primarily associated with the use of construction plant.

8.4.3.9.2 Hydrocarbons

Wherever there are vehicles and plant in use, there is the potential for a direct hydro-carbon release which have the capacity to contaminate soils and subsoils. Furthermore, a spill has the potential to indirectly pollute water, if the soil and subsoil act as a pathway from any source of pollution.

Hydrocarbon is a pollutant risk due to its toxicity to all flora and fauna organisms. Hydrocarbons adsorb (stick) onto the majority of natural solid objects it encounters, such as vegetation, animals, and earth materials such as peat. From a land and soils perspective, the naturally occurring chemical in crude oil and gasoline products-Polycyclic Aromatic Hydrocarbons or (PAHs), can burn most living organic tissue, such as vegetation, due to their volatile chemistry. It is also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water based vertebrate and invertebrate life.

The hazard posed by hydrocarbon contamination to soil is significant in terms of adversely impacting on the health of the soils associated with the proposed Site and the flora and fauna it supports, however the risk is considered limited considering the movement of same is limited. The more significant risk of hydrocarbons contamination of soils is the eventual and likely migration to surface water systems, a potentially significant negative impact - this is covered in **Chapter 9: Hydrology and Hydrogeology**.

Any accidental contaminant spillage of fuel or oil, depending on the volume, would potentially present a **significant, direct, adverse, small-scale long term to permanent,** effect on the soil and geological environment on the Site, which contrasts to Baseline. However, this potential impact is considered to be **localised** (if contained, **EIAR Chapter 9: Hydrology & Hydrogeology**), naturally **reversible** (natural attenuation over a relatively medium to long term period of time), or immediately reversible (through remediation and restoration activities over a relatively short to medium term period of time). With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

8.4.3.9.3 Horizontal Directional Drilling

In terms of the HDD process, drilling will involve plant machinery which will be powered by hydrocarbons, therefore risk during the refuelling process as stated previously remains the same. The risk of hydrocarbon spills stems primarily from broken hydraulic hoses used during the drilling/boring process. Small-scale quantities of greases known as 'drilling fluids' are also commonly used during the drilling process to keep components of the drill rig cool and lubricated. These drilling fluids are commonly composed of a mixture of bentonite clay, which can be harmful to the environment. Therefore, there is a risk of a potential oil leak from horizontal directional drilling (HDD) along the Grid Connection Route. It is unspecified at this time which drilling lubricant will be used during Grid Connection Route works. From experience in the industry the use of Clearbore is recommended, and this or a similar product will be used. Clearbore is a single component polymer-based product that is designed to instantly break down and become chemically destroyed in the presence of small quantities of calcium hypochlorite. The product is not toxic to aquatic organisms and is biodegradable.

8.4.3.9.3.1 Drill Arisings

Spoil arising from drilling activities will require temporary stockpiling and has the potential to be entrained by surface water runoff (suspended solids). Potential effects involving drill arisings are similar to those outlined in Spoil Management **Section 8.3.4.3.5.2.** For instance, spoil arising from drilling activities could be mobilised by large volumes of water which would rapidly traverse overland if not managed appropriately and has the potential to mobilise additional solids via eroding soils, or other contaminants, and infiltrate the receiving surface water bodies, or groundwater bodies.

8.4.3.9.3.2 Breakouts and Drilling Fluid Returns

Generally speaking, drilling fluids used in HDD practices are released at the beginning (launch) and termination (reception) sites of a borehole path, collected and disposed of properly. However, breakouts can in theory occur as a result of unstable conditions within the drilled bore due to low cohesion; for example;

1) the swelling and hydration of clay materials,
2) the movement and dispersion of clay minerals,
3) water blocks, and
4) low permeability of mud cakes.[15]

Potential effects involving drilling fluid returns are similar to those outlined in Hydrocarbon Contamination **Section 8.4.3.9.2.** For instance, drill fluid returns/frack outs can occur as a result of poor drilling methods, and/or improper mud formulation used in bore drilling which can cause stability issues within the bore. Given the local lithology of the Site with underlying sandy, clayey gravel and tills, potentials for breakouts must be considered. Breakouts can lead to failure in returns at either end of the bore path and subsequent drill mud being released outside the bore to the receiving environment (i.e., soils, subsoils, ground and/or surface waters).

8.4.3.9.3.3 Drilling Fluid Disposal

Drilling mud containing spoil recovered from the bored path can be retrieved at the launch and reception sites of the bore. This bentonite contaminated spoil can be treated in one of two ways. It can either be transferred off-site to an approved and authorized EPA license facility (in accordance with the Waste Management Act 1996, as amended) to be properly disposed of; or the spoil can be pumped to a mechanical separation container. This involves drill mud being stored within a holding tank until separation of particulates can be achieve only then can the fluid be discharged to the surrounding area.

8.4.3.9.3.4 Horizontal Directional Drilling Potential Effects

A worst-case scenario could possibly occur whereby the proposed works of HDD could result in an accidental contaminant spillage with a **likely**, **direct, adverse, slight to moderate, small** in scale **short term** effect on the soil quality of the Site. This impact could result from any number of indirect anthropogenic sources, most commonly would be from: inadvertent drill returns containing bentonite clay, as mentioned above or by spillages of oil,

[15] Willoughby, D. A. (2005) "Horizontal Direction Drilling Utility and Pipeline Applications" *McGraw-Hill Civil Engineering Series,* ISBN: 978-0-07-150213-9.

fuel, or drilling fluid disposal. Such spillages could potentially affect the local land and soil environment, depending on the nature of the contamination issue, and to varying degrees depending on the characteristics of the Site area. Considering the proximity to surface water associated with this type of infrastructure (i.e., directly below watercourses), the risk is elevated. However, this potential impact is considered to be **localised**, naturally **reversible** (natural attenuation over a relatively medium to long term period of time), or theoretically reversible (through remediation and restoration activities over a relatively short to medium term period of time). With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

While the Grid Connection Route traverses ground rated at 'X' and 'Extreme Vulnerability' (i.e., high risk) categories, this risk can be deescalated due to the lack of karst features present and baseline description of the underlying bedrock aquifer. There are no karst features associated with the Project.

Further information and mitigation in relation to the management of potential contaminants is provided in **Chapter 9: Hydrology and Hydrogeology**.

8.4.3.9.4 Wastewater and Sanitation

The Project includes temporary sanitation facilities for site workers during the construction and therefore has the potential to result in the accidental leakage of wastewater or chemicals associated with wastewater sanitation onto soils, and into the drainage network during the construction and operational phases of the project.

Wastewater and wastewater sanitation chemicals are pollutant risks due to their potential impact on the ecological productivity or chemical status of surface water systems, and toxicity to water-based flora and fauna.

The worst-case scenario/s associated with wastewater sanitation is the potential for sanitation chemical, particularly related to porta-loos, accidentally spilling or leaking and being intercepted by surface water drainage features and in turn surface water networks associated with the proposed development.

Potential incidents related to the release of waste and chemicals from wastewater sanitation facilities at the Site will be **likely, direct, adverse, small** in scale**, moderate to significant** effects which contrast to Baseline. This effect is considered to be localised in terms of the soil and geological environment. However, the potential impacts to downstream receptors can be **long term to permanent**. With appropriate environmental engineering controls and mitigation measures these potential impacts can be significantly reduced.

8.4.3.9.5 Construction or Cementitious Materials

The Project will require concrete for the formation of turbine bases, including in locations which are in proximity to receptors e.g., drains and surface waterbodies. This could potentially give rise to or result in the accidental spillage or deposition of construction waste into soils and in turn impact on surface water runoff, or accidental spillages directly intercepted by drainage or surface water networks associated with the Project.

Depending on the chemistry of the material in question, the introduction of such materials can lead to a local change in hydrochemistry and impact on sensitive attributes e.g., ecology. For example, the introduction of cementitious material (concrete / cement / lean mix etc.) can lead to changes in soil and water pH, and increased concentrations of sulphates and other constituents of concrete can further impact water quality. Fresh or wet concrete is a much more significant hazard when compared to set or precast concrete which is considered inert omparisonn, however it is noted that any construction materials or waste deposited, even if inert, is considered contamination.

Surface water runoff, or groundwater coming into contact with concrete will be impacted to a degree, however water percolating through lean mix concrete will be impacted significantly. Therefore, the production / acquisition, transport of material and management of plant machinery must also be considered.

The worst-case impacts associated with a release of wet or lean mix cementitious materials is considered to be potentially **likely, localised, direct, adverse, slight to significant, small** in scale, **long-term to permanent** effect, particularly in terms of potential indirect or secondary effects on the receiving surface water system. The use of cementitious material is in contrast to Baseline conditions at the Site. With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

8.4.3.9.6 General Waste

The construction phase of the Project has the potential to generate excess general wastes from construction personnel such as organic food waste, plastics (bottles and/or packaging), metals (aluminium cans and/or tins) and cardboard waste (Tetra Pak cartons, newspaper, wastepaper). This is a **likely** effect of theProject, but every effort will be made to ensure that every piece of general waste will be disposed of properly and removed from Site. The impacts associated with waste materials is considered to be **direct, adverse, slight significance, small** in scale, **localised, long term to permanent** effect which contrasts to Baseline. With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

8.4.4 Operational Phase Potential Effects

8.4.4.1 Land Take Wind farm

Land take will be required during the construction and operation of the wind farm. This will be required for construction of Site Access Roads, Turbine Foundations, Onsite Substation, Met Mast and for temporary land take the facilitate the laying of grid connection cable ducting both on and off the Site.

Land take is a Moderate (Site footprint = 28.79 ha, Site area = c. 167 ha, land take equates to 17.24% relative to the scale of the Site) direct impact of the Project, that is land being used as forestry and agricultural pastures currently will be replaced by the Project. The extent of land take will correlate with the footprint of the Project with the exception of some existing track ways, however there is also additional land take considering required cut and fill, drainage and cable trench infrastructure, and the increased excavation footprint required for safe excavation practices (e.g., batter back, discussed in the following sections).

