Appropriate Assessment Screening Report and Natura Impact Statement

Glenora Wind Farm

DOCUMENT DETAILS

Client: **Glenora Wind Farm Development Applications Company**

Project Title: **Glenora Wind Farm**

Project Number: **201120**

Document Title: **Appropriate Assessment Screening Report and Natura Impact Statement**

Document File Name: **AASR-NIS F- 2023.12.11**

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Rev	Status	Date	Author(s)	Approved By
01	Draft	19.05.2023	CM	PR
02	FINAL	11.12.2023	CM	PR

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1. INTRODUCTION

1.1 Background

McCarthy Keville O'Sullivan Ltd. (MKO) has been appointed to prepare an Appropriate Assessment screening and, if required, a Natura Impact Statement to allow the competent authority (An Bord Pleanála) to conduct an Appropriate Assessment under Part XAB of the Planning and Development Acts 2000-(as amended) of a proposed wind energy development and all associated infrastructure located at Glenora and adjacent townlands, County Mayo , as described in further detail in **Section 2** (the 'Proposed Development').

An Appropriate Assessment Screening Report has been prepared and is provided in **Section 4.** Screening for Appropriate Assessment is required under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive). A screening for appropriate assessment of a draft Land use plan or application for consent for proposed development shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that Land use plan or proposed development, individually or in combination with another plan or project is likely to have a significant effect on the European site. The competent authority shall determine that an appropriate assessment of a draft Land use plan or a proposed development, as the case may be, is required if it cannot be excluded, on the basis of objective information, that the draft Land use plan or proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site. The current project is not directly connected with, or necessary for, the management of any European Site. Consequently, the project has been subject to the Appropriate Assessment Screening process.

This Natura Impact Statement (NIS) has been prepared in accordance with the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2021) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010) and the Appropriate Assessment Screening for Development Management. Office of the Planning Regulator, Dublin 7, Ireland OPR (2021). A Natura impact statement means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a proposed development, on its own or in combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites. Without prejudice to the generality of subsection (1), a Natura impact report or a Natura impact statement, as the case may be, shall include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for one or more than one European site in view of the conservation objectives of the site or sites.

In addition to the guidelines referenced above, the following relevant guidance and legislation was adhered to in preparation of this report:

1. *Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the EU Habitats Directive) Official Journal of the European Communities. Series L 20, pp. 7-49.*
2. *Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Codified version) (the Birds Directive)*
3. *European Communities (2000) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission,*
4. *EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.*

5. *CIEEM (2022) Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment.*
6. *EC (2020) Guidance document on wind energy developments and EU nature legislation*

1.2 Statement of Authority

This report has been prepared by Inga Reich (B.Sc., Ph.D (Applied Ecology)), Colin Murphy (B.Sc (Ecology)., M.Sc) and Pat Roberts (B.Sc.(Env.) MCIEEM. Inga Reich has over 5 years' postdoctoral experience in ecology and professional ecological consultancy. Colin is an experienced ecologist with over three years professional consulting experience. Both Inga and Colin have previous experience in preparing Biodiversity Chapters for EIARs. Pat has over 15 years' experience in ecological management and assessment. The baseline ecological surveys were undertaken by Inga Reich, Sarah Mullen (B.Sc., M.Sc. Ph.D.) and Kevin McElduff (B.Sc. Env) across multiple dates in 2021 and 2022. Additional ecological surveys were undertaken by Colin Murphy, and Rachel Minogue (B.Sc Env) on the 20/04/2023, and 03/05/2023.

1.3 Methodology, Structure and Format of this Appropriate Assessment screening report and NIS

Stage 1 Screening - The purpose of the screening stage is to determine, on the basis of a preliminary assessment and objective criteria, whether a plan or project, alone and in-combination with other plans or projects, could have significant effects on a European site in view of the site's conservation objectives.

There is no necessity to establish such an effect; it is merely necessary for the competent authority to determine that there may be such an effect. The need to apply the precautionary principle in making any key decisions in relation to the tests of Appropriate Assessment (AA) has been confirmed by the case law of the Court of Justice of the European Union (CJEU). Plans or projects that have no appreciable effect on a European site may be excluded. The threshold at this first stage is a very low one and operates as a trigger in order to determine whether a Stage Two AA must be undertaken by the competent authority on the implications of the proposed development for the conservation objectives of a European site. Therefore, where significant effects are likely, uncertain or unknown at screening stage, a second stage AA will be required.

Stage 2 - A Stage Two AA is a focused and detailed examination, analysis and evaluation carried out by the competent authority of the implications of the plan or project, alone and in-combination with other plans and projects, on the integrity of a European site in view of that site's conservation objectives. Case law has established that such an Appropriate Assessment, to be lawfully conducted, in summary:
(i) must identify, in the light of the best scientific knowledge in the field, all aspects of the proposed development which can, by itself or in-combination with other plans or projects, affect the conservation objectives of the European site;
(ii) must contain complete, precise and definitive findings and conclusions and may not have lacunae or gaps; and
(iii) may only include a determination that the proposed development will not adversely affect the integrity of any relevant European site where the competent authority decides (on the basis of complete, precise and definitive findings and conclusions) that no reasonable scientific doubt remains as to the absence of the identified potential effects. If adverse impacts can be satisfactorily avoided or successfully mitigated at this stage, so that no reasonable doubt remains as to the absence of the identified potential effects, then the process is complete. If the assessment is negative, i.e. adverse effects on the integrity of a site cannot be excluded, then the process must proceed to stage three and, if necessary, stage four.

- Section Two provides a full description of all elements of the Proposed Development Site.
- In Section Three, the characteristics of the receiving environment are fully described.
- In Section 4, a Stage 1 Screening is undertaken to identify any European Sites upon which there is a potential for a likely significant effect to occur either individually or

in combination with other plans and projects as a result of the Proposed Wind Farm Development.

- Section 5 provides a detailed consideration of the Screened in European Sites and identifies the relevant qualifying features and how they may be affected in light of their conservation objectives.
- Section 6 provides an assessment of the potential for adverse effects on the identified European Sites as a result of the Proposed Wind Farm Development and in the absence of mitigation. This section also prescribes mitigation to robustly block any identified pathways for impact for effect.
- Section 7 provides an assessment of residual effects taking into consideration the proposed mitigation.
- In Section 8, the potential in combination effects of the Proposed Wind Farm Development on European Sites, when considered in combination with other plans and projects were assessed.
- A concluding statement is provided in Section 9.

2. DESCRIPTION OF PROPOSED DEVELOPMENT

2.1 Site Location

The Proposed Wind Farm Development site is located approximately 6 kilometres (km) southwest of Ballycastle, County Mayo. The Grid Reference coordinates for the approximate centre of the site are 54.245770, -9.4745922.

The proposed grid connection route runs through the town of Ballycastle. The Proposed Wind Farm Development site is located approximately 16.9km north-west of Crossmolina, approx 21.5km north-west of Ballina, approx 13.4km northwest of Killala, and approx 5km south of the Atlantic coastline, as shown in **Figure 2.1.** Wild Nephin National Park is located approx 13.2km south of the Proposed Wind Farm Development site. Elevation ranges between 110m above ordnance datum (AOD) in the southeast to 285m AOD in the west.

The site of the Proposed Wind Farm Development is located approximately 12.8km north of the N59 and is currently accessible via the regional road R314 that runs through Ballycastle town, to the northeast of the Proposed Wind Farm Development site.

The site location is shown on **Figure 2.1.**

2.2 Characteristics of the Proposed Development

2.2.1 Description of the Project

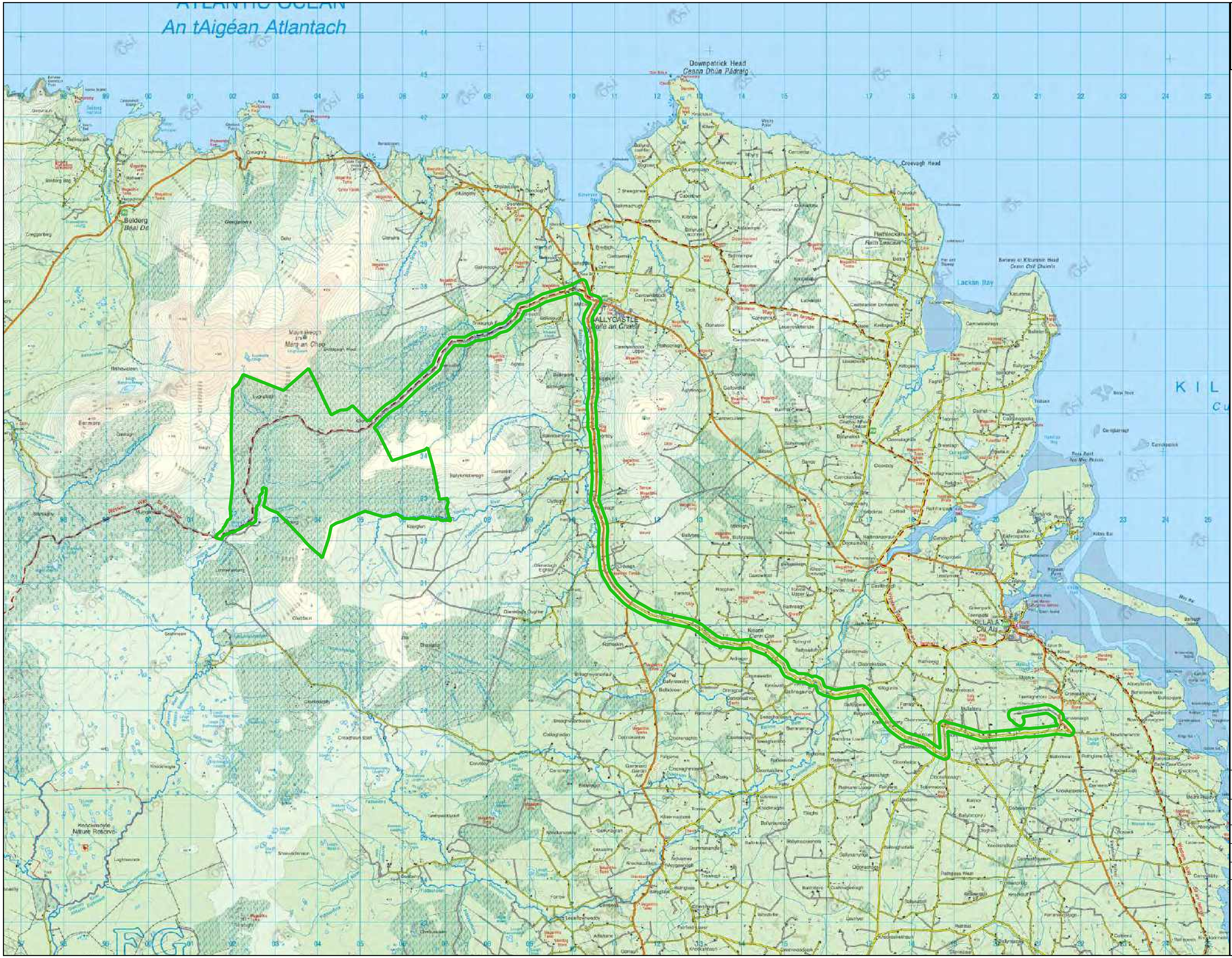
The Proposed Wind Farm Development comprises:

1. *The construction of 22 no. wind turbines and all associated hard-standing areas with the following parameters:*
    a. *A total blade tip height of 180m,*
    b. *Hub height of 99m, and*
    c. *Rotor diameter of 162m.*
2. *1 no. permanent Meteorological Anemometry Masts with a height of 99 m and associated hardstanding area;*
3. *Upgrade of existing tracks and roads, provision of new permanent site access roads and upgrade of 1 no. existing site entrance including the provision of 1 no. security cabin with automatic traffic barriers;*
4. *Temporary widening of sections of public road in the townland of Ballyglass;*
5. *The provision of a new temporary roadway in the townland of Ballyglass to facilitate the delivery of turbine components and other abnormal loads;*
6. *1 no. wind farm operation and maintenance control building in the townland of Glenora;*
7. *3 no. borrow pits.*
8. *13 no. permanent peat placement areas.*
9. *5 no. temporary construction compounds with temporary site offices and staff facilities;*
10. *Permanent recreation and amenity works, including marked trails, seating areas, amenity car park, and associated amenity signage;*
11. *Site drainage;*
12. *Site Signage;*
13. *Ancillary forestry felling to facilitate construction and operation of the proposed development;*
14. *All works associated with the habitat enhancement and biodiversity management within the proposed wind farm site;*
15. *All associated site development works and ancillary infrastructure.*

This application is seeking a ten-year permission and 35-year operational life from the date of commissioning of the renewable energy development.

It is intended to construct a 110 kV substation within the site and to connect this to the existing Tawnaghmore 110kV substation, located 14km southeast of the intended on-site substation location, in the townland of Tawghnamore Upper. The intended grid connection route will be via underground cabling located within existing forestry tracks, local county roads and national secondary roads. The cabling route measures approximately 28km in total. The construction of the grid connection cabling route will, in the event that planning consent is granted, be undertaken by a statutory undertaker having a right or interest to provide services in connection with the proposed wind farm development.

A full description of the Proposed Development is available in Chapter 4 in the EIAR accompanying this application.



Map Legend

EIAR Site Boundary

Drawing Title: EIAR Site Boundary	
Project Title: Glenora Windfarm	
Drawn By: RM	Checked By: CM
Project No.: 201120	Drawing No.: Figure 2.1
Scale: 1:78,421	Date: 01/12/2023

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2.2.2 Development Layout

The layout of the Proposed Development has been designed to minimise the potential environmental effects of the wind farm, while at the same time maximising the energy yield of the wind resource passing over the site. The overall layout of the Proposed Wind Farm Development is shown on **Figure 2.2 below.** This drawing shows the proposed locations of the wind turbines, electricity substation, grid connection route, borrow pits, peat and spoil repository, construction compounds, internal roads layout, the turbine delivery route link roads, and the main site entrance. A detailed description of all elements of the development, including construction methodology and site layout drawings of the Proposed Wind Farm Development are included in Chapter 4 and Appendix 4-1 of the EIAR accompanying this application. A summary description is provided below.

2.2.3 Construction Details

2.2.3.1 Wind Turbines

The proposed wind turbines to be installed on the site will have the following dimensions:

- Turbine Foundation-to-Blade Tip Height: 180 metres
- Hub Height: 99 metres
- Rotor Diameter: 162 metres

Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics, with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the site will be conventional three-blade turbines, which will be geared to ensure the rotors of all turbines rotate in the same direction at all times. The turbines will be off-white or matt grey in colour. The Grid Reference coordinates of the proposed turbine locations are listed in the table below.

Table 2-1. Proposed Wind Turbine Locations and Elevations

Turbine No.	Irish Transverse Mercator (ITM) Co-ordinates		Elevation (m OD)
	Easting (m)	Northing (m)	
1	502518	834923	219
2	502047	834410	212
3	502119	833745	180
4	502069	833148	154
5	504436	833410	179
6	502673	834328	164
7	503470	834687	216
8	503379	834119	200
9	503111	833456	150
10	502887	832881	149

11	504089	834197	222
12	503894	833620	177
13	503565	832645	171
14	503732	832150	220
15	504802	834370	220
16	506225	833037	161
17	504216	832709	195
18	505141	834006	218
19	505406	832947	167
20	505036	833259	216
21	505736	833494	221
22	506474	833610	219

2.2.3.1.1 Turbine Foundations

Each wind turbine is secured to a reinforced concrete foundation The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbine foundations, ranging from circular to hexagonal and square, depending on the requirements of the final turbine supplier and a foundation area large enough to accommodate modern turbine models has been assessed in this document. The turbine foundation transmits any load on the wind turbine into the ground.