Excavation, deposition and ground sealing activities associated with land take required for the Project will lead to disturbance of otherwise generally greenfield, undisturbed land, in the absence of commercial forestry practices, that is, the natural soil profile, important for the purpose of facilitating current land use practices, namely forestry and agriculture, will be directly affected under the footprint of the Project.

The overall potential effects here are considered to be of **unavoidable, direct, adverse, slight to moderate significance and scale, long term to permanent** (life of project), but **reversable** through the decommissioning and restoration phase of the Project. This effect is considered to be limited to the footprint of the Project and conforms to baseline (e.g., forestry operations). With appropriate mitigation measures, planning and management this impact can be reversed, and disturbance minimised.

Land take associated with the Turbine Delivery Route and Grid Connection Route will be limited to the Construction Phase of the Project **Section 8.4.3.2**.

8.4.5 Decommissioning Phase Potential Effects

In general, the potential effects associated with decommissioning will be similar to those associated with construction but of reduced magnitude because extensive excavation, and wet concrete handling will not be required. The potential environmental effect of soil storage and stockpiling and contamination by fuel leaks will remain during decommissioning.

On the basis that a Decommissioning plan has been established, **Appendix 2.1**, and will be implemented during the Decommissioning works associated with the Project, potential issues arising giving cause to residual impacts are likely to be **infrequent, imperceptible** to **slight, direct, adverse, localised** and **reversible**.

8.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

This section of the chapter outlines the main mitigation measures which will be applied to the wind farm in order to reduce the effects of the impacts outlined previously.

8.5.1 Design Phase

8.5.1.1 Mitigation by Avoidance

The opportunity to mitigate any effect is greatest at the design phase. In this respect, a detailed Site selection process was carried out by the design team. A process of "mitigation by avoidance" was undertaken by the EIA team during the design of the turbine and associated infrastructure layout.

- At the start of project commencement, indicative turbine locations were issued, and through a desktop assessment the most significant environment constraints (in the context of land, soils and geology and sensitive receptors) were identified on a constraints map.
- From this a new layout was issued, during the detailed design stage. With the new layout iteration, peat probing was then carried out on Site. Once peat data was processed a further constraints map produced and issue to the Client.
- Off the back of this, an additional turbine layout iteration was issued avoiding all the sensitivities highlighted.

Arising from the results of this study, a constraints map was produced that identifies areas where geotechnical constraints (deep peat, steep inclines and shallow bedrock) could make parts of the Site less suitable for development. Furthermore, within the chosen Site, areas of deep peat and shallow bedrock were identified, and the infrastructure design sought to avoid those areas as much as possible. The layout plan was reviewed and the most appropriate design available for protecting the Site's existing geotechnical (and hydrological) regime was identified, whilst avoiding other environmental constraints. The Geo-Hazard constraints are assessed and presented in **Appendix 8.1 – IWF SI Report-Stability and Geotechnical Assessment,** and the **Peat and Subsoil Stability Risk Assessments (Appendix I (a – c)).**

8.5.2 Construction Phase

Any and all direct impacts on soils/peat and bedrock arising from the Development are considered to be either localised (i.e., land take and soil and subsoils removal for the Grid Connection Route, Turbine Delivery Route or stability risks) or within the development footprint (i.e., land take for the wind farm, clear felling of forestry, soils compaction and vehicular movements). Therefore, impacts assessed and classified in the following section/s are considered at the localised scale, **Table 8.11,** including the potential indirect impacts on downgradient receptors, for example associated with surface water as introduce in **Section 8.2.1.1.**

8.5.2.1 Felling of Afforested Areas

Best practice working in specific environments such as forested areas will be adhered to including working outside of surface water or other buffer zones, and risk assessing on a case-by-case basis in terms of drainage intercepting run off, ecological and other sensitive environmental attributes.

Proposed mitigation measures regarding the management of forestry operations are described below,

- Phased felling approach (**Chapter 2: Project Description**, Section 2.3.2),
- Minimise erosion by using existing tracks and use of brash for off track areas,
- The following forestry guidance and policies;
    - Forest Protection Guidelines
    - Forestry and Water Quality Guidelines
    - Forest Harvesting and Environmental Guidelines
    - Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures
    - Forest Biodiversity Guidelines
    - Forestry and The Landscape Guidelines
    - Forestry and Archaeology Guidelines
- Maintaining a 25 m (minimum) buffer at felling locations near surface water receptors, for instance at the proposed location of T2, T4 and along Site Access Roads near the prosed location of Watercourse Crossing 3 (WC3).

Proposed mitigation measures outlined above, i.e., phased felling approaches will lessen impacts to the surrounding landscape and important surface water receptors by limiting the amount of soils, vehicular movements, soil compaction, etc. introduced to the Site at one time. This in turn can be seen as a **direct, slight to beneficial** effect.

8.5.2.2 Subsoil and Bedrock Removal

The removal of peat and mineral subsoil / bedrock is an unavoidable impact of the Project, but every effort will be made to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the impact on the geotechnical and hydrological balance of the Site. The impacts associated with this removal will be minimised using the following practices.

8.5.2.2.1 Mitigation by Good Practices

Best practice will be applied during construction which will minimise the amount of soil and rock excavation. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor in accordance with the conditions of any permission granted and agreed prior to any works commencing on Site.

Excavation of peat in areas where there is >1.0 m in peat depth, for instance at T1, T3 and T5 (**Appendix 8.1 – App A**) will follow appropriate engineering controls (**Section 9.5.2.3, Chapter 9: Hydrology and Hydrogeology**), such as the drainage of the peat along the proposed Site tracks in advance of excavation activity (1 month in advance where possible) so as to reduce pore water content and thus instability of the peat substrate prior to excavation. Such drains will be positioned at an oblique angle to slope contours to ensure ground stability. Drains will not be positioned parallel to slope contours, that is, a gradient more than zero. It is noted that some drains will be close to parallel with elevation contours. This drainage will be attenuated prior to outfall (**Chapter 9: Hydrology and Hydrogeology** and **Management Plan 3: Surface Water Management Plan 3, Appendix 2.1: CEMP**). It is noted that peat depth at the Site is generally shallow, and management of saturated peat will be required at relatively few locations of 'Moderately Deep' peat, mainly at the proposed location of T1, **Appendix 8.1: App A**.

In those parts of the Site where excavation will intercept areas of peat that are >1.0 m depth (proposed locations T1, T3 and T5), a geotechnical engineer/engineering geologist will be onsite to supervise and manage the excavation works and confirm the necessity for supporting newly excavated peat exposures or redirect initial construction phase drainage to maintain ground stability.

For side walls in all excavations a safe angle of repose will be established. This will ensure the potential for side wall collapse will be minimised. For peat, the safe angle of repose is approximately 15°, which equates to a c. 10 m horizontal distance if excavating to 2.5 m

depth, however given the quality of the peat, and the potential residual water content after pre-excavation drainage works, or increased water content following heavy rainfall events, there remains a risk of localised stability issues arising in areas of deeper peat. Therefore, for excavation in areas of deeper peat (>2.0 m), particularly at proposed location of T1, excavation supports will be used, for example temporary sheet piling, or similar. This will minimise the effect of excavation to the minimum required. Areas of the Site where deeper (>2.0 m) peat was detected during Site surveys are presented in geo-constraint maps (**Appendix 8.1**), proposed hardstand areas have avoided these areas of deep peat. Similarly, the safe angle of repose for subsoils at the Site (GRAVELS), or any other material (e.g., crushed rock) arising at the Site have also been considered and similar consideration and mitigation applied respectively. Example soil types and respective critical angle of repose under varying conditions is presented in **Error! Reference source not found.**However, in terms of peat or loamy soils the critical angle of repose will vary greatly depending on a range of factors (peat quality, fibre content, water content, etc.). For example, the friction angle of peat varies significantly due to associated shear strengths, and undrained friction angle of amorphous peat and fibrous peat is typically in the range of 27 to 32 degrees under a normal pressure, however in some regions (West Malaysia) the friction angle is in the range 3 to 25 degrees [17].

Table 8.10: Critical Angle of Repose for Various Soil Types [18]

Soil Type	Critical Angle of Repose (Degrees)		
	Dry	Moist	Wet
Topsoil (Loose)	35-40		45
Loam (Loose)	40-45		20-25
Peat (Loose) ***NOTE***	15	45	
Clay/Silt (Solid)		40-50	
Clay/Silt (Firm)		17-19	
Clay/Silt (Loose)		20-25	
Puddle Clay			15-19
Silt		19	
Sandy Clay		15	
Sand (Compact)		35-40	
Sand (Loose)	30-35		25
Sandy Gravel (Compact)		40-45	

[17] Kazemian S et al (2011) A state of art review of peat: Geotechnical engineering perspective. International Journal of the Physical Sciences Vol. 6(8), pp. 1974-1981

[18] StructX (25/04/2022) Critical Angle of Repose - Typical Angle of Repose Values for Various Soil Types [Online] Available at: https://structx.com/Soil_Properties_005.html [Accessed 01/06/2022]

Soil Type	Critical Angle of Repose (Degrees)
Sandy Gravel (Loose)	35-45
Sandy Gravel (Natural)	25-30
Gravel (Medium Coarse)	25-30
Shingle (Loose)	40
Shale (Hard)	19-22
Broken Rock	35-45
NOTE: Angle of repose for peat will be highly variable depending on in situ site conditions.	

Adopting good practices, planning ahead and real time monitoring in more sensitive (>1.0 m peat depth) areas will ensure that any excavations associated with the Project will have minimal impact, that is the risk of the activity of excavation having an increasing or variable impact will be reduced. Similarly, application of the above mitigation measures will reduce the risk of stability issues arising at a localised scale.

8.5.2.2.2 Mitigation by Reuse

Bedrock will be re-used for construction of Site Access Tracks and/or Turbine Hardstands wherever possible. The bedrock will comprise predominantly sandstone and siltstone which, when crushed and graded, will provide a good sub-base for Site Access Track construction.

Similarly, the subsoil (GRAVELS) or till at the Site possess a relatively high proportion of clay and sand particles (**Appendix 8.1, Appendix D, Appendix F** and **Appendix G**), which can enhance the entrainment of solids in runoff relative to other soils/materials. Therefore, similar precautions will be implemented when handling and reusing subsoil materials on Site.

Excess bedrock will be reused as backfill in areas previously excavated, or as backfill in cut and fill operations, for example, Site Access Roads and Turbine Hardstands. If additional hardcore material is necessary to import during the construction phase, using the local bedrock as fill will ensure that impacts to hydrochemistry are minimised. Geotechnical testing on imported material will be carried out prior to its reuse onsite particularly for reuse as a running or load bearing surface and will only be reused for those purposes if the suitability of same is conforms to relevant standards. Guidance which will be applied is as follows:

- Good Practice during Wind Farm Construction (SNH, 2015)
- Notes for Guidance on the Specification for Road Works Series NG 600 – Earthworks (TII, 2013)

- Constructed tracks in the Scottish Uplands (SNH, 2015)

Peat material excavated will be reused as backfill in areas previously excavated as much as possible, and/or for reinstatement works elsewhere on the Site. To facilitate this the acrotelm (living layer) and the catotelm (lower layer) will be treated as two separate materials. Catotelm peat will be used to backfill, for example around turbine foundation pads once established. Acrotelm peat will be used as a dressing on top of deposited catotelm peat in order to promote and re-establish flora and ensure the acrotelm layer becomes relatively cohesive in terms of localised peat stability (vegetated), refer to **Management Plan 4 of the CEMP, Appendix 2.1.**

Similarly, all soil and subsoil types or horizons identified during site investigations and during actual construction, (summary provided in **Appendix 8.1**, data presented in **Appendix D, Appendix F** and **Appendix G),** will be treated as separate materials and arisings separated accordingly. This includes, for example Acrotelm peat, catotelm pet, clays, subsoils (GRAVEL / TILL), weathered rock.

The management, movement, and temporary stockpiling of material on Site, including a materials balance assessment and plan is detailed in the CEMP, this includes identification of suitable temporary set down areas which will be located within the Project footprint and will consider and avoid geo-constraints identified in this report (**Appendix H a - c**). Temporary set down / stockpile areas will be considered similarly to active excavation areas in terms of applying precautionary measures and good practices, and mitigation measures, including those relating to control of runoff and entrapment of suspended solids (**Chapter 9: Hydrology & Hydrogeology**).

8.5.2.2.3 Mitigation by Remediation

On completion of the construction stage, any areas not required for operation will be reinstated. This will include the Temporary Construction Compound, turning areas and the Borrow Pit location. Granular material will be removed as required and reinstated with peat or other soils in keeping with the adjacent soils. Drainage measures will be reinstated as required in order to minimise future erosion of the soils. The mitigation measures listed above, namely backfilling with peat in layers, are in effect remediation measures, whereby the impact of required excavation works is remediated and limited to the extent of the actual proposed infrastructure. This will be carried out at the designated reinstatement locations, infilling with material in identified soil horizons as mentioned above to revert these areas to baseline levels.

Mitigation measures outlined here as well as in **Management Plan 4 Peat and Spoil Management Plan** in **Appendix 2.1** of the CEMP will ensure the impacts arising from excavation activities are minimised to the footprint of the Project and improve degraded areas of the Site, thus offsetting the adverse impacts of the Project.

8.5.2.3 Storage of Stockpiles

8.5.2.3.1 Mitigation by Avoidance and Good Practice

Best practice will be applied during construction which will minimise the amount of soil and rock excavation and therefore also reduce storage and stockpile requirements. All works will be managed and carried out in accordance with the Construction and Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor in accordance with the conditions of any grant of permission and agreed prior to any Site works commencing.

No permanent stockpiles will remain on the Site. All excavated materials from the Site or introduced materials for construction will be either used for infilling/reinstatement purposes or removed from the Site.

No temporary stockpiles will be positioned or placed on areas of peat which have not been assessed or are indicated as being geo-hazards, particularly in areas of unacceptable factor of safety / stability (**Appendix B, Appendix I, Appendix 8.1**). All temporary stockpiles will be positioned on established and existing hardstand areas or in designated areas which are appropriate for short term storage. No temporary stockpile placed on established hardstands or within the Project footprint in areas of peat (**Appendix 8.1 – App B Peat Database**) will be in excess of 1 m in height. This is due to potential localised stability and subsidence issues in relation to the peat under and in vicinity of the hardstand and stockpile.

Mitigation measures to address the entrainment of solids in runoff are detailed in **Chapter 9: Hydrology and Hydrogeology**, and in **Appendix 2.1**, **Management Plan 4 Peat and Spoil Management Plan** which provides for the near immediate reuse of material in so far as practical, thus reducing the potential for temporary stockpiles in general. For example, the material arising from the first excavation is deposited in areas identified as having potential for restoration or requiring fill, the material arising from the second excavation is used as fill and reinstatement material in the first excavation location, etc.

8.5.2.3.2 Mitigation by Reduction

The volume of material to be managed including temporary stockpiling is directly proportional to the volumes of material required to be excavated, in total the volume of material (35,504 m^3), however when managed appropriately (ongoing reinstatement) the volume of material to be managed at any particular time will be minimised. Whenever possible, soil and rock will be re-used on the Site immediately, thereby reducing the need for double handling, reducing the requirements of stockpiles. Generally excavated rock will be used immediately for Site Access Track construction. Topsoil and peat will be transported to the designated spoil storage areas. Peat will only be stockpiled temporarily in areas of thin or absent peat (generally towards the eastern end of the Site, **Appendix 8.1 – App A**), and only in areas which have been assessed for stability by a suitably experienced geotechnical engineer.

The Peat and Spoil Management Plan (**Management Plan 4, CEMP Appendix 2.1**) forming part of the CEMP, identifies volumes and types of materials arising, temporary stockpiling locations, routes for reuse and remediation, requirements in terms of logistics and considerations in terms of timing and planning of movements of material. The Peat and Spoil Management Plan ensures that the material arising from any excavation will have a predetermined plan and route for re-use / remediation, or disposal if all potential for reuse / remediation have been exhausted.

Mitigation measures for stockpiles related to the Grid Connection Route are as follows: stockpiles will be restricted to less than 1 m in height and will be subject to approval by the Site Manager and Environmental Clerk of Works (EnvCoW). Additionally, any excavated material will be later used to backfill the trench where appropriate, any surplus material will be transported to a licensed facility.

8.5.2.4 Ground Stability

8.5.2.4.1 Mitigation by Avoidance and Good Practice

Peat and slope stability investigations at the Site (**Appendix 8.1**) indicate that the Site has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Project. Nonetheless, the following mitigation measures will also be applied as described in the PSRA (included as **Appendix 8.1**):

- Short term temporary stockpiles will be limited to 1 m height and removed for reuse/remediation purposes or transported to the Borrow Pit as fill. It is proposed that all material will be reused on Site, unless contaminated (for example, due to accidental

hydrocarbon/fuel spill). Therefore, the risk posed by the management of material in terms of peat and slope stability is dramatically reduced.

Furthermore, with a view to applying the precautionary principle, the following procedures will be adopted as best practice mitigation measures at the Site:

- All Site excavations and construction will be supervised by a geotechnical engineer/engineering geologist.
- The Contractor's * methodology statement and risk assessment will be in line with the Construction Environmental Management Plan and will be reviewed and approved by a suitably qualified geotechnical engineer/engineering geologist prior to Site operations. (* Contractor here refers to the chosen or contracted construction company at the commencement stage of the Development).
- Particular attention and pre-construction assessment (developer / sub-contractor site specific risk assessment and method statement (RAMS) and on-site toolbox talks etc.) and mitigation measures will be implemented for all phases and locations for construction of new infrastructure, for example:

a. All works in close proximity to sensitive receptors, that is; any works with receptor buffer zones, for example, works associated with watercourse crossings. With very little distance between works and receptor, minor or localised stability issues can lead to significant consequences.
   This includes, but us not limited to:
   - Watercourse Crossings WC1, WC2 and WC3, and associated access tracks works within Surface Water buffers.

b. Hardstands and access tacks in close proximity to relatively deep peat and/or steep inclines, that is; works associated with or proximal to geo-hazards.
   This includes, but us not limited to;
   - Areas adjacent to T1, in particular deep peat to the north / northwest, and relatively steep inclines to the south.
   - Areas adjacent to T3, in particular deep peat to the north / northeast, and relatively steep inclines and elevated landslide susceptibility (GSI) to the south / southeast / east.
   - Areas adjacent to T4, in particular relatively steep inclines and elevated landslide susceptibility (GSI) to the south / southeast / east.
   - Areas adjacent to access tracks leading to T1/T2/T3, in particular deep peat to the north, and steep inclines and elevated landslide susceptibility (GSI) to south of T1 to T3 access track.

c. Where the previous two points occur in combination, that is; geohazards which are above or upgradient of particularly sensitive areas of the Site as discussed in the attached SI report (**Appendix 8.1**), and as presented in the constraints maps (**Appendices H (a – c)** as well as **Figure 8.7**, are the most important locations to advance with due care and consideration.