After the foundation level of each turbine has been formed on competent strata (i.e., bedrock or subsoil of sufficient load bearing capacity) or using piling methods, the bottom section of the turbine tower "Anchor Cage" is levelled, and reinforcing steel is then built up around and through the anchor cage. The outside of the foundation is shuttered with temporary formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level (Plate 2-1 below). Detailed construction methodology for the turbine foundations is provided in Section 4.9, Chapter 4 of the EIAR accompanying this application.

Plate 2-1 Turbine 'Anchor Cage' and Finished Turbine Base

2.2.3.2 Hardstanding Areas

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base. These will facilitate access, turbine assembly and turbine erection. The hard-standing areas are used to accommodate cranes used in the assembly and erection of the turbine. The hardstands also allow for the offloading and storage of turbine components, and generally provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations, once completed, by placing crushed stone over the foundation. The arrangement and positioning of hard standing areas are dictated by turbine suppliers. However, this NIS has assessed the potential impacts of the maximum size of the required areas. The proposed hard standing areas are shown on the site layout drawings included in Appendix 4-1 of the EIAR accompanying this application.

2.2.3.3 Site Roads

To provide access within the site of the Proposed Development and to connect the wind turbines and associated infrastructure approximately 15.4 kilometres of existing roads and tracks will need to be upgraded and approximately 10.5 kilometres of new access roads will need to be constructed.

The 2 no. road construction types proposed are as follows:

- Existing Roads to be Upgraded
  - Excavate and Replace
- Proposed New Roads
  - Excavate and Replace
  - Floating

The locations where the above construction types are proposed is shown in Figure 1-1 of Fehily Timoney & Company's (FT) Peat & Spoil Management Plan. This document is included as Appendix 4-2 of this EIAR.

The road construction design has taken into account the following key factors:

1. *Buildability considerations*
2. *Serviceability requirements for construction and wind turbine delivery and maintenance vehicles*
3. *Minimise excavation arising*
4. *Requirement to minimise disruption to peat hydrology*

Whilst the above key factors are used to determine the road design the actual construction technique employed for a particular length of road will be determined on the prevailing ground conditions encountered along that length of road.

The proposed upgrade to existing roadways and construction of new roadways will incorporate passing bays (wider sections) to allow traffic to pass easily while traveling around the site.

2.2.3.3.1 Upgrade to Existing Roads or Tracks

The existing access tracks on site were constructed using the excavate and replace construction technique. Based on the site walkover carried out by FT the existing access tracks were noted as being in relatively good condition. Upgrading works will involve widening and resurfacing of the existing access track. The construction methodology for upgrading existing sections of excavated is detailed in Section 3 of FT's Peat & Spoil Management Plan in Appendix 3 of this NIS.

2.2.3.3.2 Construction of New Excavated Roads

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site. Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat (<2.0-2.5m) provided sufficient placement/ reinstatement capacity is available on site for the excavated peat.

The methodology for the construction of new excavated roads is detailed in Section 4 of the Peat & Spoil Management Plan in Appendix 3. This methodology includes construction procedures that will minimise any adverse impact on peat stability.

2.2.3.3.3 Construction of New Floating Roads

Floating roads are only proposed in areas of flatter ground, where the peat stability assessment indicates that this construction method is suitable. The majority of the access roads will be founded on competent ground employing the methodologies outlined above.

Where floating roads are proposed, a confirmatory inspection will be carried out by a suitably the Project Geotechnical Engineer, along with the Project Hydrologist and Ecologist in advance of the construction, to reconfirm that there are no localised areas of weak/saturated peat, evidence of blocked drains, or evidence of existing peat instability.

Floating roads minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions, an excavated type access road may be more suitable.

The construction methodology for the construction of floating roads is detailed in Section 5 of the Peat and Spoil Management Plan in Appendix 3. This methodology includes construction procedures that will minimise any adverse impact on peat stability.

2.2.3.4 Borrow Pits

It is proposed to develop 3 no. on-site borrow pits as part of the Proposed Development. The borrow pits will provide the majority of all rock and hardcore material required during construction of the wind farm development. Usable rock may also be won from other infrastructure construction, including the turbine base excavations.

Borrow Pit No. 1 measures approximately 9,932m^2. It is located within 10m of an existing forest road to be upgraded, which provides access to the site from the east.

Borrow pit No. 2 measures approximately 16,189m^2. It is located approximately 280m south of T20 and is adjacent to an existing forestry road to be upgraded, providing access to T19.

Borrow Pit No. 3 measures approximately 67,483m^2. It is located approximately 310m north west of T7 and is located 10m of an existing forestry road to be upgraded, providing access to T6 and the west of the site.

The 3 no. borrow pits are shown on Figure 4-1 and on the detailed site layout drawings included as Appendix 4-1 to this EIAR accompanying this application.

2.2.3.5 Peat Placement Areas

It is proposed that any excess peat and spoil generated through construction activities, not used to reinstate the borrow pits or for landscaping, be placed around selected turbines bases and hardstands. The areas around 9 no. turbine bases and hardstands (13 no. individual peat placement areas proposed) have been assessed as suitable locations for peat and spoil placement due to suitable ground conditions including peat depths and slope angles.

The locations of these peat and spoil placement areas are shown on Figure 4-1b and in the site layout drawings in Appendix 4-1 of this EIAR to this EIAR accompanying this application.

2.2.3.6 Electricity Substation and Control Building

It is intended to construct a 110kV electricity substation within the site of the Proposed Wind Farm Development. The intended substation site is located within forestry, adjacent to the southeastern boundary of the wind farm development site, adjacent to an existing forestry road which runs north to south along the eastern boundary of the site. Access to the substation will be off the existing road.

The footprint of the onsite electricity substation compound measures approximately 21,500m2 and will include 2 no. wind farm control buildings and the electrical components necessary to consolidate the electrical energy generated by each wind turbine and export that electricity from the wind farm to the national grid.

Two wind farm control buildings will be located within the substation compound. The Independent Power Provider (IPP) Control Building will measure 20.1 metres by 10.7 metres and 6.9 metres in height. The Eirgrid Control Building will measure 25 metres by 18 metre and 8.4 metres in height. Layout and elevation drawings of the control buildings are included in Drawings No. 05795-DR-305 and 05795-DR-304 in Appendix 4-6 of the EIAR accompanying this application.

A battery-based energy storage system (BESS) will be located within the 110kV substation compound. The BESS primarily consists of 25 no. steel containers and 10 no. power supply units assembled in rows at the development site.

The battery storage compound will operate continuously, linked to the on-site substation. It will be monitored in tandem with the overall development and there will be sporadic maintenance visits as required.

2.2.3.7 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 33/66kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building at the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in trenches that will be approximately 1.2 metres in depth and 0.6 metres in width, within the wind farm access roadways. The route of the cable ducts will follow the access track to each turbine location.

2.2.4 Grid Connection Cabling

A 110kV connection between the Proposed Development and the national electricity grid will be necessary to export electricity from the proposed wind farm. This underground cable connection will originate at the proposed onsite substation located within the north-eastern corner of the site, adjacent to an existing forestry road. The underground cable connection will run north eastwards from the substation along the existing forestry road for approximately 4.7km before meeting the unnamed local road in the townland of Ballyglass.

The proposed grid connection cabling route will then continue north along the local road for approximately 1.6km before turning southeast onto the R314 Regional Route for 390m before turning south onto the R315 Regional Route. The cabling route will then head in a southerly direction along the R315 Regional Road for approximately 7.5km before turning east on to the local road in the townland of Creevagh More for and continuing for 8.4km in a southeasterly direction. The grid route then runs northward for approximately 600m before travelling east along the local road in the townland of Lisglennon for approximately 3km. The grid connection route then turns north onto the R314 for a short distance before turning west into the existing 110kV Tawnaghmore substation in townland of Tawnaghmore Upper.

2.2.5 Meteorological Mast

One permanent meteorological (met) mast is proposed as part of the Proposed Development. The met mast will be equipped with wind monitoring equipment at various heights. The mast will be located E503515, N832315 as shown on the site layout drawing in Figure 2-2. The mast will be a slender structure and will be 99m in height. The mast will be a free-standing structure. The mast will be constructed on a hard-standing area sufficiently large to accommodate the crane that will be used to erect the mast, adjacent to an existing track.

2.2.6 Temporary Construction Compounds

Five temporary construction compounds measuring approximately 45 metres by 70 metres and 3,100m2 in area are proposed as part of the wind farm development.

- Compound No. 1 is located at the site entrance along an existing road within 320m of Turbine No. 15 and approximately 50m west of the substation compound. (Primary Construction Compound)
- Compound No. 2 is located along an existing road approximately 230m of Turbine No. 7.
- Compound No. 3 is located along an existing road approximately 260m southwest of Turbine No. 6.
- Compound No. 4 is located along a proposed new road approximately 300m south of Turbine No 5.
- Compound No. 6 is located along an existing road and approximately 140m northwest of Turbine No. 19.

The layout of construction compounds will be the same for all five proposed compounds. The construction compounds will consist of temporary site offices, staff facilities, construction materials storage and car-parking areas for staff and visitors. Turbine components will be brought directly to the proposed turbine locations following their delivery to the site. The locations of the construction compounds are shown on Figure 2-2.

2.2.7 Tree Felling

The majority of the site (approximately 64%) currently comprises commercial coniferous forestry plantation. As part of the Proposed Wind Farm Development, tree felling will be required within and around the Proposed Wind Farm Development to allow the construction of turbine bases, access roads and the other ancillary infrastructure.

A total of 116 hectares of forestry will be permanently felled within and around the Proposed Wind Farm Development in order to facilitate infrastructure construction and turbine erection.

The tree felling activities required as part of the Proposed Wind Farm Development will be the subject of a Limited Felling Licence (LFL) application to the Forest Service in accordance with the “Forestry Act” and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service’s policy on granting felling licenses for wind farm developments. The policy requires that a copy of the planning permission for the Proposed Wind Farm Development be submitted with the felling licence application; therefore, the felling license cannot be applied for until such time as planning permission is obtained for the Proposed Wind Farm Development.

2.2.7.1 Forestry Replanting

The estimated 116 hectares that will be permanently felled for the footprint of the turbines and the other infrastructure and turbine erection will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that might be issued in respect of the proposed wind farm development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

2.2.8 Recreation and Amenity Proposals

The proposed recreation and amenity facilities consist of a series of marked walkways complimented by waypoint signage, a viewing point and a trailhead and visitor car park. The recreation and amenity facilities proposed for the Glenora Wind Farm development are intended to appeal to walkers, cyclists, trail runners, amongst others.

2.2.8.1 Visitor Entrance and Car Park

Access to the site for visitors during the operational phase, will be via the proposed upgraded entrance off the existing forest road to the northeast of the site boundary in the townland of Glenora. The proposed upgraded entrance will have adequate visibility splays for safe access and egress for passenger vehicles or cyclists.

It is proposed repurpose the construction compound nearest the main site entrance for use as a visitor car park for recreational users of the area. At the end of the wind farm’s construction, the surface dressing of a portion of the construction compound will be upgraded to provide a level, compacted car park surface. It is not intended to delineate individual car parking spaces, however there will be sufficient space to safely accommodate up to 24 vehicles. A suitably sized hydrocarbon interceptor and grit trap will be installed as part of the drainage system for the car park.

The car park will act as a landing point or trailhead for recreation and amenity users arriving at the site. The car park will provide a safe and easily accessible landing point, allowing visitors to orientate themselves on the site or demount bicycles from cars.

2.2.8.2 Amenity Walkways

It is proposed to create dedicated marked trails and walking loops for walkers, cyclists, trail runners and general outdoor recreation. All trails and loops will make use of the proposed wind farm site road network and no additional tracks are required to be constructed. The Altderg Walk/Cycle Route comprises an approximate 6km walking loop through the site complete with benches and information posts. The amenity carpark will be located at the start of this loop. An additional route providing a view of the turbines is a 2km linear route which starts from the amenity car park to the viewing platform located at Turbine No. 1. Both links will link up to the existing Western Way which runs along the site.

2.2.8.3 Seating Areas

Seating areas will be provided at different locations across the site to allow visitors to rest and take advantage of the scenic views of the wider area from the site, including wooden benches and a picnic table.

2.2.8.4 Viewing Point

The hardstanding area at Turbine No. 1 is proposed a viewing point of the surrounding landscape and wind farm. This is the most elevated of the proposed turbine locations. The viewing point will comprise a labelled panorama photograph of the available view, a seating area and information signage highlighting the heritage of the wider area and the importance of renewable energy. Three different forms of information and waypoint signage will be provided across the proposed recreation and amenity area.

2.2.9 Site Drainage

The drainage design for the Proposed Wind Farm Development has been prepared by CDM Smith (refer to EIAR Chapter 9, Appendix 2 of this NIS). The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Wind Farm Development. The Proposed Wind Farm Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the Proposed Wind Farm Development and turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones of 50m around rivers and streams, respectively, have been used to inform the layout of the Proposed Wind Farm Development.

2.2.9.1 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the Proposed Wind Farm Development. Turbine locations have been selected to avoid natural watercourses. Up to 2 no. new watercourse crossings and 8 no. potential crossing upgrades will be required as part of the Proposed Wind Farm Development.

There will be no direct discharges to natural watercourses. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at an appropriate distance from natural watercourse and lakes. Buffer zones around the existing natural drainage features have informed the layout of the Proposed Wind Farm Development and are indicated on the drainage design drawings.

Where artificial drains are currently in place in the vicinity of proposed works areas, these drains may have to be diverted around the proposed works areas to minimise the amount of water in the vicinity of works areas. Where it may not be possible to divert artificial drains around proposed work areas, the drains will be blocked to ensure sediment laden water from the works areas has no direct route to other watercourses. Where drains must be blocked, the blocking will only take place after an alternative drainage system to handle the same water has been put in place.

Existing artificial drains in the vicinity of existing site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

Details of all proposed drainage measures incorporated into the Proposed Wind Farm Development are fully described in Section 4.7, Chapter 4 of the EIAR, Section 9.4.2, Chapter 9 '*Hydrology and Hydrogeology*' (Appendix 2) and Section 3.2 of the CEMP, Appendix 1 of this NIS.

2.2.10 Proposed Clear-span Watercourse Crossings

There are a number of natural watercourses within the site of the Glenora Wind Farm development.

It is proposed to construct clear-span crossings watercourse crossings along the wind farm access roads at 2 no. locations using a bottomless box culvert. The locations of these crossings are shown on the layout drawings included in Appendix 4-1 of this EIAR. The clearspan watercourse crossing methodologies presented below will ensure that no instream works are necessary.

The watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

Confirmatory inspections of each proposed new watercourse crossing location will be carried out by the project civil/structural engineer and the project hydrologist prior to the construction of each crossing.

2.2.11 Grid Connection Watercourse/Culvert Crossings

There is a total of 10 bridge crossings along the proposed cable route including 10 No. HDD crossings. The proposed underground cable will also encounter 30 no. culvert crossings along the proposed cable route. A schedule of the culverts identified and the proposed crossing method to be implemented is detailed in Appendix 4-6 of this EIAR and the locations are shown on the site layout drawings included in Appendix 4-1. Where the cable route intersects with existing watercourses, a detailed construction method statement will be prepared by the Contractor prior to the commencement of construction and is to be approved by the Local Authority and relevant environmental agencies. The cable will be located within the bridge deck where there is sufficient depth and width available on the bridge, where there is insufficient depth and width available horizontal directional drilling (HDD) may be employed as an alternative.