- Groundwater level (pore water pressure) will be kept low at all times (excavation dewatering) to avoid ground stability risks (subsidence) associated with peat and careful attention will be given to the existing drainage and how structures might affect it (**Appendix 9.6 – Tile 11**). Draining water from the construction area will be done through advanced dewatering techniques. In particular, ponding of water will not be allowed to occur in recent excavations, particularly in any areas encountered where peat is >1 m (proposed locations of T1 and T3). All deliberate or incidental sumps will be drained to carry water away from the sump following rainfall. Otherwise, this water will increase hydraulic heads locally and in turn increase pore water pressure which can potentially lead to instability.
- Peat will be carefully managed particularly when in temporary storage. Due to peat's fluid-like properties, all peat excavated will be immediately removed from sloping areas. Temporary storage areas will be isolated from the receiving environment by means of temporary infrastructure such as boundary berms comprised of subsoils sourced at the Site, or similar material (**Appendix 9.6 – Tile 12**). There is potential for large volumes of bog water draining from new stockpiles which will also be managed. Mitigation will include removal of gross solids from runoff prior to bog water intercepting the wind farm drainage network **(Appendix 9.6 – Tile 11, Tile 14).** Temporary measures such as dewatering and pumping through silt bags (**Appendix 9.6 – Tile 15),** will be employed to assist this process. Draining of stockpiled peat, in a controlled manner is proposed (**Management Plan 4 CEMP Appendix 2.1),** with a view to reducing the weight and mobility of the material, therefore reducing risk in terms of localised stability. These measures will also be applied to the management of subsoil arisings at the Site.
- Peat is required for reinstatement, therefore acrotelm peat (top living layer, c. 0.5 m) will be stripped off the surface of the bog, segregated, and placed carefully at the margins of the Project along the Site Access Roads and Turbine Hardstand margins that are characterised by near-horizontal slopes (<6°), (**Appendix 9.6 – Tile 23).**
- Relatively high impact construction activities (e.g., excavations, movement of soils / subsoils / rock) will be carried out throughout the year, while taking into account the various restrictions of the Project, (for example, breeding bird seasons). However, considering the variability of metrological conditions and the potential for significant events to occur at any stage of the year, the construction phase will be limited to

favourable meteorological conditions. In order to mitigate for particular earth works tasks and suitable meteorological conditions, construction activities will not occur during periods of sustained significant rainfall events, or directly after such events (allowing time for work areas to drain excessive surface water loading and discharge rates reduce).

- From examination of factual evidence to date, the majority of landslides occur after an intense period of rainfall. Stability issues at a localised scale will be similarly impacted by rainfall events, particularly when dealing with exposed soils or open excavations. An emergency response system has been developed for the construction phase of the Project (**Appendix 2.1: CEMP, Management Plan 1: Emergency Response Plan**), particularly during the early excavation phase. This, at a minimum, will involve 24-hour advance meteorological forecasting (Met Éireann) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g., one in a 100-year storm event or very heavy rainfall at >25 mm/hr), planned responses will be undertaken. These responses will include; cessation of construction until the storm event including storm runoff has passed over. Following heavy rainfall events, and before construction works recommence, the Site will be inspected and corrective measures implemented to ensure safe working conditions, for example dewatering of standing water in open excavations, etc.
- Any impact to the hydrological and/or hydrogeological regime will be avoided as far as practical in relation to identified Geo-Hazards and receptors (**Appendix H**) where the presence of steep inclines (T2, T3, T4 and T5), deep till deposits and iron pan (T2, T3, T5) give rise to elevated ground stability (T3, T4, T5), particularly where the potential for impacts to hydrogeology in those area / subsoils exists. For example, runoff from constructed hardstands will not be diverted and discharged (**Appendix 9.6 – Tile 11, Tile 15, Tile 16)** near / towards Geo-Hazard areas where possible. If unavoidable, due to slope direction etc., attenuation and erosion control will be implemented, as discussed under **Chapter 9: Hydrology and Hydrogeology**. Consequences of impacting, diverting and/or concentrating runoff in or towards geo-hazard constraints will potentially impact on stability at the Site.

Vehicular movements will be restricted to the footprint of the Project, and advancing ahead of any constructed hardstand will be minimised in so far as practical, for example; excavation ahead of established hardstands will be in line with expected phases of hardstand and track construction in terms of both delivery of and installation of material and Site activity periods whereby excavations will not be opened ahead of Site shut down periods. This will be done with a view to minimising soils / subsoils exposure to rain and runoff.

Ancillary machinery will be kept on established hardstands, no vehicles will be permitted outside of the footprint of the Project and will not move onto land that is not proposed for the Project.. Vehicular access to any areas of deep peat (>1 m), i.e., the vicinity of T1, during construction will be restricted to low ground pressure vehicles, with all construction vehicles travelling on existing access tracks whenever possible.

Best practice will be applied during construction which will minimise the risk of ground instability. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP, **Appendix 2.1**), which will be updated by the civil engineering contractor in accordance with the conditions of any grant of permission and agreed prior to any Site works commencing.

A Geotechnical Clerk of Works will be employed during the construction phase in order to continuously monitor areas of peat. Ongoing physical stability checks and calculations will be undertaken in order to verify that safety standards are being met.

Adhering to the mitigation measures described herewith will minimise the adverse impacts posed by vehicular movements, and ultimately any impacts arising will be temporary considering the initial decommissioning and construction of the Project will in effect reverse any impact by vehicular movement within the footprint of the Project.

8.5.2.4.2 Mitigation by Reduction

The temporary storage of construction materials, equipment, and earth materials will be kept to an absolute minimum during the construction phase of the Project. This will be achieved by means of appropriate planning and logistical considerations forming part of the CEMP (**Appendix 2.1**), these measures will also be applied in relation to the management of spoil on the Site.

For example, the excavation material for the construction of access track will not progress ahead of actual track construction (as discussed under mitigation addressing vehicular movements), therefore minimising the volume of arisings to be managed. Areas for permanent deposit of material e.g., backfill adjacent to constructed infrastructure, will be identified and suitable material deposited as it becomes available. These efficiencies will be designed into the detailed CEMP (**Appendix 2.1**).

8.5.2.4.3 Mitigation by Remediation

There are no indications of significant issues on the Site in terms of ground stability, however excavation and construction activities will lead to some potential impacts with respect to the immediate area adjacent to the Project and areas impacted by potential localised stability issues. In these instances, remediation of soils will include the deposit of suitable material where required. This will include replacement of soils / subsoils in line with baseline conditions and soils horizons. For example, the three principal materials excavated in order of depth will include peat / peat soil (including segregated acrotelm (top living layer) and catotelm peat or topsoil at the surface, till, and crushed rock, **Appendix 9.6 – Tile 22 and Tile 23.** Remediated areas will be managed and monitored in terms of reestablishment of vegetated cover.

In the unlikely event that a peat or slope stability issue does arise on the Site during the construction or operational phases of the Project, emergency response measures have been prescribed below and as part of the Construction Environment Management Plan, **Appendix 2.1 - Management Plan 1.**

8.5.2.4.4 Emergency Response and Monitoring

Mitigation measures as outlined in the previous sections will reduce the potential for stability issues arising during the decommissioning and construction phase of the Project. However, there remains a low risk of stability issues arising, particularly at a localised scale.

Emergency responses to potential stability incidents have been assessed (**EIAR Chapter 16: Major Accidents and Natural Disasters**) and established to form part of the CEMP, **Management Plan 1, Emergency Response Plan** before construction works initiate. The following potential emergencies and respective emergency responses are addressed under **Section 6.1: Procedures to be followed in the event of an incident** in **Management Plan 1 of the CEMP**:

- Peat stability issues at a localised scale during excavation works – In the event that soil stability issues arise during construction activities, all ongoing construction activities at the particular area of the Site will cease immediately, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed. Localised stability issues will likely occur with a broad range in severity including; minor side will collapse with no significant impact, to relatively significant areas of peat being impacted by excavation activities, or in worst case scenarios localised stability at one location triggering a chain of events leading to significant peat or slope stability issue arising. The assigned geotechnical engineer will assess each scenario and will implement the following measures as the need arises.

- Provision for a peat stability monitoring programme to identify early signs of potential bog slides (pre-failure indicators, for example cracks forming). This will be done in line with Scottish Governments' "Peat Landslide Hazard and Risk Assessments".[19]
- Significant peat or slope stability issues during construction activities – In the unlikely event that soil and slope stability issues arise during construction activities, all ongoing activities in the vicinity will cease immediately, all operators will evacuate the area by foot, if safe to do so, until the area is assessed by competent person/s, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed. The area impacted will be characterised fully and risk assessments completed prior to any further works commencing at or near the location. This assessment will be phased including initial rapid response Phase 1 Assessment which will include at a minimum the prescription of exclusion zones and preliminary mitigation steps to be taken, for example, the management of runoff in or from the affected area.

Considering the highly dynamic nature of peat or soil stability issues at any particular site, an equally dynamic yet robust framework to follow in the event of an incident has been established. Establishment of an emergency framework will follow relevant guidance (e.g. SNH (2015) Good Practice during Wind Farm Construction) and standard practices, including for health and safety risk assessment to initially qualify any incident (by on site competent geotechnical engineer) and risk assess the area, and to then apply initial measures and design a complete emergency / contingency plan in line with an established structured emergency response. Relevant guidance as presented in **Section 8.3** will be adhered to.

Emergency response will prioritise isolating and containing any materials which is being or will be intercepted by the established drainage network or receiving surface water network. Emergency materials and equipment requirements will be identified, incorporated in the CEMP, and will be managed on Site with a view to be being easily accessible and readily available.

Onsite training and toolbox talks will ensure any response to any potential incident is mobilised quickly and efficiently.