It is proposed to cross existing culverts using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. A confirmatory site survey of all culverts will be completed as part of the next phase of the project prior to construction to confirm the findings of the design phase surveys.

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled "*Requirements for the Protection of Fisheries Habitats during Construction and Development*

Works at River Sites", and these guidelines will be adhered to during the construction of the proposed development.

Horizontal Directional Drilling

It is proposed to implement Horizontal Directional Drilling (HDD) for 10 no. crossings. However, following confirmatory site investigations prior to construction it may be necessary to utilise HDD for additional crossings.

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, culverts, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. The proposed HDD methodology is as follows: -

- A works area of circa .40 square metres will be fenced on both sides of the river crossing
- The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
- Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.
- A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
- The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
- A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
- The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
- Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
- Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
- The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
- The ducts will be cleaned and proven and their installed location surveyed.
- The entry and exit pits will be reinstated to the specification of ESB Networks, EirGrid and Mayo County Council.
- A transition coupler will be installed at either side of the bridge/following the horizontal directional drilling as per ESBN and EirGrid requirements, this will join the HDD ducts to the standard ducts.

A joint bay or transition chamber will be installed on either side of the bridge following the horizontal directional drilling as per ESB/Eirgrid requirements.

2.3 Operation

The Proposed Wind Farm Development is expected to have a lifespan of approximately 35 years. Planning permission is being sought for a 35-year operation period commencing from the date of full operational commissioning of the wind farm. During the operational period, on a day-to-day basis the wind turbines will operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction.

The wind turbines will be connected together, and data relayed from the wind turbines to an off-site control centre. Each turbine will also be monitored off-site by the wind turbine supplier. The monitoring of turbine output, performance, wind speeds, and responses to any key alarms will be monitored at an off-site control centre 24-hours per day.

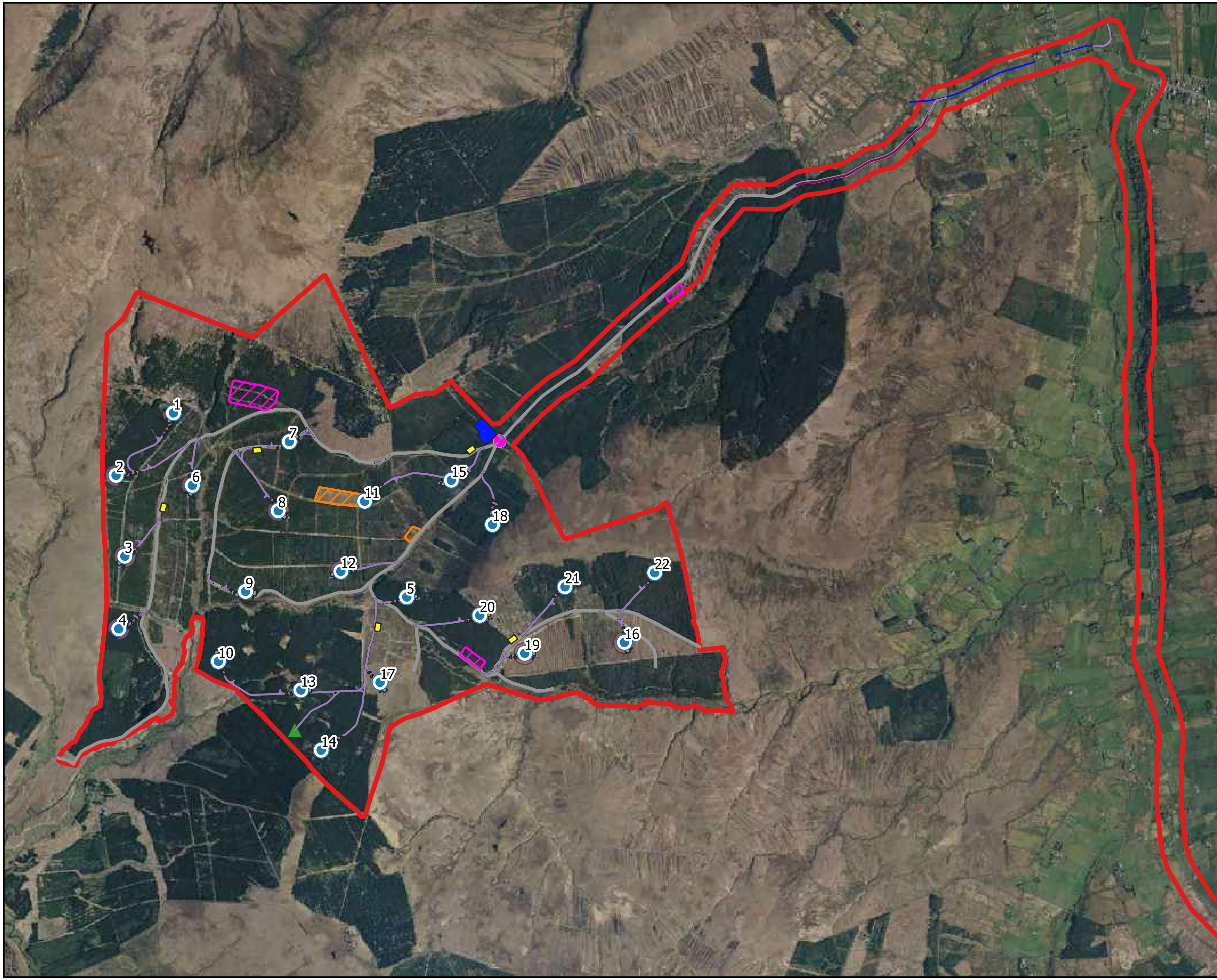
Each turbine will be subject to a routine maintenance programme involving a number of checks and changing of consumables, including oil changes. In addition, there will be a requirement for unscheduled maintenance, which could vary between resetting alarms to major component changes requiring a crane. Maintenance traffic will consist of four-wheel drive vehicles or vans. The electricity substation components and site tracks will also require periodic maintenance.

2.4 Decommissioning

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of approximately 35 years. Following the end of the operational life of the wind farm, the wind turbines may be retained and the operational life extended or replaced with a new set of turbines, subject to planning permission being obtained. In the event that neither of the above options are implemented, the Proposed Development will be decommissioned fully as agreed with the Planning Authority. The onsite substation will remain in place as it will be under the ownership of the ESB and will form a permanent part of the national electricity grid.

Upon decommissioning of the Proposed Development, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and will be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration. Site roadways will be left in situ, for future forestry operations. The amenity and recreation infrastructure will also be left in-situ. Underground cables, including grid connection, will be removed and the ducting left in place.

A Decommissioning Plan has been prepared and included as Appendix 4-7 of the EIAR accompanying this application, which will be agreed with the local authority prior to any decommissioning. The plan provides details of the methodologies that will be adopted, throughout decommissioning, the environmental controls that will be implemented, the Emergency Response Procedure to be adopted, methods for reviewing compliance and an indicative programme of decommissioning works.



Map Legend

- EIAR Site Boundary
- Existing Roads
- Met Mast
- Turbine Layout
- Coillte Biodiversity Area
- Borrow Pits
- Construction Compounds
- Hardstand Footprints
- New Roads
- Substation
- Security Cabin
- Temporary Road Widening
- Turbine storage
- Alternative Assessed Access Road

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Drawing Title Proposed Windfarm Infrastructure	
Project Title Glenora Windfarm	
Drawn By RM	Checked By CM
Project No. 201120	Drawing No. Figure 2.2
Scale 1:40,582	Date 01/12/2023

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3. CHARACTERISTICS OF THE RECEIVING ENVIRONMENT

The ecological surveys that were undertaken to inform this NIS are fully described in this section. A general description of the ecology of the site of the Proposed Wind Farm Development is provided in the AA Screening Report in **Section 4** of this NIS. The specific surveys that were undertaken to assess the potential effects on the identified European Sites are described below.

3.1 Methodologies

3.1.1 Scoping and Consultation

MKO undertook a scoping exercise during preparation of this NIS and associated planning application documentation, as fully described in Chapter 2, Section 2.6 of the accompanying EIAR.

Copies of all scoping responses are included in Appendix 2.1 of the accompanying EIAR. The recommendations of the consultees have informed the EIAR preparation process and the contents of this NIS. The comments raised in the scoping responses received have been addressed in this NIS.

A data request was sent to the NPWS Scientific Data Unit, and a response was received on the 27th of May 2021. The only species recorded by the NPWS were also QIs of any potentially impacted SACs were Slender green feather moss (*Hamatocaulis vernicosus*), Marsh saxifrage (*Saxifraga hirculus*) and Otter (*Lutra lutra*).

In addition to the above, two meetings were held with the NPWS on the 24.09.2021 and 24.01.2022 to discuss the Ecological and Ornithological aspects of the Proposed Wind Farm Development.

3.2 Ecological Survey Methodologies

A comprehensive survey of the biodiversity of the entire EIAR Site Boundary was undertaken on various dates throughout 2021, 2022 and 2023. The following sections fully describe the ecological surveys that have been undertaken and provide details of the methodologies, dates of survey and guidance followed.

3.2.1 Ecological Multidisciplinary Walkover Surveys

Multidisciplinary ecological walkover surveys were undertaken in accordance with TII guidelines on *Ecological Surveying Techniques for Protected Flora and Fauna during the planning of National Road Schemes* (TII, 2009 by Inga Reich (B.Sc., Ph.D.), Sarah Mullen (B.Sc., M.Sc. Ph.D.), Kevin McElduff (B.Sc), Colin Murphy (B.Sc., M.Sc), Rachel Minogue (B.Sc) within the EIAR Site Boundary on the following dates throughout 2021, 2022, and 2023:

- 2nd July 2021
- 9th July 2021
- 18th August 2021
- 2nd September 2021
- 24th September 2021
- 18th January 2022
- 25th January 2022
- 20th of April 2023
- 3rd May 2023

All surveys of vegetation were completed within the optimum period for vegetation surveys/habitat mapping, i.e., April to September (Smith *et al*., 2011). A comprehensive walkover of the entire EIAR Site Boundary was completed. Surveys undertaken outside of this period were not used to evaluate habitats.

The walkover surveys were also designed to detect the presence, or likely presence, of a range of protected species.

The multi-disciplinary walkover surveys comprehensively covered the entire EIAR Site Boundary for features and locations of ecological significance. Based on the multi-disciplinary walkover survey findings, further detailed targeted surveys were carried out during follow-up species specific survey visits. These are described in detail below. These surveys were carried out in accordance with NRA *Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna* on National Road Schemes (NRA, 2009).

During the multidisciplinary surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities Regulations 2011 (as amended) was conducted.

Other targeted survey methodologies undertaken at the site are described in the following subsections.

3.2.2 Birds survey

Extensive bird surveys were undertaken to inform the EIAR and have been reviewed in the preparation of this NIS. As fully described in the Bird Impact Assessment Report prepared by Malachy Walsh and Brian Madden (appendix 7b) accompanying EIAR and Appendix 4 of this NIS for the proposed development, dedicated bird surveys were undertaken in accordance with industry standard best practice i.e. Scottish Natural Heritage (2017) 'Recommended bird survey methods to inform impact assessment of onshore wind farms. Scottish Natural Heritage'.

The field surveys comprised two main elements: vantage point (VP) watches to gather flight activity data for target species, and targeted distribution and abundance surveys to gain an understanding of bird species occurring in the area which may be subject to impacts from the development.

The targeted distribution and abundance surveys undertaken comprised the following elements:

Breeding Survey Season (April to September)

- Transect and Point Count surveys
- Walkover surveys
- Nocturnal Surveys
- Hinterland Surveys

Winter Survey Season (October to March)

- Transect and Point Count surveys
- Walkover surveys
- Hinterland surveys

3.2.2.1 Vantage Point Surveys

VP surveys were carried out in accordance with the Scottish Natural Heritage guidance document 'Recommended bird survey methods to inform impact assessment of onshore wind farms' (SNH, 2017). The overall aim of these surveys was to quantify the level of target species flight activity within the flight activity survey area which was taken to be that area encompassing the proposed wind farm site extending out to a distance of 500 m beyond the site boundary.

SNH (2017) recommends a minimum 2-year survey period comprising 72 hours per VP location divided between seasons (36 hours breeding and 36 hours non-breeding) per year.

VP surveys were undertaken on a monthly basis by qualified personnel for the winter and breeding seasons encompassed in the 4-year period April 2019 to March 2023, inclusive. 36 survey hours were generally achieved at each VP location in each season during the overall 4-year survey period. Overall, the minimum total number of VP hours recommended by SNH (2017) was achieved at all VPs.

VP locations were selected to provide maximum site coverage. Seven VP locations were selected and surveyed over the course of the winter and breeding seasons. The Irish Transverse Mercator (ITM) grid co-ordinates for each VP location are provided in the table below.

Table 3-1. VP locations and associated ITM coordinates

Vantage Point	ITM Grid Coordinates
1	501874 833565
2	503387 834934
3	504150 834475
4	505610 832136
5	507221 832235
6	503674 835781
7	505664 834300

3.2.2.2 Distribution and Abundance Surveys

A variety of distribution and abundance surveys were carried out to record numbers and distributions of local and migrant bird species using the site or surrounding area that might be affected, either directly or indirectly, by the proposal.

3.2.2.2.1 Breeding Season

Transect Surveys and Point Counts

Transects were completed on a monthly basis during the breeding season period for the first two years of surveys, as set out in the table below.

Transect surveys were completed within the proposed wind farm site boundary using two separate transect routes (A & B) which utilised the existing internal forestry access road network within the site (see Appendix 2 of the BIAR for mapped transect routes). The transect routes were selected to provide representative coverage of all habitats, both open and closed, occurring within the proposed wind farm site boundary, comprising mainly mature forestry and clearfell.

Counts of all bird species seen or heard, typically within 100 m of the transect routes, were recorded, although the topography of the landscape often allowed for detection of birds at greater distances. Where target and/or secondary species were recorded, areas of activity and general behaviour was noted/mapped.

Birds were also surveyed during each transect using point count (PC) methodologies. Point count locations were sited at 500 m to 600 m intervals along the overall length of each transect route. Transect A encompassed ten PC locations (PC1- PC10) and Transect B encompassed five PC locations (PC1- PC5).

Table 3-2. Breeding transect survey months within BIAR Site (2019 - 2022)

Survey Period	Corresponding Transect Survey Months
Breeding 2019	April, May, June, July, August and September 2019
Breeding 2020	May*, June, July, August and September 2020
Breeding 2021	April, June and August 2021
Breeding 2022	June, July and September 2022

Breeding Season Walkover Surveys

Breeding season walkover surveys were undertaken to determine the presence of target species within areas of potentially suitable breeding habitat within the 500 m survey area buffer surrounding the proposed wind farm site. The methodologies were broadly based on methods described in Bibby et al., (2000) and Gilbert et al., (1998).

Breeding season walkover routes encompassed areas of potentially suitable habitat, comprising open bog, occurring within the 500 m buffer surrounding the site. A total of two different survey routes (A & B) were utilised over the course of the overall breeding season survey periods (summer 2019 to summer 2022). Route A encompassed the open bog extending north and west from the proposed wind farm site boundary, while Route B encompassed the open bog situated to the north-east of the proposed wind farm site boundary.