[19] Scottish Government (2017) "Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Developments" *Energy Consents Unit Scottish Government.*

This is in combination with mitigation measures as described under EIAR **Chapter 9: Hydrology and Hydrogeology** whereby precautionary measures e.g., silt screen fencing etc. will be in place. Emergency response above existing or in place measures might include crudely building dams with an excavator to attenuate or direct flow until conditions stabilise, depositing subsoil or crushed rock material to dam drainage channels, and reactionary dewatering through silt bags to appropriate areas of the Site i.e., vegetated area and without impacting on problem area in terms of stability.

8.5.2.5 *Vehicular Movements*

Vehicular movements will be restricted to the Project footprint (**Figure 8.7**) and advancing ahead of any constructed hardstand will be minimised in so far as practical. This will include any temporary stockpiling. For example, excavation ahead of established hardstands will be in line with expected phases of Turbine Hardstand and Site Access Track construction in terms of both delivery of and installation of material and site activity periods whereby excavations will not be opened ahead of site shut down periods. This approach to limiting vehicular movements and temporary handling of arisings to the Project footprint is very important in the context and scope of peat and slope stability risk assessment and its conclusions (**Appendix 8.1**) and limiting other potential impacts including soil compaction and degradation.

The only exception to limiting vehicular movements to the footprint of the Project will be for forestry clear felling (Tree Felling areas presented in **Figure 8.7**). Clear felling of forestry is in line with baseline conditions / Do Nothing impact, will be carried out in line with forestry operations best practice guidance, and in line with relevant mitigation measures set out in this report in terms of monitoring ground stability locally and managing potential sources of contamination. No intrusive or excavation works are anticipated as part of tree felling activities. The management vehicles used for tree felling will align with measures set out in this report, for example; spill kits to hand, etc. During construction down time / overnight, vehicles will be stored in suitable locations on the Project footprint and not left un-manned on vegetated / tree felling / soils areas, or within sensitive areas / receptor buffers.

Where vehicular movements are necessary outside of the Project footprint, ground conditions will be maintained and reinstated. This includes for example replacing sods, smoothing over with excavator bucket etc. Where ground conditions are poor, or prolonged works, temporary access measures will be deployed, for example floating platforms / floating access track.

For the Grid Connection route, before starting construction, the area around the edge of each joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage.

Implementation of proposed mitigation measures described will minimise the adverse impacts posed by vehicular movements, and any localised unforeseen impacts will trigger escalation of response ensuring locations are restored and any potential pathways to receptors are isolated.

8.5.2.6 Soil Contamination

Any accidental spillage of introduced materials, such as concrete, will be removed from the Site.

Soil contamination, or the potential for same, is an inherent risk associated with any development. As such, good practice during construction activities, as detailed in the CEMP **(Appendix 2.1),** will address and minimise the potential for soil contamination to occur. The CEMP will be developed to include the scheduled checks of assets (plant, vehicles, fuel bowsers) on a regular basis during the construction phase of the Project. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations. In addition, all such management plans will be revised as 'live' documents, so that lessons learned, and improvements will be made over course of the Project.

8.5.2.6.1 Mitigation by Avoidance and Good Practice

8.5.2.6.1.1 Release of Hydrocarbons

Contaminants which pose the most significant risk to soils, namely hydrocarbons and construction materials such as cement / concrete, pose an even greater risk to surface waters and groundwaters. In the event an accidental discharge was to occur without mitigation, contaminates will likely leak or be spilled on soils initially. Protecting soils from such will in turn mitigate against the potential for contaminates reaching the hydrological network associated with the Site, however given that such features are fundamental to the potential effect of contaminants down gradient of surface water receptors, mitigation measures for contaminants are presented in detail in **Chapter 9: Hydrology and Hydrogeology.** To control and contain any potential hydrocarbon or other harmful substance spillages by vehicles during construction. Plant equipment will be refuelled off the development Site, thus mitigating this potential impact by avoidance.

Where fuelling offsite is impractical (e.g., bulldozers, cranes, etc.) and fuelling must occur on Site, all oil and chemical storage facilities will be bunded to 110% volume capacity of fuels stored at the Site, **Appendix 9.6 – Tile 19**. A "fuel station" will be designated for the purpose of safe fuel storage and fuel transfer to vehicles, located at the Temporary Contractor's Compound. Furthermore, an Emergency Response Plan will be in place as part of the Construction and Environment Management Plan (**Appendix 2.1**) before consented works are carried out.

As discussed, construction activities will be restricted to the footprint of the Project, therefore the potential for contaminants reaching soils is likely limited to the footprint of the Project or construction area. There remains the potential for contaminant migration through soils however, scope for migration is limited considering the Site geology i.e., peat / loamy soil with low permeability and transmissivity rates, and similarly poorly productive bedrock aquifers with only localised connectivity. The highest permeability and transmissivity rates at the Site are attributed to the underlying till / gravels. It is also noted that the scale of any potential contamination impact will likely be minor in scale, for example; plant machinery leak (on exposed ground), as opposed to a fuel tank rupture (in bunded structure).

A fuel management plan will be prepared (and included in the CEMP) which will incorporate the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores
- Ancillary equipment such as hoses, pipes will be contained within the bund
- Taps, nozzles or valves will be fitted with a lock system
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage
- Only designated trained operators will be authorised to refuel plant on Site.

In the event of an accidental spill during the construction, operational or decommissioning phase of the Project, contamination occurrences will be addressed immediately, this includes the cessation of works in the area of the spillage until the issue is resolved. In this regard, appropriate spill kits, **Appendix 9.6 – Tile 20**, will be provided across the Site to deal with the event of a spillage and made available at all times. Spill kits will contain a minimum of; oil absorbent granules, oil absorbent pads, oil absorbent booms, and heavy-duty refuse bags (for collection and appropriate disposal of contaminated matter). Staff will

be trained in their use and details of personnel and location and type of spill kits will be listed in the CEMP (**Appendix 2.1**), which will be updated by the selected site Contractor. No materials contaminated or otherwise will be left on the Site. Suitable receptacles for hydrocarbon contaminated materials will also be at hand. Upon usage, spill kits will be promptly replaced.

In the event of a significant or catastrophic hydrocarbon spillage, emergency responses will be escalated accordingly. Escalation will include measures such as the installation of temporary sumps, drains or dykes to control the flow or migration of hydrocarbons, excavation and disposal of contaminated material. Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the vicinity of works.

The mitigated impacts associated with hydrocarbons is considered to be **neutral to slight and temporary.**

8.5.2.6.1.2 Release of Horizontal Drilling Fluid and Material

In order to mitigate the potential impact posed by the use of drilling fluid material and the associated effects on the receiving environment, the following precautions and mitigation measures are recommended:

- Spoil from drill arisings will be managed akin to mitigation measures outlined in **EIAR Chapter 9: Hydrology and Hydrogeology** for the release of suspended solids, in that arising will require temporary stockpiling which the potential to be entrained by surface water runoff. This includes but is not limited to: stockpiling out of designated surface water buffer zones and the utilisation of silt fencing around stockpiles to contain sediment laden runoff.
- In the case of a major spill or a breakout and drilling fluid return, the leak will be stopped if safe to do so, contained and prevented from entering drains or water courses. Any recoverable product will be collected, similar in means of a hydrocarbon spill, and disposed of properly. If a significant quantity of material enters drains or watercourses, emergency services will be advised immediately.
- In terms of drilling fluid disposal, very fine solids, or colloidal particles, are very slow to settle out of waters and the finest of particles require near still water and relatively long periods of time to settle, therefore, such particles are unlikely to settle at sufficient rates. To address this, flocculant will be used to promote the settlement of finer solids prior to discharging to surface water networks, **Appendix 9.6 – Tile 14**. Flocculant 'gel blocks'

are passive systems, self-dosing and self-limiting, however they still require management as per the manufactures instructions. Flocculants are made from ionic polymers. Cation polymers (positive charge) are effective flocculants; however, their positive charge makes them toxic to aquatic organisms. Anionic polymers (negative charge) are also effective flocculants, and are not toxic i.e., environmentally friendly.[20] Therefore, if flocculants are deployed the material used must be made from anionic polymers. Flocculants are discussed in greater detail in **EIAR Chapter 9: Hydrology and Hydrogeology.**

The mitigated impacts associated with HDD arisings is considered to be **not significant.**

8.5.2.6.1.3 Release of Wastewater and Sanitation Contaminants

A temporary compound area will be constructed on-site to contain temporary facilities for the construction phase including 'port-a-cabin' structures. The temporary compound will be constructed on a base of geo-textile matting laid at ground level. This will be stabilized with the laying of hardcore material on top. During the construction phase, foul effluent will be periodically removed for offsite disposal.

Wastewater/sewerage from the staff welfare facilities located in the Temporary Construction Compound will be collected and held in a sealed storage holding tank, fitted with a high-level alarm. The high-level alarm is a device installed in the storage tank that is capable of sounding an alarm during a filling operation when the liquid level nears the top of the tank. Chemicals are likely to be used to reduce odours.

All wastewaters will be emptied periodically, tankered off-site by a licensed waste collector to the local wastewater sanitation plant for treatment. There will be no onsite treatment of wastewater. A wastewater or sewerage leakage is not anticipated in a properly managed Site.

The mitigated impacts associated with wastewater and sewerage is considered to be **temporary and neutral to slight.**

[20] USEPA (2013) "Stormwater Best Management Practice: Polymer Flocculation" *United States Environmental Protection Agency: Office of Water*, 4203 M.