The majority of open bog surrounding the proposed wind farm site was encompassed by the walkover routes utilised. An area of bog within the 500 m buffer to the east of the site was not included due to the very steep terrain and H&S concerns; however, this area was entirely covered by the viewsheds of VP4 and VP5 which would have contributed to the capture of target species activity in this area, where occurring. Breeding season walkover routes are mapped in Appendix 2 of the BIAR.

The dates on which breeding season walkover surveys were undertaken and the routes which were utilised on each date are outlined in the table below.

Table 3-3. Breeding season walkover surveys 2019 – 2022 within 500 m survey area around BIAR Site

Survey Period	Survey Date	Survey Route
Breeding 2019	16th July 2019	Route A
Breeding 2020	8th May 2020	Route A & B
Breeding 2021	15th July 2021 21st July 2021 28th July 2021	Route A Route B Route A & B
21st July 2021	17th June 2022 24th August 2022	Route A & B Route A & B

Nocturnal Breeding Surveys (within BIAR Site)

Nocturnal breeding surveys were undertaken within areas of suitable breeding habitat for woodcock (*Scolopax rusticola*) and nightjar (*Caprimulgus europaeus*) within the proposed wind farm site boundary to record any potential breeding activity.

Breeding Hinterland Surveys

Breeding season hinterland surveys, comprising primarily driven transects, encompassing the area surrounding the proposed wind farm site, were undertaken during the 2019, 2021 and 2022 breeding seasons. The driven transects utilised sections of the existing local road network extending out to an approximate 5 km radius of the site. The 2019 breeding season hinterland surveys also encompassed an area of cutover bog located approximately 1.5 km to the north of the site.

The main purpose of these surveys was to identify any potential areas of interest within the area surrounding the site for breeding waterbirds and birds of prey, and record evidence of breeding activity, if any. All target species were recorded, where encountered. The table below outlines the dates on which hinterland surveys were undertaken during the breeding 2019, breeding 2021 and breeding 2022 survey periods.

Table 3-4. Breeding season hinterland surveys 2019, 2021, 2022

Survey Period	Survey Date	Survey Type/Area
Breeding 2019	18th July 2019	**Count** - Cutover Bog north of site, and **Driven Transect**
Breeding 2021	28th June 2021	**Driven Transect**
Breeding 2022	15th September 2022	**Driven Transect**

Breeding season hinterland surveys were also undertaken on certain dates at pre-selected locations in the wider landscape surrounding the proposed wind farm site identified as having potential for target species to occur. These areas comprised the following:

• Ballycastle Strand/Buntrahir Bay – located approximately 6.1 km to the north-east.

• Downpatrick Head - located approximately 9.5 km to the north-east. This survey focused on counts of birds on sea cliff and on open water and included a driven transect around the area of the headland.

3.2.2.2.2 Winter Season

Transect Surveys with Point Counts

Transect surveys were completed within the proposed wind farm site boundary using the same two transect routes (A & B) along existing forestry access tracks as were used during breeding season surveys (see Appendix 2 of the BIAR for mapped transect routes). The transect routes provided representative coverage of the open and closed habitats, comprising mainly mature forestry and clearfell, encompassed within the proposed wind farm site boundary.

As for the breeding transect surveys (see Section 5.3.1.2.1 above) transects were completed on a monthly basis during the winter season survey period for the first two years of survey, after which they were completed on a rotational basis comprising three months per winter season survey period, as set out in the table below.

Table 3-5. Winter transect survey months (2019/20 to 2022/23) within BIAR Site

Survey Period	Corresponding Transect Survey Months
Winter 2019/20	October, November, December 2019 & January, February and March 2020
Winter 2020/21	October, November, December 2020 & January, February and March 2021
Winter 2021/22	October and December 2021 and January 2022
Winter 2022/23	November 2022 and February and March 2023

Winter Season Walkover Surveys

Winter walkover surveys were undertaken to determine the presence of target species within areas of potentially suitable habitat within the study area. As for the breeding season walkover surveys, these surveys focussed on suitable habitat located within the 500 m survey area buffer surrounding the proposed wind farm site. The same walkover routes (Route A & B) as were used during breeding season walkover surveys were used for the winter season walkover surveys (winter 2019/20 to winter 2022/23).

The methodology was broadly based on methods described in Bibby et al., (2000). All target and secondary species were recorded, with a focus on red grouse, merlin, golden plover and other wader and raptor species. During each walkover survey, surveyors walked the pre-selected route(s) within areas of suitable habitat and recorded any calls or activity observed. March surveys undertaken in 2022 and 2023 also contributed to the capture of data on target species potentially breeding in the 500 m survey area (i.e., potential early breeding attempts), where present.

The dates on which winter season walkover surveys were undertaken and the routes which were utilised on each date are outlined in the table below.

Table 3-6. Winter season walkover surveys 2019/20 – 2022/23

Survey Period	Survey Date	Survey Route
Winter 2019/20	21st February 2020	Route A & B
Winter 2020/21	19th February 2021	Route A
	24th February	Route B
Winter 2021/22	10th November 2021	Route A & B
	9th February 2022	Route A & B
	14th March 2022	Route A & B
Winter 2022/23	18th January 2023	Route A & B
	17th February 2023	Route A & B
	24th March 2023	Route A & B

A full impact assessment has been completed by Malachy Walsh and Brian Madden in the BIAR available in appendix 4 of this NIS. The assessment concluded that the proposed development is not expected to have any significant effects on the SCIs of any Special Protection Area. This is further explained in the Appropriate Assessment Screening section of this report (section 4.1.1).

3.3 Description of the Existing Environment

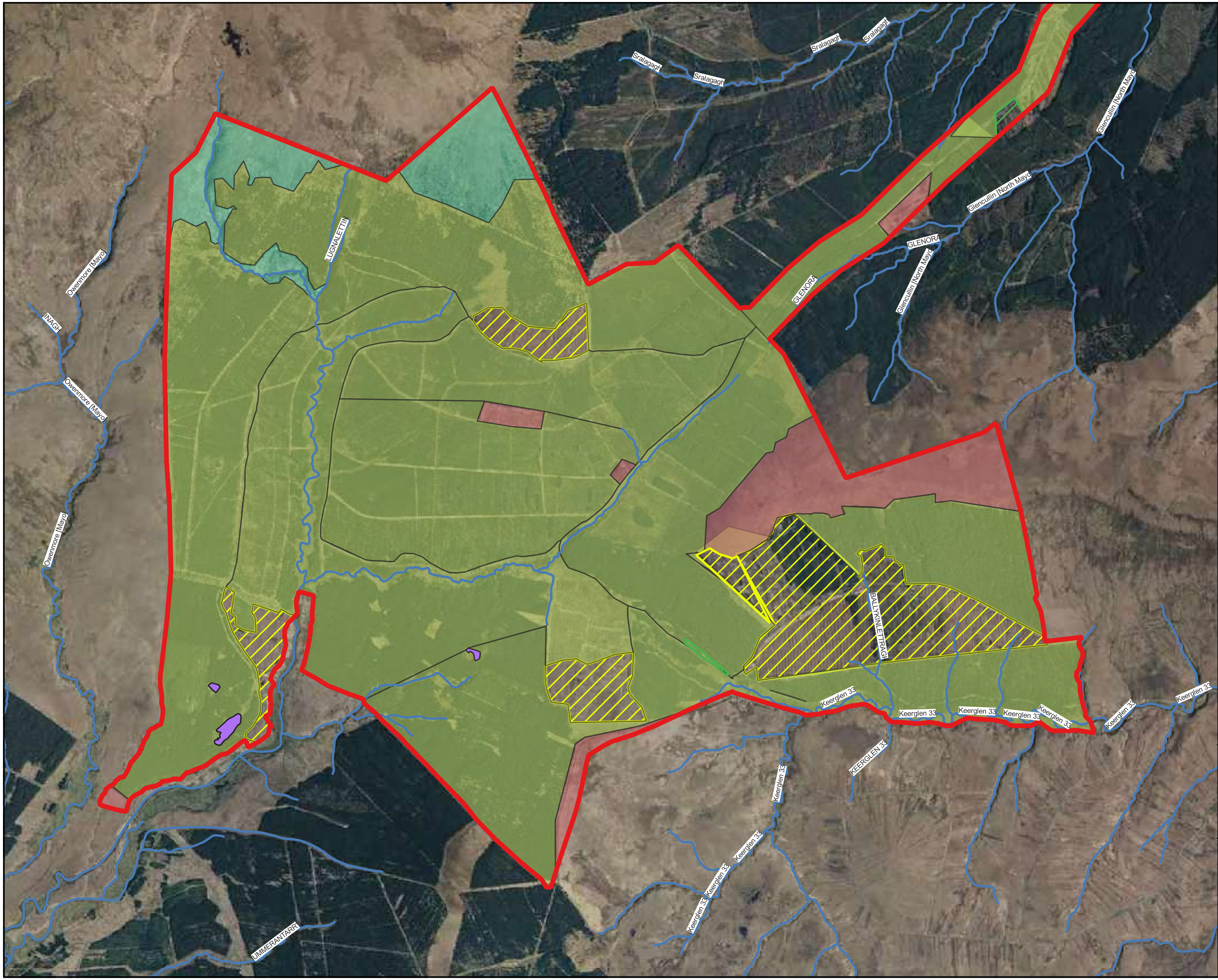
The habitat classifications and codes correspond to those described in 'A Guide to Habitats in Ireland' (Fossitt 2000). A total of fifteen habitats were recorded within the EIAR Site Boundary (**Table 3-1**). Peatland habitats have also been categorised to plant communities from the National Survey of Upland Habitats (Perrin et al. 2014) and the Irish Vegetation Classification.

A habitat map of the Proposed Wind Farm Site is provided in **Figure 3-1.**

A habitat map is also provided with the proposed Wind Farm Development infrastructure overlain in **Figure 3-2.**

Table 3-7 Habitats recorded within the EIAR Site Boundary.

Habitat Name	Fossitt Code
1. Conifer plantation	**WD4**
2. Recently felled woodland	**WS5**
3. Upland blanket bog	**PB2**
4. Wet heath	**HH3**
5. Eroding/upland rivers	**FW1**
6. Dystrophic lakes	**FL1**
7. Hedgerow	**WL1**
8. Drainage ditches	**FW4**
9. Spoil and bare ground	**ED2**
10. Recolonising bare ground	**ED3**
11. Dry meadows and grassy verges	**GS2**
12. Wet grassland	**GS4**
13. Scrub	**WS1**
14. Buildings and artificial surfaces	**BL3**
15. Agricultural grassland	**GA1**



Map Legend

- EIAR Site Boundary
- Buildings and Artifical Surfaces (BL3)
- Dystrophic Lake (FL1)
- Wet Heath (HH3)
- Blanket Bog (PB2)
- Wet Heath/Blanket Bog Mosaic (PB2/HH3)
- Conifer plantation (WD4)
- Immature Woodland (WS2)
- Recently felled Woodland (WS5)
- EPA River Watercourses

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Drawing Title	
Habitat Map	
Project Title	
Glenora Windfarm	
Drawn By RM	Checked By CM
Project No. 201120	Drawing No. Figure 3.1
Scale 1:27,526	Date 01/12/2023

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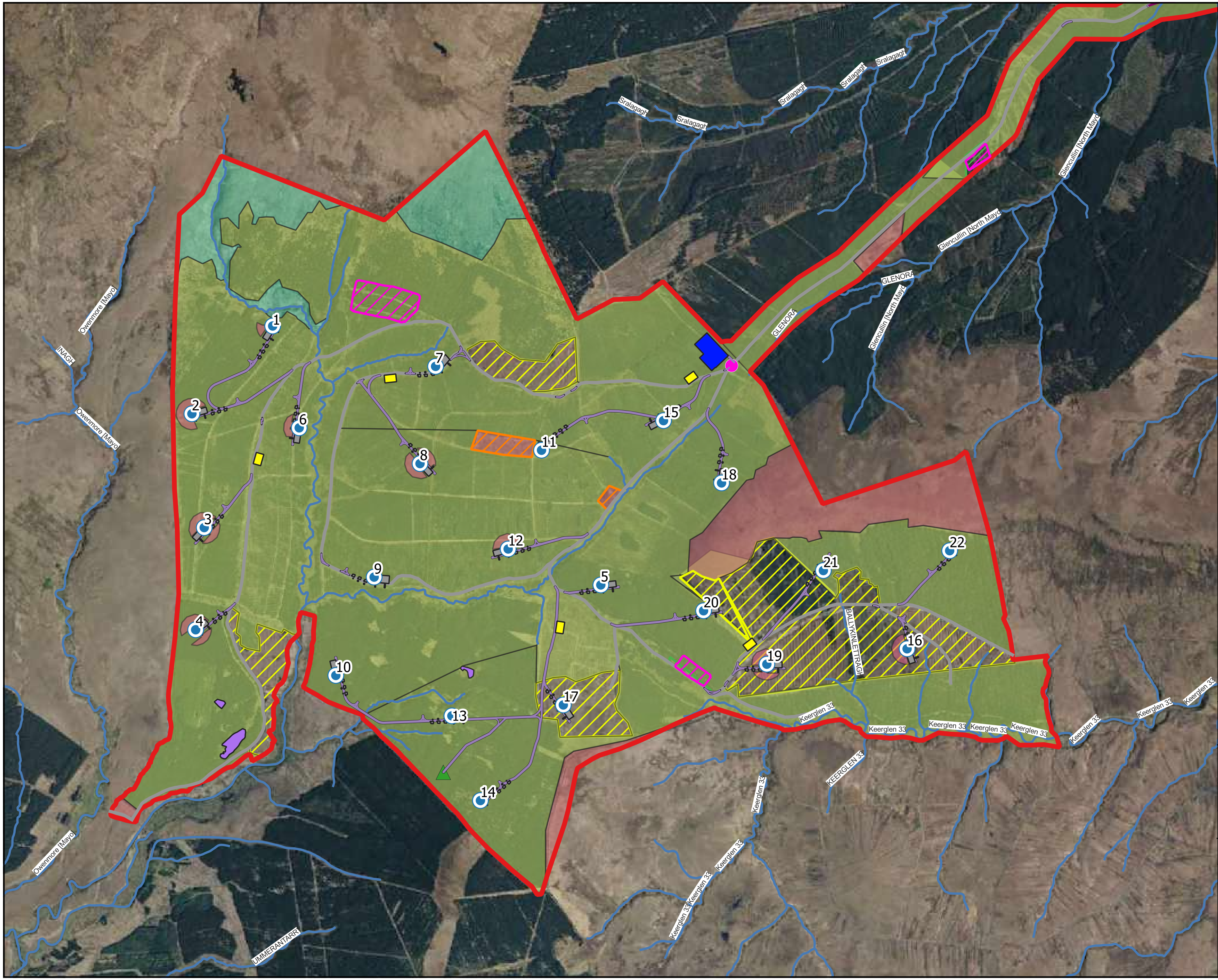

Map Legend

- EIAR Site Boundary
- Buildings and Artifical Surfaces (BL3)
- Dystrophic Lake (FL1)
- Wet Heath (HH3)
- Blanket Bog (PB2)
- Wet Heath/Blanket Bog Mosaic (PB2/HH3)
- Conifer plantation (WD4)
- Immature Woodland (WS2)
- Recently felled Woodland (WS5)
- EPA River Watercourses
- Turbine Storage
- Security Cabin
- Substation
- Proposed New Roads
- Hardstand Footprints
- Construction Compounds
- Borrow Pits
- Existing Roads
- Met Mast
- Turbine Layout
- New Roads
- Coillte Biodiversity Area

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Drawing Title Habitat Map with Windfarm Infrastructure Overlain	
Project Title Glenora Windfarm	
Drawn By RM	Checked By CM
Project No. 201120	Drawing No. Figure 3.2
Scale 1:28,841	Date 01/12/2023

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3.3.1.1 Habitats Recorded Within the EIAR Site Boundary

The majority of the EIAR Site Boundary (1,157ha) is dominated by plantation forestry (including clear fells), comprising mainly of Lodgepole pine (*Pinus contorta*) and Sitka spruce (*Picea sitchenis*) planted on blanket bog. Remnants of this habitat are still found on the site in various forms of degradation. The site is accessible via the Western Way and a network of existing forestry access tracks and forestry rides.