8.5.2.6.1.4 Release of Construction and Cementitious Materials

In order to mitigate the potential impact posed by the use of concrete and the associated effects on the receiving environment, the following precautions and mitigation measures will be implemented, as set out in the CEMP **(Appendix 2.1):**

- Precast concrete will be used wherever possible i.e., formed offsite. Elements of the Project where the use of precast concrete is not possible includes turbine foundations. Where the use of precast concrete is not possible the following mitigation measures will apply:
- Lean mix concrete, often used to provide protection to main foundations of infrastructure from soil biome, will be minimized, limited to the requirement of turbine foundations if necessary. Lean mix concrete can alter the pH of water if introduced, which would then require the treatment of acid before being discharged to the surrounding environment. The risk of runoff will be minimal, as concrete will be contained in an enclosed, excavated area
- The acquisition, transport and use of any cement or concrete on Site will be planned fully in advance of commencing works by the Contractor's Environmental Manager and supervised at all times by the Developer appointed Environmental Clerk of Works (EnvCoW).
- There will be no excess cementitious material on the vehicle which could be deposited on trackways or anywhere else on Site. To this end, delivery trucks, tools and equipment will be cleaned at designated washout areas located conveniently and within a controlled area of the Site. Vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed Site or progress beyond the contractor's yard.

In addition, the following drainage measures will apply;

- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during periods of minimal precipitation. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e., avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3 mm/hour). This also will avoid such conditions while concrete is curing, in so far as practical.
- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of in accordance with the Waste Management Plan (see **Appendix 2.1; CEMP, Management Plan 5: Waste Management Plan**).

- Pouring of concrete into standing water within excavations will not be undertaken. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- No surplus concrete will be stored or deposited anywhere on Site. Such material will be returned to the source location or disposed of off-site appropriately.

Elements of the Project where precast concrete will be used will be identified in the CEMP. Elements of the Project where the use of precast concrete will be used include e.g., structural elements of watercourse crossings (single span / closed culverts) as well as cable joint bay structures.

Supplementary mitigation measures outlined in **Chapter 9: Hydrology and Hydrogeology** to surface water receptors will also apply. The mitigated impacts associated with construction waste is considered to be **neutral to slight.**

8.5.2.7 General Waste

All construction and operation waste materials will be correctly sorted, recycled or disposed of in accordance with good site practice described in Management Plan 5 of the CEMP, a policy of Reduce, Reuse and Recycle will apply. The mitigated impacts associated with general waste is considered to be **temporary** and **neutral to slight.**

8.5.2.8 Material and Waste Management

A site-specific Peat and Spoil Management Plan and a Waste Management Plan have been prepared as part of **Appendix 2.1, Management Plan 4**. All excavated earth materials will either be re-used in an environmentally appropriate and safe manner e.g., landscaping and bog restoration or removed from the Site at the end of the construction phase. No permeant stockpiles will be left on the site.

Any surplus of natural materials (e.g., peat) to be used as backfill or deposited elsewhere in the Site will not be deposited to above existing ground level for the area in question. This ensures that peat used as backfill around newly established turbine foundations will not exceed local ground level, and any peat or natural materials deposited elsewhere will not exceed original ground level. In essence, no permanent stockpiles will be established as a product of the construction phase of the Project, or associated restoration activities as all materials will be re-used as much as possible on-site.

Excavated materials onsite will be reused and recycled according to the Waste Hierarchy as much as possible. Where it is not possible to do so, any excess materials (road building materials) or artificial (PVC piping, cement materials, electrical wiring etc.) will be taken offsite and disposed of at a licensed facility at the end of the construction phase, refer to **EIAR Appendix 2.1**, Management Plan 5: Waste Management. In the event of waste arising at the Site, management of waste arising from the construction phase of the Project will require classification, appropriate transfer, and appropriate disposal. Waste streams will vary and will include the following potential categories:

- Inert / Non-Hazardous Soils & Stones (EWC Code: 17 05 04) – greenfield subsoils and bedrock is likely to be Inert. This could include surplus coarse / hardcore aggregate contaminated with soils remaining at the end of the construction phase of the development.
- Hazardous Soils & Stones (EWC Code: 17 05 03*) or oily waste (spill kit consumables) – Soils or any materials with significant hydrocarbon contamination will likely be hazardous due to Total Petroleum Hydrocarbon concentrations. Soils impacted by significantly by cementitious material contamination will likely be hazardous due to elevated pH concentrations

All materials used on Site and wastes generated on Site will be reduced by good Site practice. Mitigation by remediation, for example, housekeeping, maintenance etc., in terms of waste or contaminants will be an ongoing measure throughout the construction phase of the Project, that is any and all contaminants will be removed from the Site in an appropriate manner when ever produced or observed.

Waste management measures to avoid Site pollution are specified in the **CEMP Appendix 2.1** and **Chapter 13: Material Assets**. A policy of reduce, re-use and recycle will apply. All waste will be segregated and re-used where possible or removed from Site for recycling. Any waste which is not recyclable or compostable will be properly disposed of to landfill.

8.5.2.9 Mitigated Sequence of Events During Wind Farm Construction on the Receiving Environment

The following sections outlines and summarises the general stages or elements of construction related to the Project. In contrast to **Section 8.4.3.1 Typical Sequence of Events in Wind Farm Construction on the Receiving Environment,** the following sequence includes a high level description of mitigation which is relevant to the respective steps. Specific details and important design considerations for mitigation measures prescribed in response to each activity type are discussed in the previous sections. Cross

referencing to **EIAR Chapter 9: Hydrology and Hydrogeology** is included due to the consistent relationship between disciplines, namely; hydrology, hydrogeology, geology.

8.5.2.9.1 Activities – With Mitigation

1. General Site Preparation:

- Install Surface Water Monitoring Equipment: It's important to install surface water monitoring equipment in downstream rivers to monitor the impact of construction activities on water quality. This equipment can include water quality sensors, flow meters, and sediment samplers, among others. The monitoring equipment will be installed prior to works commencing construction activities to establish baseline data and will continue to be monitored throughout the construction process to ensure compliance with environmental quality standards.
- Install Silt Screens, Interceptor Drains, and SuDS: To manage runoff and sediment control during the initial phases of construction, it's important to install silt screens, interceptor drains, and SuDS. Silt screens will be installed along the perimeter of the Site to capture sediment and prevent it from entering watercourses. Interceptor drains will be installed to divert runoff away from construction areas and towards designated settling ponds or treatment systems. SuDS, such as permeable pavement or infiltration trenches, will also be installed to manage runoff and reduce the impact of construction on the Site's hydrology. This work involves excavation activities and spoil management.
- Prepare Temporary Stockpile Areas: It's important to prepare designated temporary stockpile areas for the different types of waste generated during the construction process. This includes separate areas for vegetation, topsoil, subsoil, and other types of waste. These areas will be prepared in a location that minimizes the potential for runoff and erosion.
- Clear Vegetation and Soils: As part of site preparation, it's important to clear the vegetation and topsoil to prepare the area for construction. This will include cutting down trees and removing all vegetation from the Site, including grass, shrubs, and bushes. The vegetation and topsoil are temporarily stockpiled in designated areas in addition, the subsoil is also removed to the required depth to prepare the area for construction, and it's also stockpiled in a designated area for later use in the restoration of the Site.
- Excavate and grade the area for the construction of access tracks, hardstand areas, foundations, and other significant infrastructure units. This work involves excavation activities and spoil management.

2. Access Track and Hardstand Areas:

- Install silt screens, interceptor drains, and temporary SuDS:
  - Install silt screens along the perimeter of the Site to capture sediment and prevent it from entering watercourses.
  - Install interceptor drains to divert runoff away from construction areas and towards designated settling ponds or treatment systems.
  - Install SuDS, such as permeable pavement or infiltration trenches, to manage runoff and reduce the impact of construction on the Site's hydrology.
  - Ensure that all drainage structures and SuDS are regularly inspected and maintained to prevent blockages and ensure proper functioning.
  - Monitor water quality downstream of the construction Site to assess the effectiveness of these measures in managing runoff and sediment control.
- Clear vegetation and soil layers:
  - Cut down trees and remove all vegetation from the Site where relevant, including grass, shrubs, and bushes.
  - Stockpile vegetation in a designated area for later removal or use in the restoration of the Site.
  - Remove the acrotelm peat and/or topsoil to the required depth to prepare the area for construction.
  - Stockpile the acrotelm peat and/or topsoil in a designated area for later use in the restoration of the Site.
  - Remove the catotelm peat and/or subsoil to the required depth to prepare the area for construction.
  - Stockpile the catotelm peat and/or subsoil in a designated area for later use in the restoration of the Site.
  - Use silt screens and other temporary measures to manage runoff and prevent sediment from entering watercourses or drains.
- Install drainage structures and erosion control measures, such as culverts and Permanent SuDS.
- Construct the road base and hardstand using suitable materials, such as crushed rock or concrete.
- Construct hardstand areas for the installation and maintenance of wind turbines.
- Use designated temporary stockpile areas and segregation of materials for different types of material, including materials arising at the Site, and being imported to the Site. Types of material to be segregated and managed separately;
  1. Topsoil
  2. Acrotelm Peat

3. Catotelm Peat
4. Subsoil – this can be subdivided between material suitable or unsuitable for engineering fill etc.
5. Weathered or crushed rock
6. Specific waste streams including contaminated soil is it arises.