Waterbodies within the EIAR Site Boundary including drainage ditches and small streams classified as **Eroding/upland rivers (FW1)** provide hydrological connectivity with downstream designated sites and are further described in this section. Watercourses within the EIAR Site Boundary are mapped **on Figure 3-1**, indicating hydrological connectivity with downstream European Designated Sites.

Conifer plantation (WD4) and recently felled woodland (WS5)
In total, approximately 1,157ha of the EIAR Site Boundary comprises of coniferous plantation forestry (**Plate 3-1 and Plate 3-2**). This includes forestry of various ages including clear-felled areas, semi-mature and mature stands, along with immature pre-thicket areas of both first and second rotation (**Plate 3-1**). The main species are Lodgepole pine (*Pinus contorta*) and Sitka spruce (*Picea sitchensis*), other trees that are very occasionally included particularly in immature areas are Larch (*Larix decidua*), Alder (*Alnus* sp.) and Birch (*Betula* spp.) Mature conifer plantation is interspersed with immature stands.

The understorey is typically species-poor in forestry plantations and covered with needles (**Plate 3-2**). Vegetation is usually restricted to a few bryophytes and ferns which include Hard fern (*Blechnum spicant*), Bracken (*Pteridium aquilinum*), *Sphagnum* spp., *Rhytideadelphus loreus*, *Hypnum jutlandicum* and *Thuidium tamariscum*. Occasionally, Lesser twayblade (*Listera cordata*) was found growing within the plantation.

The ground vegetation in clear fells and immature stands was frequently dominated by Soft rush (*J. effusus*) or by brash and stumps overgrown with Bracken (*Pteridium aquilinum*), Bramble (*Rubus fruticosus* agg.), Foxglove (*Digitalis purpurea*), and *Polytrichum* spp. interspersed with peatland plants such as Purple moor grass (*Molinia caerulea*) and Ling heather (*Calluna vulgaris*).

As the forestry was originally planted on peatland habitats, forestry rides or areas where forestry failed to achieve closed canopy are frequently dominated by Purple moor grass, Ling heather and *Sphagnum spp* (**Plate 3-3**). Several rides had areas of exposed peat and standing water, supporting a wide variety of species such as Bog cotton (*Eriophorum angustifolium*), Hare's tail cottongrass (*Eriophorum vaginatum*), Heath star moss (*Campylobus introflexus*), Tormentil (*Potentilla erecta*), Deergrass (*Trichophorum*, *cespositum*), Cross-leaved heather (*Erica tetralix*), Rushes (*Juncus inflexus, J. effusus, J. conglomeratus*) and Carnation sedge (*Carex pancicea)* (**Plate 3-4**). Occasionally, Round-leaved sundew (*Drosera rotundifolia*), Heath milkwort (*Polygala serpyllifolia*), Devil's bit scabious (*Succisa pratensis*) and Marsh orchids (*Dactylorhiza spp.*) were found as well. These areas are small and only make up a fraction of the overall forestry plantation.

Plate 3-1 View of the eastern area of the EIAR Site Boundary with extensively clear-felled area partially overgrown with Rushes (Juncus spp) and mature plantation.

Plate 3-2 Open area dominated with Purple moor grass within the plantation in the vicinity of proposed Turbine.

Plate 3-3 Typical ground cover within the plantation

Plate 3-4 Typical forestry ride in the west of the EIAR Site Boundary.

Upland Blanket Bog (PB2) and Wet Heath (HH3)

Areas of upland blanket bog and wet heath are generally restricted to the periphery of the EIAR Site Boundary where they connect to larger peatlands, partially designated as NHAs or SACs. Two small sections can be found in the south-west and south-east of the EIAR Site Boundary and larger sections occur in the north-east and north-western corners. The larger sections are mapped as Annex I Wet Heath and Active Blanket Bog respectively. In addition, two small areas of blanket bog, marked as Coillte Biodiversity Areas, can be found within the centre of the EIAR Site Boundary, one of which is also mapped as Annex I Active Blanket Bog. All areas mapped as either habitat in **Figure 3.1** qualify as **Annex I Blanket Bog [7130] or Northern Atlantic wet heaths with *Erica tetralix*** [4010] respectively.

None of this habitat will be impacted by the Proposed Wind Farm Development..

Areas in the south of the EIAR Site Boundary were on flat ground and vegetation was dominated by Bog cotton, Ling heather, *Cladonia portentosa,* Hare's tail cottongrass and *Sphagnum spp* (**Plate 3-5).** They were classified as '*Calluna vulgaris –Eriophorum* spp. Bog' using the Irish Vegetation Classification (IVC) following analysis with ERICA[1]. This is described as a community of deep,

[1] *Engine for Relevés to Irish Communities Assignment (ERICA)*

ombrogenous, wet, and acidic peat soils in the uplands (mean altitude = 371 m). The relevé data from this habitat is shown in the Botanical Survey Report available in Appendix 6-1 of the EIAR.

Plate 3-5 Area of blanket bog in the south-western corner of the EIAR Site Boundary

The area in the north-east of the EIAR Site Boundary was gently sloping and dominated by Purple moor grass and Ling heather and had a high *Sphagnum* cover (about 75%) **(Plate 3.6).** It was classified as '*Calluna vulgaris – Molinia caerulea – Erica cinerea* Heath' using the IVC classification system. This is described as a community of the lower to middle slopes of hills and mountains (mean altitude = 227 m), primarily wet heathland where soils are rather poorly drained, acidic, and infertile. As the peat depths in this area were well in excess of 50cm, the habitat was categorised as **Upland Blanket Bog (PB2).** The majority of the area was fenced off by a deer fence from the plantation and showed only few signs of disturbance and degradation resulting from trampling or grazing. The relevé data from this habitat is shown in the Botanical Survey Report available in Appendix 6-1 of the EIAR.

Plate 3-6 Upland Blanket Bog in the north-east of the EIAR Site Boundary.

The peatland in the north-west of the EIAR Site Boundary is generally located on gentle and steeply sloping ground and forms a mosaic of upland blanket bog and wet heath. Vegetation is dominated by Purple moor grass or Ling heather with variable, but generally low (<10%) *Sphagnum* cover.

The area surrounding the river valley in the vicinity of proposed Turbine 1 was dominated by Purple Moor grass, other plants recorded include Ling heather, Tormentil, Cross-leaved heather, Heath milkwort, Hare's tail cottongrass and *Dactylorhiza* spp. Bracken and conifer saplings were frequent in patches (Plate 3-7). Following IVC classification system, the community was classified as '*Molinia caerulea – Calluna vulgaris – Erica tetralix* Heath', which is described as a community of lower and middle slopes of hills and mountains (mean altitude = 224m) on wet, acidic, and infertile peaty soils. The relevé data from this habitat is shown in the Botanical Survey Report available in Appendix 6-1 of the EIAR.

Plate 3-7 Wet Heath on either side of the river valley north-west of proposed Turbine 1

Further north, the vegetation was dominated by ling heather with some purple moor grass and was very dry underfoot (Plate 3-8). Following the IVC classification system, it was classified as '*Calluna vulgaris – Molinia caerulea – Erica cinerea* Heath' as described above.

Plate 3-8 Heath in the north-west of the EIAR Site Boundary.

Dystrophic lakes (FL1)

Several small, potential Dystrophic lakes/ponds (FL1) can be found in the south-west of the EIAR Site Boundary, which are usually more or less covered with *Sphagnum cuspidatum* (**Plate 3-9**). Vegetation surrounding the ponds generally consisted of Purple moor grass, Ling heather, *S. cuspidatum* and *S. magellanicum* and margins were quaking in parts. As these ponds are part of the blanket bog system present within the site, they qualify as **Annex I Blanket bog [7130].**

Plate 3-9 Sphagnum-covered, potential dystrophic pond in the west of the EIAR Site Boundary

Altderg Lough is noticeably larger, and the majority of the lake is free of vegetation bar occasional Bog bean (*Menyanthes trifoliata*) and White-water lily (*Nymphaea alba*) (**Plate 3.10**). Due to its nature and size, this lake qualifies as **Annex I Natural Dystrophic Lakes and Ponds [3160].** To the north and south-west of the lake are large, quaking areas dominated by *S. cuspidatum* and *S. magellanicum* and occasional Ling heather, Bog cotton and Bog bean (**Plate 3-11**) which qualify as **Annex I Blanket bog [7130].**

Plate 3-10 View of Altderg Lough from the south-eastern shoreline

Plate 3-11 Quaking bog area on the northern shore of Altderg Lough

Spoil and bare ground (ED2) and Recolonising bare ground (ED3)

Unbound forestry tracks throughout the EIAR Site Boundary were categorised as Spoil and bare ground (ED2) (**Plate 3-12**) or Recolonising bare ground (ED3) in parts where tracks have not been regularly used. The verges or recolonising vegetation across much of the site contained species typical of grassy verges, wet grassland or surrounding peatland habitats such as Ragged robin (*Silene flos-cuculi*), Meadow buttercup (*Ranunculus acris*), Birds-foot trefoil (*Lotus cornicatus*), Oxeye daisy (*Leucanthemum vulgare*), Cuckooflower (*Cardamine pratensis*), Yorkshire fog (*Holcus lanatus*), Ribwort plantain (*Plantago lanceolata*), Devil's bit scabious, Soft rush, Horsetails (*Equisetum* spp.), Heath bedstraw (*Galium saxatile*), Ling heather or Bracken. Willow (*Salix* sp.) and other broadleaves such as Rowan (*Sorbus aucuparia*) or Birch can be occasionally found along the roads as well, generally where they run parallel to the riparian zones which are also marked as Coillte Biodiversity Areas. Upgrading of existing forestry tracks is proposed across the EIAR Site Boundary, as shown **in Figure 3.2-**

Plate 3-12 Forestry Road in the west of the EIAR Site Boundary

Eroding/upland rivers (FW1)

A number of watercourses drain the EIAR Site Boundary site with the majority of the watercourses being headwaters of the Altderg River which eventually flows into the Owenmore River, while the south-eastern portion of the EIAR Site Boundary is drained by tributaries of the Ballinglen River. The streams within the EIAR Site Boundary were generally small, up to a metre wide, high-energy and with boulder and cobble substrate (**Plate 3-13).** The streams did not contain aquatic macrophytes due to their fast flow and were mostly bordered by forestry, usually separated by a buffer of heath or wet grassland vegetation such as Ling heather, Soft rush, Bracken, Heath bedstraw and Yorkshire fog. Willow and Gorse scrub as well as stands of Willow, Rowan or Birch bordered some stretches of watercourses.

Apart from the existing water crossings, there will be up to two potential river crossings of Altderg River tributaries in the south of the EIAR Site Boundary to facilitate access to proposed Turbine 10 (**Plate 3-14).**

Plate 3-13 Unnamed headwater of the Altderg River where it flows underneath an existing crossing of the forestry road in the north-west of the EIAR Site Boundary.

Plate 3-14 Unnamed headwater of the Altderg River which will be potentially crossed to connect proposed Turbines 9 and 10

Drainage ditches (FW4)

Drainage ditches are frequently present along the existing roads (**Plate 3-15**). Most carried water and had a flow depending on the gradient of the terrain. It is assumed that they connect to watercourses which eventually flow to the Owenmore or Ballinglen River.

Plate 3-15 Drainage feature along the forestry road in the north of the EIAR Site Boundary.

3.3.1.2 Habitats on the Grid Connection and Site Access Route

The grid connection route has a proposed length of 27km. It will leave the on-site substation north-east, following existing forestry roads categorised as Spoil and Bare Ground (ED2) through conifer plantation (WD4) and adjacent to upland blanket bog (PB2) and scrub (WS1). The section of upland blanket bog, which is located just to the east of the conifer plantation after about 3.5km is mapped as Annex I Blanket bog [7310] and Annex I Northern Atlantic wet heaths with *Erica tetralix* [4010]. After about 5km, it will turn east onto a local road categorised as buildings and artificial surfaces (BL3) (**Plate 3-16),** which ends at the R314 after 2.5km and the grid connection route will follow this regional road west until Ballycastle, when it turns south onto the R315 which it follows for 7.5km until Kilfian. Here the grid connection will run east for 12km along other local roads until Killala Business Park where it connects to the substation. No Annex I habitat are mapped directly adjacent to this part of the grid connection route Habitats along these regional and local roads are mostly agricultural grassland (GA1), scrub (WS1), conifer plantation (WS4) and degraded blanket bog (PB2/3) which has been partially cutover for domestic turf extraction. The grid connection route crosses several watercourses within the Glencullin (NorthMayo)_SC_010.

The site access road is the same as the grid connection route.

Plate 3-16 Existing Road (BL3) into which the cable is going to be laid.

3.3.1.3 Habitats at the site of the Met Mast

The proposed met mast is located within Conifer plantation forestry (WD4) within the EIAR Site Boundary, located south of proposed Turbine 13 and north-west of proposed Turbine 14. The area is dominated by Lodgepole pine and is generally of low ecological significance and subject to ongoing forestry activity.

3.3.1.4 Habitats at the site of the Proposed Borrow Pits

There are three borrow pits proposed within the EIAR Site Boundary. The proposed borrow pits are located to the northeast of T7, to the south of T20 and west of T19, and along the local road accessing the EIAR Site Boundary. The locations of the proposed borrow pits are shown in **Figure 3.2.**

The first borrow pit is located along the local road accessing the EIAR Site Boundary. The borrow pit is located on a highly degraded peatland habitat that has been subject to peat extraction in the past. Conifer plantation surrounds the borrow pit location and as a result, the area has been extensively drained. Three releves were taken from this area and are fully described in the Botanical Survey Report available in **Appendix 6-1** of the EIAR. Through ERICA, and following the IVC classification system, no dominant IVC habitats were described. Based on the peat depths recorded within this area (ranging from 30-220cm), this area is classified as a mosaic habitat of **BG2C/ HE2E/ BG2B**: Annex I: 4010 Wet heath / 7130 Blanket bog (active). **(Plate 3-17).**

Species recorded within this area include Ling heather (*Calluna vulgaris),* Purple moor grass (*Molinia caerula)*, Common cotton grass (*Eriophorum angustifolium*), Deer grass (*Trichophorum cespitosum*), Scots pine sapling (*Pinus sylvestris*), Reindeer lichen (*Cladonia portentosa*), Tormentil (*Potentilla erecta)*, Cross leaved heath (*Erica tetralix)*, *Sphagnum capillifolium,* Heath Milkwort (*Polygala serpyllifolia*), Brook Fork Moss (*Rhytidiadelphus loreus*), Red Stem feathermoss (*Pleurozium schreberi*). Marsh lousewort (*Pedicularis palustris*), and Bog asphodel (*Narthecium ossifragum).*

Plate 3-17 The first Proposed Borrow Pit located along the existing access track, to the south of the road.