3. Drainage & Sustainable Drainage Systems (SuDS)

- Sustainable Drainage Systems (SuDS): SuDS are a set of techniques that are designed to manage surface water runoff in a more sustainable way than traditional drainage systems. SuDS mimic natural drainage processes by promoting infiltration, evapotranspiration, and the use of storage and delayed release systems. They can include a range of features such as permeable paving, green roofs, and rain gardens.
- Designing SuDS: The design of SuDS will be site-specific and tailored to local conditions. It will consider the Site's topography, soil type, rainfall intensity, and available space. The design will also incorporate a range of techniques to manage runoff, such as infiltration, storage, and conveyance. The aim of SuDS is to reduce the volume and rate of runoff, improve water quality, and provide amenity and biodiversity benefits.
- Benefits of SuDS: The benefits of SuDS are numerous, including reducing the risk of flooding, improving water quality, enhancing biodiversity, and creating green spaces. SuDS can also provide additional benefits, such as reducing urban heat island effects, improving air quality, and enhancing the visual amenity of an area.
- SuDS maintenance: SuDS require regular maintenance to ensure they continue to function effectively. This includes regular inspections, cleaning of drainage systems, and the removal of debris and sediment. Maintenance is essential to ensure that the SuDS system continues to provide the intended benefits and meets regulatory requirements. Maintenance will be carried out by a trained and experienced professional, and a maintenance plan will be developed for each individual SuDS system.
    - Construction of Drainage Channel: The drainage channel will be constructed with a lining of coarse aggregate to reduce erosion and promote infiltration. The channel will be graded appropriately to ensure proper flow, and regular outfalls will be included to promote diffuse discharge to vegetated (low risk) areas where possible.
    - Installation of Check Dams: In line check dams will be installed in a continuous manner along the drainage network to slow down the flow of water, reduce erosion, and promote sediment deposition. The design, placement, and construction of check dams

will be carefully considered to ensure that they are effective in reducing the velocity of runoff while not impeding the flow of water.

- Purpose of SuDS: The use of SuDS, including coarse drainage, check dams, and stilling ponds, serves several purposes. They attenuate runoff by slowing down the flow of water, settling out gross solids, promoting recharge by allowing water to infiltrate into the soil, reducing the hydrological response to rainfall at the Site, and supporting potential biodiversity gains by creating suitable habitat for certain plant and animal species.
- Installation of outfalls: Once the drainage channel is constructed, outfalls will be installed at regular intervals to manage runoff and prevent erosion. Stilling ponds will be installed at the base of the outfall to slow down the flow of water and allow sediment to settle out. Buffered outfalls will be used where the drainage channel discharges into sensitive receiving waters, and outfalls will be directed towards vegetated areas where possible.
- Maintenance: A regular maintenance program will be established for the drainage system to ensure that it continues to function effectively. This will include regular inspections of the drainage channel and outfalls to identify any erosion or damage, as well as routine cleaning and removal of accumulated sediment.

4. Watercourse crossings and culverts:

- Culverts:
  - In line with, inter alia, SEPA (2010) Engineering in the Water Environment Good Practice Guide for River Crossings, design and plan the culvert to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
  - Install silt screens and sediment traps upgradient of the construction area to intercept, manage and divert runoff, reduce entrainment of solids and capture sediment and prevent it from entering the watercourse.
  - Divert the watercourse flow, if necessary, to facilitate the construction of the culvert. This will involve temporarily diverting the watercourse or over-pumping the water to a temporary diversion channel.
  - Excavate the area for the culvert installation, taking care to prevent sediment from entering the watercourse.
  - Use Active Construction Water Management techniques to remove silt/solid laden waters and sludges/slurries. This will include excavation dewatering and pumping of construction waters to a treatment tank / settlement tank, equipped with monitoring and treatment equipment as required.

- Construct the culvert using suitable materials, such as precast concrete segments, to the required size and shape.
- Backfill the area around the culvert with suitable materials to ensure the culvert is properly supported and to prevent settlement.
- Install headwalls at the inlet and outlet of the culvert to protect the culvert and prevent erosion.
- Restore the natural watercourse flow and conduct any necessary erosion control measures, such as seeding or installing erosion control blankets.
- Maintaining or improving ecological value at each culvert crossing will be achieved.

- Clear Span Bridges:
  - In line with, inter alia, OPW (2019) (05-3) A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act 1945, design and plan the clear span bridge to meet the required hydraulic capacity and align with the watercourse's natural flow pattern. Abutments will be positioned as far back as reasonably practical; it is proposed to maximise the width in nearly all circumstances. The indicative max width of a clear span bridge is 10-12 m.
  - Prepare the area for the bridge construction, taking care to prevent sediment from entering the watercourse.
  - Install silt screens and sediment traps upstream of the construction area to capture sediment and prevent it from entering the watercourse.
  - Diversion of the watercourse flow will not be required as part of the construction of single span structures. Single span structures are proposed mainly due to the fact there are no in stream structures or works required.
  - Construct the bridge abutments and piers using suitable materials, such as concrete or steel, to the required size and shape.
  - Install the bridge beams or arches using suitable materials, such as steel or composite materials, to span the watercourse.
  - Backfill the areas around the abutments and piers with suitable materials to ensure they are properly supported and to prevent settlement.
  - Install any necessary guardrails or barriers to protect the bridge users.
  - Restore the area and conduct any necessary erosion control measures, such as seeding or installing erosion control blankets.

5. Foundations:

- Excavate the area to the required depth and diameter for the wind turbine foundation. Foundation dimensions: 2.8 m to 3.2 m depth, 22 m to 22.5 m diameter.

- Excavate and Backfill: To construct the wind turbine foundation, the area will be excavated to the required depth ranging from 2.8 m to 3.2 m and diameter ranging from 22 m to 22.5 m. The excavation volume for Turbine Foundations and Met Mast Foundations will range from 1,938 m^3 to 3,601 m^3 (see **Appendix 2.1: CEMP, Management Plan 4: Peat and Spoil Management Plan**). Foundation locations will be excavated to a greater depth, such as 4.0 m depth, and backfilled to around 2.5 m below ground level with crushed rock.
- Form and Pour Foundation: Shuttering and membranes are used to form the foundation pour structure, and foundation reinforcement steel rebar is installed and formed. Concrete is then poured into the foundation structure.

6. Other Significant Infrastructure Units:

- Construct Infrastructure Units: Other significant infrastructure units, such as substation buildings, electrical cabling, and meteorological masts, will be constructed using suitable materials such as concrete or steel.
- Install Drainage Structures and Erosion Control Measures: As with access track and hardstand areas, drainage structures and erosion control measures such as culverts and erosion control blankets will be installed for other significant infrastructure units.

7. Site Restoration:

- Backfilling: Excavation areas, such as those where wind turbine foundations were installed, will be backfilled with suitable soil or subsoil materials to restore the land's natural contours and soil properties. The backfilling process will be done in such a way that it mirrors the baseline conditions of the Site, including the depths of the subsoil and topsoil layers. This will help to restore the land's original drainage patterns and prevent erosion.
- Soil and Vegetation: Topsoil / Catotelm Peat that was removed during the Site preparation phase will be redistributed and seeded with appropriate vegetation to help stabilize the soil and prevent erosion. The soil (topsoil) will be tested for its nutrient content, and appropriate soil amendments will be used as needed to encourage healthy vegetation growth.
- Erosion Control: Measures such as seeding, mulching, or installing erosion control blankets will be necessary in areas where vegetation is slow to establish, or in areas with steep slopes or exposed soil. These measures will be implemented as required and will help to stabilize the soil and prevent erosion.
- Landscaping: Landscaping will be necessary to restore the Site to its original state. This will be limited to the development footprint where excavations and associated vehicular

movements are limited to. This will include as necessary planting suitable vegetation e.g. trees/hedge/shrubs in agricultural settings, sphagnum in peat settings..

- Monitoring: Post-construction monitoring of soil and water quality will be conducted to ensure that the Site is returning to its pre-construction state. This will involve testing for pollutants or other contaminants that could have been introduced during the construction phase, and taking corrective measures as needed.
- Waste Management: Waste, including waste soil/subsoil, will be minimised. This will be achieved by means of a robust and efficient **Peat and Spoil Management Plan** and **Waste Management Plan (Appendix 2.1 CEMP**; Management Plan 4 and 5, respectively). Any remaining construction materials or waste will be properly disposed of or recycled, in accordance with local regulations. This will include materials such as soil, rock, concrete, metal, or plastic, as well as hazardous waste such as batteries or oils.

Overall, the restoration phase is an important part of the wind farm construction process, as it ensures that the land is returned to its original state and can continue to support the ecosystem and local communities. A positive commitment to achieve neutral impacts at a minimum and to promote beneficial impacts where possible will inform the setting of objectives. It is important to carefully plan and execute this phase to ensure that the restoration is successful and meets the objectives which will incorporate all relevant environmental objectives, standards and targets.

8.5.2.10 Construction Phase Residual Effects

Mitigation measures outlined in this report lay down the framework to avoid and minimise all potential impacts of the Project on Geological receptors. Geological mitigation measures and impacts are strongly connected to those related to Hydrology and Hydrogeology. Furthermore, the mitigation laid out in this chapter provides mitigation by avoidance measures for hydrology and hydrogeology impacts. The mtigated potential impacts lay down the achievable benchmarks provided measures are considered and implemented adequately, including adequate monitoring, and escalation of emergency responses if required.

The residual impacts after implementation of all mitigation measures for the construction phase of the development are summarised and presented in **Table 8.11.**

8.5.2.11 Operational Phase Residual Effects

No new impacts are anticipated during the operational phase of the Project on the geological, geomorphological and geotechnical environment therefore no additional mitigation measures are required.

Maintenance and monitoring during the operational phase of the Project pose similar hazards and risks associated with the construction phase but to a far lesser extent, for example, the potential for fuel spills from vehicles, etc. The mitigation measures described in this EIAR chapter will be adopted and implemented. All wastes from the control building and ancillary facilities will be removed by the appropriate contractor. The operational team will carry out maintenance works (to Site Access Tracks, Onsite Substation and turbines) and will put in place control measures to mitigate the risk of hydrocarbon or oil spills during the operational phase of the windfarm. Any vehicles utilised during the operational phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected.

Regular monitoring, similar to the construction phase but on a less frequent basis will be required i.e. monthly. The Project will be inspected on a routine quarterly basis and following storm events. Any potential issues arising will be noted and remedial action taken in line with construction phase mitigation.