The second proposed borrow pit located to the south of T20, and southwest of T19. The majority of the borrow pit is located within conifer plantation forestry. A small strip of highly degraded peatland habitat is located along the eastern boundary of the borrow pit and is adjoining the existing forestry road. As with the borrow pit along the access road, the remaining peatland in this location is highly degraded and has been subject to extensive drainage resulting from forestry activity. Three releves were taken from this area and are fully described in the Botanical Survey Report available in **Appendix 6-1** of the main EIAR document.

Through ERICA, and following the IVC classification system, this area is described as **HE4E** Annex I: 4010 Wet heath. This IVC habitat conforms to the following Fossitt (2000) habitat code: Wet Heath **(HH3) (Plate 3-18).** Species recorded within the proposed borrow pit location to the south of T20 include Ling Heather (*Calluna vulgaris*), Purple Moor-Grass (*Molinia caerulea*), Cross-leaved Heather (*Erica tetralix*), Tormentil (*Potentilla erecta*), Cotton Grass (*Eriophorum angustifolium),* Red Bog Moss (*Sphagnum capillifolium*), Red-Stemmed Feathermoss (*Pleurozium schreberi),* Reindeer Lichen (*Cladonia portentosa*), Little Shaggy Moss (*Rhytidiadelphus loreus*), Soft Rush (*Juncus effusus*), Deergrass (*Trichophorum cespitosum),* Broom Forkmoss (*Dicranum scoparium*), and Bell Heather (*Erica cinerea*).

Plate 3-18 The second Proposed Borrow Pit located to the south of T20, and southwest of T19.

The third proposed borrow pit located to the northeast of T7 is located, within a Conifer Plantation (WD4) dominated by Sikta Spruce (*Picea sitchensis*), and Lodgepole pine (*Pinus contorta*). To the north and east of the plantation, is an existing quarry/ extraction area **(Plate 3.18).**

Plate 3-19 The third Proposed Borrow Pit located to the northeast of T7.

3.3.1.5 Habitats at the site of the Proposed Local Road Widening

In order to accommodate the delivery of turbine components and other abnormal loads, road widening works will be required along the existing local access road into the EIAR Site Boundary and the main entrance just off the R314. The proposed road widening to the northern margins of the Ballyglass local road has a proposed of length of 1.3km. The road widening works will extend slightly into Hedgerow (WL1), Treeline (WL2), Scrub (WS1), and Improved Agricultural Grassland (GA1) habitats **(Plates 3-20-3.22).** Species recorded within these habitats include Gorse (*Ilex spp*), Bramble (*Rubus spp*), Holly (*Ilex aquifolium*), Yellow Iris (*Iris pseudacorus*), Dandelion (*Taraxacum vulgaria*), Willow (*Salix spp*), Pine (*Pinus spp*), and Hawthorn (*Crataegus monogyna*).

Plate 3-20 Hedgerow (WL1) dominated by Bramble (Rubus spp) location within the proposed road widening area.

Plate 3-21 Treeline (WL2) and Scrub (WS1) habitats located within the proposed road widening, with species of Bramble (Rubus spp), Pine (Pinus spp), and Willow (Salix spp).

Plate 3-22 Improved Agricultural Grassland (GA1) located within the proposed road widening area, dominated by grass species (Poa spp), and Soft Rush (Junus effusus).

3.3.1.6 Habitats at the site of the Proposed New Road along the Grid Connection Route

It is proposed to construct a new road at the junction of the R314 and the main local road accessing the EIAR Site Boundary The new road has a length of 278m and will be constructed to facilitate the delivery of turbine to accommodate the delivery of turbine components and other abnormal loads. The new road will be located primarily in Improved Agricultural Grassland (GA1), which is currently subject to grazing by livestock (**Plate 3-23).** A Drainage Ditch (FW4) runs along the field boundary parallel to the R314 (**Plate 3-24**). The western section of the proposed road intersects a small area of commercial planted broadleaf Immature Woodland (WS2), 40m in length. Ground Flora recorded here included Yellow iris (*Iris pseudacorus)* and Soft rush (*Juncus effusus*) (**Plate 3-25).**

Plate 3-23. Proposed new road location within an Improved Agricultural Grassland (GA1)

Plate 3-24. Drainage Ditch located along the agricultural grassland adjacent to the R134.

Plate 3-25. Commercial planted broadleaf Immature Woodland (WS2) that has been recently planted to the western section of the proposed new road.

3.3.1.7 Habitats within the Coillte Biodiversity Areas

The Coillte Biodiversity Areas are located to the west of T11, and to the east of T12, and west of T15, as shown on **Figure 3.2**. Both areas are surrounded by Conifer Plantation (WD4). This habitat was categorised as HE4E-Annex I: 4010 Wet heath- *Molinia caerulea – Calluna vulgaris – Erica tetralix* heath using the IVC classification system. **(Plate 3-26- 3.27).** Species recorded within these areas include Purple Moor-Grass (*Molinia caerulea*), Ling heather (*Calluna vulgaris*), *Rhytidiadelphus triquetrus*, Deer grass (*Trichophorum germanicum*), Devil's bit scabious (*Succisa pratensis*), Bilberry (*Vaccinium myrtillus*), Cross leaved heath (*Erica tetralix*), *Sphagnum capillifolium,* Tormentil (*Potentilla erecta*), Bog cotton (*Eriophorum angustifolium*), and Soft Rush (*Juncus effucus*).

There is no infrastructure proposed in either of the Coillte designated biodiversity areas.

Plate 3-26 Coillte Biodiversity Area west of T11.

Plate 3-27 Coillte Biodiversity Area located to the east of T12, and southwest of T15.

3.3.1.8 Habitats within the Biodiversity Management Enhancement Plan (BMEP) Area

The area for the proposed biodiversity management enhancement plan (BMEP) is located to the northern margin of the EIAR Site Boundary, north of T7. This habitat was categorised as **HE2D:** Annex I: 4010 Wet heath- *Calluna vulgaris – Molinia caerulea – Erica cinerea* heath using the IVC classification. Species recorded in this area include Ling Heather (*Calluna vulgaris*), Purple Moor Grass (*Molinia caerula*), Cross Leaved Heath (*Erica tetralix*), Tormentil (*Potentilla erecta*), Cotton Grass (*Eriophorum angustifolium*), *Sphagnum capillifolium*, Red Stem feathermoss (*Pleurozium schreberi*), Reindeer lichen (*Cladonia portentosa*), Woolly Fringe-moss (*Racomitrium lanuginosum*), and Little Shaggy-Moss (*Rhytidiadelphus loreus*). Self-seeded conifers have established in the southern and eastern sections of the proposed BMEP area (**Plate 3.28).**

A full description of this habitat is provided in the Biodiversity Management and Enhancement Plan available in appendix 6-5 of the main EIAR.

Plate 3-28 Biodiversity Management Enhancement Plan (BMEP) Area located to the northern margin of the EIAR Site Boundary.

3.3.2 Description of Fauna

The main watercourses within the Proposed Development site were assessed as providing suitable commuting and foraging habitat for Otter and this species may occur within the study area, at least on occasion. The sites on the Owenmore River, unnamed river and Keerglen, provided the best overall salmonid habitat, with good-quality nursery habitat present at all three sites.

A full list of the bird survey results is provided in section 3.3.1 in the BIAR report available in appendix 4. Section 4.5.1 of the BIAR concluded the Proposed Development is not expected to have any significant effects on the SCIs of any Special Protection Area.

4. STAGE 1 – APPROPRIATE ASSESSMENT SCREENING

4.1 Identification of Relevant European Sites

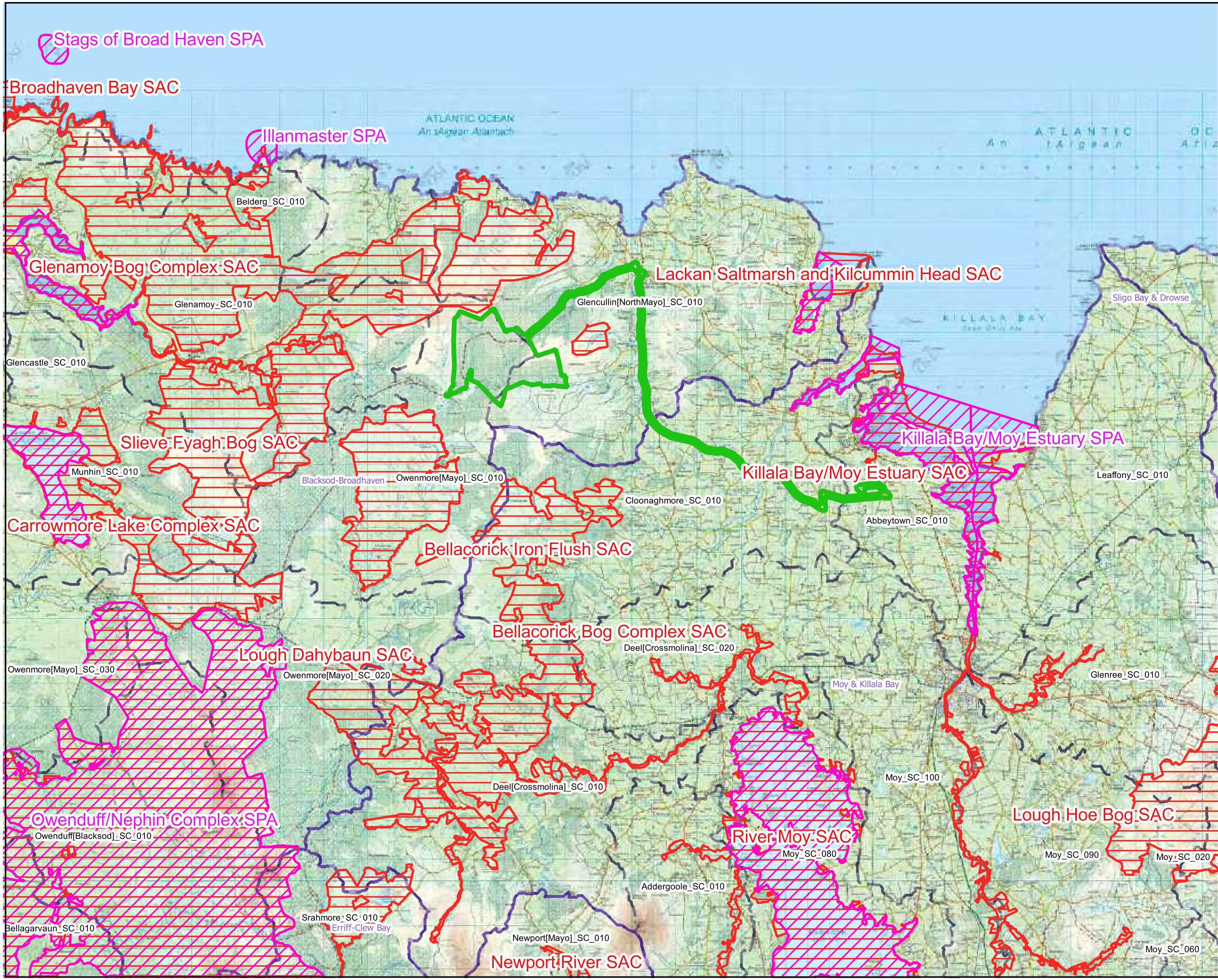
The following methodology was used to establish any European Sites upon which there is a potential for a likely significant effect to occur either individually or in combination with other plans and projects as a result of the Proposed Wind Farm Development:

- Initially the most up to date GIS spatial datasets for European designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on 27.11.2023.
- All European Sites that could potentially be affected were identified using a source-pathway - receptor model. To provide context for the assessment, European Sites surrounding the development site are shown on **Figure 4-1**. Information on these sites according to the site-specific conservation objectives is provided in **Table 4-1.** Sites that were further away from the Proposed Wind Farm Development were also considered and no complete source-pathway-receptor chain for significant effect was identified for any other European Site. no complete source-pathway-receptor chain for significant effect was identified for any other European Site.
- All candidate European Sites (cSAC/ cSPA) were also considered.
- The catchment mapping was used to establish or discount potential hydrological connectivity between the site of the Proposed Wind Farm Development and any European Sites. The hydrological catchments are also shown in **Figure 4-1.** A full description on the hydrological information of the EIAR Site boundary is provided in **section 5.2 of** this report.
- In relation to Special Protection Areas, in the absence of any specific European or Irish guidance in relation to such sites, the Scottish Natural Heritage (SNH) Guidance, '*Assessing Connectivity with Special Protection Areas* (SPA)' (2016) was consulted, and is widely accepted by ecological experts as best practice guidance. This document provides guidance in relation to the identification of connectivity between the Proposed Wind Farm Development and Special Protection Areas. The guidance takes into consideration the distances species may travel beyond the boundary of their SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects.
- **Table 4-1** provides details of all relevant European Sites as identified in the preceding steps and assesses the potential for likely significant effects on each.
- The assessment considers any likely direct or indirect impacts of the Proposed Wind Farm Development, both alone and in combination with other plans and projects, on European Sites by virtue of criteria including the following: size and scale, land-take, distance from the European Site or key features of the site, resource requirements emissions, ecological connectivity, excavation requirements, transportation requirements and duration of construction, operation and decommissioning were considered in this assessment.
- The site synopses and conservation objectives of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of preparing this report 27.11.2023.
- Where potential pathways for Likely Significant Effect are identified, the site is included within the Likely Zone of Influence and further assessment is required within the NIS.
- The potential for the Proposed Wind Farm Development to result in cumulative impacts on any European Sites in combination with other plans and projects was

considered in the assessment that is presented in **Table 4**-1. Plans and projects considered include those that are listed in **Appendix 5.**

4.1.1 European Designated Sites Within the Zone of Influence

An assessment of the potential for the proposed development to result in Likely Significant Effects on European Sites is provided in Table 4.1



Map Legend

- EIAR Site Boundary
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- EPA Hydrological Catchments
- EPA Hydrological Subcatchments

MKO

Drawing Title European Designated Sites Within the Likely Zone of Influence	
Project Title Glenora Wind Farm	
Drawn By RM	Checked By CM
Project No. 201120	Drawing No. Figure 4.1
Scale 1:224,594	Date 01/12/2023

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Table 4-1 Identification of European Sites within the Likely Zone of Influence

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
Special Areas of Conservation (SAC)			
Glenamoy Bog Complex SAC [000500] **Distance from Wind Farm Site Boundary:** 0.2km **Distance from Grid Connection:** 1.2km	› [1106] Salmon (*Salmo salar)* › [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts › [1393] Slender Green Feathermoss (*Drepanocladus vernicosus*) › [139]5 Petalwort (*Petalophyllum ralfsii)* › [1528] Marsh Saxifrage (*Saxifraga hirculus*) › [21A0] Machairs (* in Ireland) › [3160] Natural dystrophic lakes and ponds › [4010] Northern Atlantic wet heaths with *Erica tetralix* › [5130] *Juniperus communis* formations on heaths or calcareous grasslands › [7130] Blanket bogs (* if active bog) › [7140] Transition mires and quaking bogs › [715]0 Depressions on peat substrates of the Rhynchosporion	Detailed conservation objectives for this site (Version 1, June 2017) were reviewed as part of the assessment and are available at www.npws.ie: The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in Glenamoy Bog Complex SAC'*	There will be no direct effects as the Proposed Wind Farm Development Site is located entirely outside the designated site. The closest works associated with the Proposed Wind Farm Development is the construction of T1, which is located approx. 1km away from the boundary of Glenamoy Bog Complex SAC. Further, there is no downstream surface water connectivity between the Proposed Wind Farm Development and this Designated Site. As such, no source-pathway-receptor chain for impact was identified between the site of the Proposed Wind Farm Development and the habitats and species for which this site has been designated. Potential for direct or indirect impact on the European Site can be excluded. No pathway for significant effect on this European Designated Site was identified, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
Bellacorick Bog Complex SAC [001922] **Distance from Wind Farm Site Boundary:** 0.9km **Distance from Grid Connection**: 3km **Hydrological Distance**: 2.6km	- [1013] Geyer's Whorl Snail (*Vertigo geyeri*) - [1528] Marsh Saxifrage (*Saxifraga hirculus*) - [3160] Natural dystrophic lakes and ponds - [4010] Northern Atlantic wet heaths with *Erica tetralix* - [7130] Blanket bogs (* if active bog) - [7150] Depressions on peat substrates of the Rhynchosporion - [7230] Alkaline fens	Detailed conservation objectives for this site (Version 1, October 2017) were reviewed as part of the assessment and are available at www.npws.ie. The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in Bellacorick Bog Complex SAC'.*	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. There is downstream surface water connectivity between the Proposed Wind Farm development site and Bellacorick Bog Complex SAC, via the Owenmore River which flows in a southerly direction through the southwestern parcel of the Proposed Wind Farm Development site, and into this SAC after approx 2.6km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the Proposed Wind Farm Development, (including the grid connection route and turbine delivery route) may result in pollution to surface waters, adversely impacting the aquatic influenced QI habitats and species within the SAC, via the deterioration of water quality, in the absence of mitigation. A complete source pathway receptor chain was identified and in the absence of mitigation, there is potential for the Proposed Wind Farm Development to result in likely significant effects on this European Site in the absence of mitigation. Therefore, the European Site is located within the Likely Zone of Influence and **is considered further in this assessment.**
Bellacorick Iron Flush SAC [000466]	- [1528] Marsh Saxifrage (*Saxifraga hirculus)*	Detailed conservation objectives for this site (Version 1, November 2019) were reviewed as part of the	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site.

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
Distance from Wind Farm Site Boundary: 7.3km **Distance from Grid Connection**: 11.3km		assessment and are available at www.npws.ie. The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in. Bellacorick Iron Flush SAC*'	The closest works associated with the Proposed Wind Farm Development is the construction of T14, which is located approx. 7km away from the boundary of Bellacorick Iron Flush SAC. Further, there is no downstream surface water connectivity between the Proposed Wind Farm Development and this Designated Site. As such, no source-pathway-receptor chain for impact was identified between the site of the Proposed Wind Farm Development and the terrestrial QI species for which this site has been designated. Potential for direct or indirect impact on the European Site can be excluded. No pathway for significant effect on this European Designated Site was identified, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**
Slieve Fyagh Bog SAC [000542] **Distance from Wind Farm Site Boundary:** 7.8km **Distance from Grid Connection**: 11.9km	- [7130] Blanket bogs (* if active bog)	Detailed conservation objectives for this site (Version 1, August 2016) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in. Slieve Fyagh Bog SAC*	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. The closest works associated with the Proposed Wind Farm Development is the construction of T4, which is located approx. 8.5km away from the boundary of Slieve Fyagh Bog SAC. Further, there is no downstream surface water connectivity between the Proposed Wind Farm Development and this Designated Site. As such, no source-pathway-receptor chain for impact was identified between the site of the Proposed Wind Farm Development and the

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
			terrestrial QI habitat for which this site has been designated. Potential for direct or indirect impact on the European Site can be excluded. No pathway for significant effect on this European Designated Site was identified arising from the Proposed Development, grid connection or turbine deliver route, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**
Lackan Saltmarsh and Kilcummin Head SAC [000516] **Distance from Wind Farm Site Boundary:** 10.5km **Distance from Grid Connection**: 6.2km	- [1310] *Salicornia* and other annuals colonising mud and sand. - [1330] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) - [1410] Mediterranean salt meadows (Juncetalia maritimi) - [2120] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) - [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes)	Detailed conservation objectives for this site (Version 1, December 2016) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in Lackan Saltmarsh and Kilcummin Head SAC*	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. There is no direct downstream surface water connectivity between the Proposed Wind Farm Development and the Designated Site, which is buffered from the closest downstream connected watercourse by more than 8km of river/estuary channel and 6km of the Atlantic Ocean. However, due to the nature, scale, and location of the proposed Wind Farm Development, the separation distance of approx 10.2km, and the assimilative capacity of the intervening waterbodies, there is no potential for significant effects on water quality. No pathway for significant effect on this European Designated Site was identified arising from the Proposed Development, grid connection or turbine deliver route, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
Carrowmore Lake Complex SAC [000476] **Distance from Wind Farm Site Boundary:** 10.9km **Distance from Grid Connection**: 18.1km	- [1393] Slender Green Feathermoss (*Drepanocladus vernicosus*) - [1528] Marsh Saxifrage (*Saxifraga hirculus*) - [7130] Blanket bogs (* if active bog) - [7150] Depressions on peat substrates of the Rhynchosporion	Detailed conservation objectives for this site (Version 1, May 2017) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in.* Carrowmore Lake Complex SAC	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. The closest works associated with the Proposed Wind Farm Development is the construction of T4, which is located approx. 15.5km away from the boundary of Carrowmore Lake Complex SAC. Further, there is no downstream surface water connectivity between the Proposed Wind Farm Development and this Designated Site. As such, no source-pathway-receptor chain for impact was identified between the site of the Proposed Wind Farm Development and the terrestrial QI habitats and species for which this site has been designated. Potential for direct or indirect impact on the European Site can be excluded. No pathway for significant effect on this European Designated Site was identified arising from the Proposed Development, grid connection or turbine deliver route, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**
Lough Dahybaun SAC [002177] **Distance from Wind Farm Site Boundary:** 11.7km	- [1833] Slender Naiad (*Najas flexilis*)	Detailed conservation objectives for this site (Version 1, January 2021) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is:	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. The closest works associated with the Proposed Wind Farm Development is the construction of T14, which is located approx. 12km away from the boundary of Lough Dahybaun SAC.

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
Distance from Grid Connection:15km		'*To maintain the favourable conservation condition of the QI's in.* Lough Dahybaun SAC	Further, there is no downstream surface water connectivity between the Proposed Wind Farm Development and this Designated Site. As such, no source-pathway-receptor chain for impact was identified between the site of the Proposed Wind Farm Development and the QI species for which this site has been designated. Potential for direct or indirect impact on the European Site can be excluded. No pathway for significant effect on this European Designated Site was identified arising from the Proposed Development, grid connection or turbine deliver route, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**
River Moy SAC [002298] **Distance from Wind Farm Site Boundary:** 12.9km **Distance from Grid Connection**: 6.3km f	- [1092] White-clawed Crayfish (*Austropotamobius pallipes*) - [1095] Sea Lamprey (*Petromyzon marinus*) - [1096] Brook Lamprey (*Lampetra planeri*) - [1106] Salmon (*Salmo salar*) - [1355] Otter (*Lutra lutra*) - [7110] Active raised bogs* - [7120] Degraded raised bogs still capable of natural regeneration - [7150] Depressions on peat substrates of the Rhynchosporion - [7230] Alkaline fens	Detailed conservation objectives for this site (Version 1, August 2016) were reviewed as part of the assessment and are available at www.npws.ie. The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in.* River Moy SAC	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. The closest works associated with the Proposed Wind Farm Development is the construction of the proposed grid connection, which is located approx. 6.3km away from the boundary of the River Moy SAC. Further, there is no downstream surface water connectivity between the Proposed Wind Farm Development and this Designated Site. As such, no source-pathway-receptor chain for impact was identified between the site of the Proposed Wind Farm Development and the QI habitats and species for which this European Site has been designated. Potential for direct or indirect impact on the European Site can be excluded.

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
	› [91A0] Old sessile oak woods with *Ilex and Blechnum* in the British Isles › [91E0] Alluvial forests with *Alnus glutinosa and Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*		No pathway for significant effect on this European Designated Site was identified arising from the Proposed Development, grid connection or turbine deliver route, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**
Killala Bay/Moy Estuary SAC [000458] **Distance from Wind Farm Site Boundary:** 13km **Distance from Grid Connection:** 1.1km **Hydrological Distance:** 7km	› [1014] Narrow-mouthed Whorl Snail (*Vertigo angustior*) › [1095] Sea Lamprey (*Petromyzon marinus*) › [1130] Estuaries › [1140] Mudflats and sandflats not covered by seawater at low tide. › [1210] Annual vegetation of drift lines › [1310] Salicornia and other annuals colonizing mud and sand. › [1330] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) › [1365] Harbour Seal (P*hoca vitulina*). › [2110] Embryonic shifting dunes › [2120] Shifting dunes along the shoreline with Ammophila arenaria ('white dunes')	Detailed conservation objectives for this site (Version 1, October 2012) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in.* Killala Bay/Moy Estuary SAC	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. There is downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SAC, via the Cloonaghmore River, which crosses the grid connection route in two places, flowing in a northerly direction before discharging into Killala Bay after approx 7km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the proposed grid connection may result in pollution to surface waters, adversely impacting the aquatic influenced QI habitats and species within the SAC, via the deterioration of water quality, in the absence of mitigation. A complete source pathway receptor chain was identified and in the absence of mitigation, there is potential for the Proposed Wind Farm Development to result in likely significant effects on this European Site. Therefore, the European Site is located within the Likely Zone **of Influence and is considered further in this assessment.**

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
	› [2130] *Fixed coastal dunes with herbaceous vegetation ('grey dunes') › [2190] Humid dune slacks		
Owenduff/Nephin Complex SAC [000534] **Distance from Wind Farm Site Boundary** 13.3km **Distance from Grid Connection**: 19.5km	› [1106] Salmon (*Salmo salar)* › [1355] Otter (*Lutra lutra)* › [1393] Slender Green Feathermoss (*Drepanocladus vernicosus*) › 1528] Marsh Saxifrage (*Saxifraga hirculus*) › [3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) › [3130] Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea › [3160] Natural dystrophic lakes and ponds › [3260] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation › [4010] Northern Atlantic wet heaths with *Erica tetralix.* › [4060] Alpine and Boreal heaths	Detailed conservation objectives for this site (Version 1, July 2017) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is: '*To maintain the favourable conservation condition of the QI's in.* Owenduff/Nephin Complex SAC	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. Downstream surface connectivity (approximately 20km surface water distance) with the SAC has been identified via the watercourses that flow from the west of development site into the Owenmore River and there is potential for deterioration of water quality during the construction, operational and decommissioning phases. However, due to the nature, scale, and location of the Proposed Wind Farm Development, the buffering distance of approx 20km, and the assimilative capacity of the intervening waterbodies, there is no potential for significant effects on water quality. No pathway for significant effect on this European Designated Site was identified arising from the Proposed Development, grid connection or turbine deliver route, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
	[5130] *Juniperus communis* formations on heaths or calcareous grasslands [7130] Blanket bogs (* if active bog) [7140] Transition mires and quaking bogs		
Special Protection Area (SPA)			
Killala Bay/Moy Estuary SPA [004036] **Distance from Wind Farm Site Boundary:** 10.2km **Distance from Grid Connection**: 2km **Hydrological Distance**: 3.5km	[A137] Ringed Plover (*Charadrius hiaticula*) [A140] Golden Plover (*Pluvialis apricaria*) [A141] Grey Plover (*Pluvialis squatarola)* [A144] Sanderling (*Calidris alba)* [A149] Dunlin Calidris *(alpina alpina)* [A157] Bar-tailed Godwit (*Limosa lapponica)* [A160] Curlew (*Numenius arquata)* [A162] Redshank *(Tringa totanus)* [A999] Wetlands	Detailed conservation objectives for this site (Version 1, May 2013) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is: '*To maintain the favourable conservation condition of the SCI Species in Killala Bay/Moy Estuary SPA'.* And *'To maintain the favourable conservation condition of wetland habitat in Killala Bay/Moy Estuary SPA as a resource for the regularly*	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. There is downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SPA, via the Cloonaghmore River, which crosses the grid connection route in two places, flowing in a northerly direction before discharging into Killala Bay after approx. 3.5km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the proposed grid connection may result in pollution to surface waters, adversely impacting the supporting habitats for these SCI species within this SPA, via the deterioration of water quality, in the absence of mitigation.

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
		occurring migratory waterbirds that utilise it'.	Section 4.5.1 of the EIAR prepared by Malachy Walsh states *'The Killala Bay/Moy Estuary SPA, located at a distance of 10.2 km from the proposed wind farm development site, has golden plover as a SCI (SPA has habitat for non-breeding birds). Whilst wintering/passage golden plover at times occur in the area of the proposed Development site, due to the distance from the SPA it is highly unlikely that these birds commute between the two locations.'* Based on this finding, it can be concluded there is no potential for disturbance, displacement or injury/mortality due to turbine collision during the construction or operational phase of the Proposed Development on any SCI species associated with this SPA. A complete source pathway receptor chain was identified and in the absence of mitigation, there is potential for the Proposed Wind Farm Development to result in likely significant effects on this European Site in the absence of mitigation. Therefore, the European Site **is considered further in this assessment.**
Illanmaster SPA [004074] **Distance from Wind Farm Site Boundary:** 10.8km **Distance from Grid Connection**: 13.9km	- [A014] Storm Petrel *(Hydrobates pelagicus)*	This site has the generic conservation objective: *'To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA'.* *NPWS (2022) Conservation objectives for Illanmaster SPA [004074]. First Order Site-specific Conservation*	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. There is no direct downstream surface water connectivity between the Proposed Wind Farm Development and the Designated Site, which is buffered from the closest outlet of a downstream connected watercourse by more than 18km of the Atlantic Ocean. Due to the nature, scale and location of the proposed works along with the buffering properties of the intervening waterbodies, there is no potential for significant effects arising from water pollution.