8.5.2.12 Operational Phase Residual Effects

The potential effects on the soil and geological environment during the operational phase of the work will be mitigated through good Site practice; vehicular movements, hydrocarbon controls, sustainable use of natural resources, human health etc. as discussed previously. Overall, the residual effects from these aspects will have a **slight to moderate, permanent, adverse** effect on the Site. The residual effect of land take for the operational windfarm has a **slight to moderate, long-term to permanent** but **reversible** after decommissioning and restoration effect of the Development.

8.5.3 Development Decommissioning and Restoration Phases

8.5.3.1 Decommissioning of Infrastructure

Following the permitted lifespan of the wind farm, decommissioning of the infrastructure will occur. Decommissioning of the proposed windfarm will include:

- Removal of five wind turbines and concrete plinths.
- Removal of permanent meteorological mast.
- Removal of all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation. Ducting is to remain in-situ.

Cranes of similar size to those used for construction will disassemble each turbine using the same crane hardstands. Turbines will be cut on Site so as to fit on articulated trucks, therefore allowing the use of the civil construction delivery route for removal. All physical infrastructure; towers, blades and all above ground components will be removed from Site and reused, recycled, or disposed of in a suitably licenced facility as appropriate.

Residual impacts after the decommissioning phase are complete include all impacts classified as being long-term to permanent effects of the Project, that is, there will remain a change in ground conditions at the Site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. This is a **localised, adverse, moderate significance, direct permanent** change to the materials composition at the Site.

No new impacts are anticipated during the decommissioning phase of the Project (removal of turbines and similar infrastructure on the geological, geomorphological and geotechnical environment) therefore no new mitigation measures are required, however the decommissioning of major infrastructure including proposed turbines poses similar hazards and risks to the environment compared to that of the construction phase.

Restoration of the Site following decommissioning of the proposed infrastructure is in its own right a phase of the Development. Restoration activities have the potential to be disruptive and hazardous to the environment, to the point that a 'benefit analysis' will be required to evaluate any such activity before it is permitted. Ultimately, any such restoration activities will need to be assessed under the scope of multiple environmental disciplines, similar to this EIAR, and the potential synergistic effects. Given that the condition of the environment will likely change over the course of the operational phase of the Development, particularly in terms of the condition and degree of establishment of blanket bog and associated ecology, and ornithology, it is recommended that the potential for restoration following the decommissioning phase of the Development is evaluated closer to the time (c. 25-30 years). It is noted that restoration activities do not currently conform to baseline conditions.

Extensive vehicular movement on peat is not anticipated to any significant extent considering adequate Turbine Hardstand will have been established, however the risk of fuel or other contaminant spillages, or management of waste are valid hazards during the decommissioning phase. The mitigation measures described in this EIAR chapter will be adopted and implemented by means of a Decommissioning Plan.

On the basis that a Decommissioning Plan has been established, **Management Plan 6** of the CEMP **(Appendix 2.1)** and will be implemented during the decommissioning works associated with the Project, potential issues arising giving cause to residual effects are likely to be **infrequent, imperceptible to slight, localised and reversible**.

Residual impacts after the decommissioning phase are complete include all impacts classified as being long-term to permanent effects of the Project, that is, there will remain a change in ground conditions at the Site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. This is a localised, negative, moderate significance, Significant / Moderate weighted significance, direct permanent change to the materials composition at the Site. However, the carefully managed reintroduction and/or reuse of soils and peat at the Site in place of Turbine Hardstand areas, and successful habitat management, revegetating and rewilding of those areas will have beneficial impacts, or revert to baseline conditions preconstruction phase.

8.5.4 Cumulative Effects

Considering the discipline under investigation, soils and geology, and the fact that potential effects of the Project on same are generally localised, the cumulative effects of the Project are not considered to vary dramatically or behave synergistically when considering the Site as a unit, or indeed when considering in conjunction with other developments, outlined in **Appendix 2.5**, in the vicinity or downgradient of the Site. However, on a national scale the importance of soils and peatlands in particular in terms of ecological value and carbon value must be considered. The cumulative effects on land use are likely to be imperceptible to slight. The cumulative impacts associated with hydrological and hydrogeological characteristics of the Site are also identified in **Chapter 9: Hydrology and Hydrogeology**.

8.6 SUMMARY OF SIGNIFICANT EFFECTS

This chapter assesses all elements of the Project in terms of Land, Soils, and Geology. The potential impacts that could arise from the Project during the construction, operational and decommissioning phases relate to the potential for increased stability issues and the erosion of soils and entrainment of solids in runoff associated with Site preparation activities and excavations for the infrastructure elements including the turbine foundations and cable trenches.

The unavoidable residual impacts on the soils and geology environment as a function of the Project is that there will be a change in ground conditions at the Site with natural materials such as peat, subsoil and bedrock being replaced by concrete, subgrade and surfacing materials.

Other potential impacts are considered to range in significance from Slight to Moderate, **Table 8.11**, while others range from Significant to Profound (e.g., Landslide – *worst case*). Providing the prescribed mitigation measures outlined in this report are fully implemented and best practice is followed on Site, the risk of such potential impacts can be significantly reduced or in some cases are considered avoidable resulting in neutral impacts. Furthermore, some impacts have some benefit to the receiving environment, including the incremental clear fell of forestry.

No new impacts are anticipated during the operational phase of the Project. Similar impacts are identified when comparing the construction and operational phases of the Project (i.e., hydrocarbon spill, excavations, etc.), however considering that works will be far less intensive during the operational phase the likelihood of impacts is low, thus the risk is low.

No new adverse impacts are anticipated during the decommissioning phase of the Project however the phase will be considered similar in nature to the construction phase in terms of impacts and application of mitigation measures.

A summary of Potential Effects on the receiving environment from the Project is presented in the following table. The table presents both un-mitigated or pre-mitigation effects, and anticipated effects with the adequate application of the prescribed mitigation measures.

Table 8.11: Summary of Potential Effects on receiving environment from the Project in the absence of and with mitigation measures.

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Land Take Grid Connection Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g., public roads.	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight
Land Take Turbine Delivery Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g., public roads.	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight
Clear Felling of Afforested Areas	Construction	Direct *	Adverse	Small to Moderate	Moderate	Development Footprint and turbine buffer felling zones.	Conforms to baseline e.g., forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse to Beneficial	Slight Adverse to Small Beneficial

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Subsoil and Bedrock Removal – General Excavations	Construction	Direct *	Adverse	Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Site Access Tracks	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Hardstand and Foundation Areas	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Yes	Adverse	Slight to Moderate

	Qualifying Criteria Pre-Mitigation									Qualifying Criteria with Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Subsoil and Bedrock Removal – Borrow Pit	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible **	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Site Cable Trenches	Construction	Direct *	Adverse	Small to Moderate	Slight	Development Footprint	Conforms to Baseline e.g., public roads and services.	Unavoidable	Permanent / Reversible	Yes	Adverse	Neutral
Subsoil and Bedrock Removal – Turbine Delivery Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g., public roads and services.	Unavoidable	Permanent / Reversible	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Subsoil and Bedrock Removal – Grid Connection Route	Construction	Direct *	Adverse	Moderate	Slight	Localised	Conforms to Baseline e.g., public roads and services.	Unavoidable	Permanent / Reversible	Yes	Adverse	Neutral
Spoil Management	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint; Localised	Conforms to Baseline e.g., public roads and services.	Likely	Permanent / Reversible	Yes	Adverse	Neutral / Beneficial
Geological Stability	Construction	Direct *	Adverse	Small to Large	Slight	Localised	Contrast to Baseline	Unlikely	Permanent	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria with Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Vehicular Movements - Compaction, Erosion and Degradation	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to Baseline (forestry)	Likely	Permanent	Yes	Adverse	Neutral
Localised Stability Issue (Peat/soil stability issues arising from e.g., vehicular movement or excavations)	Construction	Direct *	Adverse	Small to Moderate	Slight (to Profound)	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary / Reversible	Yes	Adverse	Slight
Landslide – worst case (Stability issues and slope failure arising from e.g., vehicular movement and excavations).	Construction	Direct *	Adverse	Small to Moderate	Significant (to Profound)	Localised (Potentially Regional)	Contrast to Baseline	Unlikely	Permanent	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Soil Contamination - Hydrocarbon	Construction	Direct *	Adverse	Small	Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral
Soil Contamination - Horizontal Direction Drilling Material	Construction	Direct *	Adverse	Small	Slight to Moderate	Localised*	Contrast to Baseline	Likely	Short term / Reversible	Yes	Adverse	Slight
Soil Contamination - Wastewater Sanitation – Waste	Construction	Direct *	Adverse	Small	Moderate to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Soil Contamination - Wastewater Sanitation – Chemicals	Construction	Direct *	Adverse	Small	Moderate to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral
Soil Contamination - Construction of Cementitious Material	Construction	Direct *	Adverse	Small	Slight to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Slight
Soil Contamination - General Waste	Construction	Direct *	Adverse	Small	Slight	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Yes	Adverse	Neutral

	Qualifying Criteria Pre-Mitigation										Qualifying Criteria with Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Land Take Wind Farm	Operational	Direct *	Adverse	Small to Moderate	Slight to Moderate	Development Footprint	Conforms to baseline e.g., Agri/forestry tracks or operations)	Unavoidable	Long term/ Permanent / Reversible after Decommissioning / Restoration	Yes	Adverse	Slight to Moderate

Note:
* Includes Indirect / Secondary impacts to receptors i.e., Hydrology/Hydrogeology. For example: Contamination of soils / peat by hydrocarbons is considered a localised impact, however if hydrocarbon contamination is intercepted by surface water features or groundwater bodies the impact is potentially regional depending in the environmental circumstances (**Chapter 9: Hydrology and Hydrogeology**)
** Not reversible in terms of geology e.g., replacing competent bedrock, but impacts to ground levels will be reversible through reinstatement with fill.

8.7 REFERENCES

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