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
		Objectives Version 1.0. Department of Housing, Local Government and Heritage.	The Proposed Wind Farm Development site offers no suitable habitat for Storm Petrel and there is no potential for significant effect on this species. No pathway for significant effect on this European Designated Site was identified, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**
Owenduff/Nephin Complex SPA [004098] **Distance from Wind Farm Site Boundary:** 13.3km **Distance from Grid Connection**: 19.5km **Hydrological distance: 20km**	- [A098] Merlin (*Falco columbarius)* - [A140] Golden Plover (*Pluvialis apricaria)*	This site has the generic conservation objective: '*To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA'.* *NPWS (2022) Conservation objectives for Owenduff/Nephin Complex SPA [004098]. First Order Site-specific Conservation Objectives Version 1.0. Department of Housing, Local Government and Heritage.*	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. Downstream surface connectivity (approximately 20km surface water distance) with the SPA has been identified via the watercourses that flow from the west of development site into the Owenmore River and there is potential for deterioration of water quality during the construction, operational and decommissioning phases. However, due to the attenuation provided by the intervening 20km of river channel, and the buffering distance of approx 20km from the proposed windfarm site to this SPA, there is no potential for significant adverse effects on water quality. Section 4.5.1 of the BIAR prepared by Malachy Walsh states 'The Owenduff/Nephin SPA, which is located approximately 13.4 km from the proposed Development site, has merlin and golden plover as SCIs. As the foraging distances of these species (merlin: within 5 km; golden plover: within core range of 3 km and maximum range of 11 km –

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
			SNH 2016) are less than the distance between the two locations, it can be concluded that it is highly unlikely that any records at the Proposed Development site of merlin and/or golden plover are connected with the populations within the SPA. Based on this finding, it can be concluded there is no potential for disturbance, displacement or injury/mortality due to turbine collision during the construction or operational phase of the Proposed Development on any SCI species associated with this SPA. A complete source pathway receptor chain was identified and in the absence of mitigation, there is potential for the Proposed Wind Farm Development to result in likely significant effects on this European Site in the absence of mitigation. Therefore, the European Site is located within the Likely Zone of Influence and **is considered further in this assessment.**
Blacksod Bay/ Broadhaven SPA [004037] **Distance from Wind Farm Site Boundary** 14.5km **Distance from Grid Connection**: 17.7km	- [A003] Great Northern Diver (*Gavia immer*) - [A046] Brent Goose (*Branta bernicla hrota*) - [A065] Common Scoter (*Melanitta nigra*) - [A069] Red-breasted Merganser (*Mergus serrator)* - [A137] Ringed Plover (*Charadrius hiaticula*) - [A144] Sanderling (*Calidris alba*)	Detailed conservation objectives for this site (Version 1, December 2014) were reviewed as part of the assessment and are available at www.npws.ie The conservation objective for this site is: *'To maintain the favourable conservation condition of the SCI*	There will be no direct effects as the Proposed Wind Farm Development is located entirely outside the designated site. There is no direct surface water connectivity between the Proposed Wind Farm Development and the Designated Site, which is buffered from the closest outlet of a downstream connected watercourse by more than by more than 40km of the Atlantic Ocean. Due to the nature, scale, and location of the proposed works along with the buffering properties of the intervening waterbodies, there is no potential for significant effects arising from water pollution.

European Sites and distance from Proposed Wind Farm Development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 27.11.2023	Conservation Objectives	Identification of Source-Pathway- Receptor chain
	- [A149] Dunlin (*Calidris alpina alpina*) - [A157] Bar-tailed Godwit (*Limosa lapponica*) - [A160] Curlew (*Numenius arquata)* - A191 Sandwich Tern (*Sterna sandvicensis)* - [A466] Dunlin (*Calidris alpina schinzii*) - A999 Wetlands	*Species in in Blacksod Bay/Broad Haven SPA'.* And *'To maintain the favourable conservation condition of the wetland habitat in Blacksod Bay/Broad Haven SPA as a resource for the regularly occurring migratory waterbirds that utilise it'.*	The Proposed Wind Farm Development site offers no suitable habitat for any of the SCIs apart from curlew and is located outside of the maximum range of this species (2km; SNH 2016) and there is no potential for significant impact any of the SCI species. No pathway for significant effect on this European Designated Site was identified, when considered in the absence of any mitigation, individually or cumulatively with other plans or projects and the European Site **is not considered further in this assessment**

4.2 Stage 1 Appropriate Assessment Screening Conclusion

It cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the Proposed Wind Farm development, individually or in combination with other plans and projects, will have have a significant effect on the following European Sites. Measures intended to avoid or reduce the harmful effects of the proposed development on European sites (i.e., "mitigation measures") or best practice measures have not been taken into account in the screening stage appraisal.

- Bellacorick Bog Complex SAC [001922]
- Killala Bay/Moy Estuary SAC [000458]
- Killala Bay/Moy Estuary SPA [004036]

As a result, an Appropriate Assessment is required, and a Natura Impact Statement shall be prepared in respect of the proposed development. It has also been concluded that it can be excluded on the basis of objective information that the Proposed Development, individually or in combination with any other plan or project will not have a significant effect on any other European Site. Accordingly, it is respectfully submitted that an Appropriate Assessment is required for the above 3 European Sites, however it is noted that An Bord Pleanála, as the competent authority, will make its determination in this regard. A NIS has been prepared in respect of the effects of the Proposed Development individually or in combination with any other plans or projects on the aforementioned 4 European Sites **(see section 5)**

5. STAGE 2- NATURA IMPACT STATEMENT (NIS)

The potential for likely significant effects on the following European Sites in the absence of any mitigation, individually or cumulatively with other plans or projects, was identified in the preceding section:

- Bellacorick Bog Complex SAC [001922]
- Killala Bay/Moy Estuary SAC [000458]
- Killala Bay/Moy Estuary SPA [004036]

The following sections consider each European Site individually to:

1. Determine which individual qualifying features have the potential to be adversely affected by the Proposed Wind Farm Development.
2. Provide information with regard to the Conservation Objectives and site-specific pressures and threats for those qualifying features that have the potential to be adversely affected.
3. Provide the results of any additional survey work that was necessary to inform an impact assessment.

5.1 Identification of relevant Qualifying Features and Desk Study

5.1.1 Bellacorick Bog Complex SAC [001922]

The potential for impacts on this SAC were identified in **Section 4.1 above**. The identified pathways for effect include the following:

- Downstream surface water connectivity between the Proposed Windfarm Development site and Bellacorick Bog Complex SAC, via the Owenmore River which may result in pollution to surface waters, adversely impacting the aquatic influenced QI habitats and species within the SAC, via the deterioration of water quality, in the absence of mitigation.

Table 5-1 below lists the qualifying features of this European Site and determines, in the light of their Conservation Objectives, whether there is any complete source-pathway-receptor chain, by which adverse effects may occur.

5.1.1.1 Identification of Individual Qualifying Features with the Potential to be Affected.

Table 5-1 Assessment of Qualifying features of Bellacorick Bog Complex SAC potentially affected.

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2017), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
[3160] Natural dystrophic lakes and ponds	To maintain the favourable conservation condition of Natural dystrophic lakes and ponds in Bellacorick Bog Complex SAC Conservation Objectives documents (NPWS, Version 1, September 2016[2]),	This SAC is located approx. 0.9km south and southeast from the boundary of the Proposed Wind Farm Development site, and approx. 3km southwest from the grid connection. As per Map 3 in the SSCO document (NPWS 2017), this QI habitat Natural dystrophic lakes and ponds is mapped approx. 0.92km south of the Proposed Wind Farm Development site. The SSCO document states this QI habitat is likely to occur in all pools and lakes and all are mapped as potential 3160 (map 3). Although there are more than 5,700 lake/pool polygons, many pools are not mapped in the 1:5,000 OSi data (see map 3). Further, there is downstream surface water connectivity between the Proposed Wind Farm Development site and Bellacorick Bog Complex SAC, via the Owenmore River which flows in a southerly direction through the southwestern parcel of the Proposed Wind Farm Development site, and into this SAC after approx. 2.6km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the Proposed Wind Farm Development may result in pollution to surface waters, adversely impacting this aquatic influenced QI habitat: Natural dystrophic lakes and ponds via the deterioration of water quality, in the absence of mitigation. **A complete source-pathway-receptor chain for adverse effects on this habitat was identified and it is assessed further in this NIS.**	Yes

[2] *NPWS (2016) Conservation Objectives: Ballynamona Bog and Corkip Lough SAC 002339. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.*

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2017), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
[4010] Northern Atlantic wet heaths with *Erica tetralix.*	To restore the favourable conservation condition of Northern Atlantic wet heaths with *Erica tetralix* in Bellacorick Bog Complex SAC.	This SAC is located approx 0.9km south and southeast from the boundary of the Proposed Wind Farm Development site, and approx. 3km southwest from the grid connection According to the SSCO document (NPWS 2017), this QI habitat: Northern Atlantic wet heaths with *Erica tetralix* has not been mapped in detail for Bellacorick Bog Complex SAC, but from current available data the total area of the qualifying habitat is estimated to be approximately 187ha, covering 2% of the SAC. However, indirect impacts on the following QI habitat Northern Atlantic wet heaths with *Erica tetralix* can be ruled out due to the terrestrial nature of this habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No
[7130] Blanket bogs (* if active bog)	To restore the favourable conservation condition of Blanket bogs (* if active bog) in Bellacorick Bog Complex SAC.	This SAC is located approx 0.9km south and southeast from the boundary of the Proposed Wind Farm Development site, and approx. 3km southwest from the grid connection. According to the SSCO document (NPWS 2017), this QI habitat: Blanket bog has not been mapped in detail for Bellacorick Bog Complex SAC, but from current available data the total area of the qualifying habitat is estimated to be approximately 6,286ha, covering 66% of the SAC. However, indirect impacts on the following QI habitat: Blanket bogs (* if active bog) can be ruled out due to the terrestrial nature of this habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2017), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
[7150] Depressions on peat substrates of the Rhynchosporion	To restore the favourable conservation condition of Depressions on peat substrates of the Rhynchosporion in Bellacorick Bog Complex SAC.	This SAC is located approx 0.9km south and southeast from the boundary of the Proposed Wind Farm Development site, and approx. 3km southwest from the grid connection. According to the SSCO document (NPWS 2017), this QI habitat: Depressions on peat substrates of the Rhynchosporion has not been mapped in detail for Bellacorick Bog Complex SAC and thus the total area of the qualifying habitat in the SAC is unknown. The habitat occurs in locations supporting pools and wet quaking peat. However, indirect impacts on the following QI habitat: Depressions on peat substrates of the Rhynchosporion can be ruled out due to the terrestrial nature of this habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No
[7230] Alkaline fens	To restore the favourable conservation condition of Alkaline fens in Bellacorick Bog Complex SAC,	This SAC is located approx 0.9km south and southeast from the boundary of the Proposed Wind Farm Development site, and approx. 3km southwest from the grid connection. According to the SSCO document (NPWS 2017), Alkaline fens has not been mapped in detail for Bellacorick Bog Complex SAC and thus the total area of the qualifying habitat in the SAC is unknown. The habitat is documented to occur throughout the SAC but is most well-developed along the eastern margin. Further, there is downstream surface water connectivity between the Proposed Wind Farm Development site and Bellacorick Bog Complex SAC, via the Owenmore River which flows in a southerly direction through the southwestern parcel of the Proposed Wind Farm Development site, and into this SAC after approx 2.6km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the Proposed Wind Farm Development may result in pollution to surface waters,	Yes

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2017), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
		adversely impacting this aquatic influenced QI habitat: Alkaline fens via the deterioration of water quality, in the absence of mitigation. **A complete source-pathway-receptor chain for adverse effects on this habitat was identified and it is assessed further in this NIS.**	
[1013] Geyer's Whorl Snail *Vertigo geyeri*	To maintain the favourable conservation condition of Geyer's Whorl Snail in Bellacorick Bog Complex SAC	This SAC is located approx 0.9km south and southeast from the boundary of the Proposed Wind Farm Development site, and approx. 3km southwest from the grid connection According to Map 4 in the SSCO document (NPWS 2017), the closest mapped record of this QI species: Geyer's Whorl Snail (*Vertigo geyeri)* is approx. 7.9km southeast of the Proposed Wind Farm Development site. The SSCO document (NPWS 2017) states there have been records of Geyer's whorl snail (*Vertigo geyeri)* from three 1km grid squares within the Bellacorick Bog Complex SAC boundary (G0522, G0718 and G0818). Indirect impacts on the following QI species: Geyer's Whorl Snail (*Vertigo geyeri*) can be ruled out due to the buffering distance of approx. 7.9km from the Proposed Wind Farm Development area and the mapped location of this species, and the absence of a complete source-pathway-receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this species as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No
[1528] Marsh Saxifrage *Saxifraga hirculus*	To maintain the favourable conservation condition of Marsh Saxifrage in Bellacorick Bog Complex SAC	This SAC is located approx 0.9km south and southeast from the boundary of the Proposed Wind Farm Development site, and approx. 3km southwest from grid connection. According to the SSCO document (NPWS 2017), the known populations of this QI species: Marsh saxifrage (*Saxifraga hirculus*) in Bellacorick Bog Complex SAC occur in five flushes: Formoyle, Sheskin A, Sheskin B, Sheskin C and Croaghaun East.	No

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2017), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
		Indirect impacts on the following QI species: Marsh Saxifrage *Saxifraga hirculus* can be ruled out due to the absence of suitable habitat, surface, or ground water connection between the Proposed Wind Farm Development site and this QI species, and the absence of a complete source-pathway-receptor chain. No further assessment is required. **No complete source- pathway- receptor chain for any effect on this species as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	

5.1.1.2 Site Specific Pressures and Threats

As per the Natura 2000 Data Form, the site-specific threats, pressures, and activities with potential to impact on the European Site were reviewed and considered in relation to the Proposed Wind Farm Development. These are provided in **Table 5.2 below**.

Table 5-2 Site-specific threats, pressures, and activities of Bellacorick Bog Complex SAC

Rank	Threats and Pressures
High	Forest planting on open ground
	Mechanical removal of peat
Medium	Electricity and phone lines
	Grazing
	Industrial or commercial areas
Low	Dispersed habitation
	Forest planting on open ground
	Hand cutting of peat
	Hunting
	Improved access to site
	Invasive non-native species
	Roads, motorways
Rank	**Activities, Management**
Medium	Electricity and phone lines
	Grazing
	Industrial or commercial areas
Low	Dispersed habitation
	Hunting
	Improved access to site
	Roads, motorways

Potential pathways for effect with regard to site-specific threats, pressures and activities have been identified in relation to potential for *'Forest planting on open ground', 'Mechanical removal of peat', and 'Grazing'.*

5.1.1.3 Species Specific Information

5.1.1.3.1 [3160] Natural dystrophic lakes and ponds

Description from SSCO document

According to the SSCO document for Bellacorick Bog Complex SAC (NPWS 2017), this SAC has some of the most extensive extant areas of lowland blanket bog pool systems. Habitat 3160 is likely to occur in all pools and lakes and all are mapped as potential 3160 (map 3). Although there are more than 5,700 lake/pool polygons, many pools are not mapped in the 1:5,000 OSi data (see map 3). The habitat is of high conservation value in the SAC, owing to the area, extent, and morphological diversity of pools. For further information on the distribution, vegetation, and morphology of the habitat in the SAC, see Foss and McGee (1987) and Douglas et al. (1989). Two measures of extent should be used: 1. the area of the lake itself and 2. the extent of the vegetation communities/zones that typify the habitat. Further information relating to all attributes is provided in the lake habitats supporting document for the purposes of site-specific conservation objectives and Article 17 reporting (O Connor, 2015). As noted above, the habitat is widespread in the SAC (see map 3). All lake/pond polygons have been mapped as potential 3160.

According to the Article 17 reporting (NPWS, 2019) the largest pressures to this habitat include on-going damage to peatland results in hydrological changes in lakes and ponds with the habitat, as well as increased sedimentation, colour, turbidity, organic material and ammonia. Fertilisation of forests can contribute to enrichment of the habitat. The Overall Status of the habitat is Inadequate, unchanged since the 2013 assessment. The trend has changed from deteriorating to stable. This change is due to use of a different assessment method and the trend is considered to have been stable since before the last assessment.

Targets and Attributes

Table 5-3 Targets and Attributes for [3160] Natural dystrophic lakes and ponds

Attribute	Target
Habitat area	Area stable or increasing, subject to natural processes.
Habitat distribution	No decline, subject to natural processes
Typical species	Typical species present, in good condition, and demonstrating typical abundances and distribution
Vegetation composition: characteristic zonation	All characteristic zones should be present, correctly distributed and in good condition
Vegetation distribution: maximum depth	Maintain maximum depth of vegetation, subject to natural processes
Hydrological regime: water level fluctuations	Maintain appropriate natural hydrological regime necessary to support the habitat
Lake substratum quality	Maintain appropriate substratum type, extent, and chemistry to support the vegetation
Water quality: transparency	Maintain appropriate Secchi transparency. There should be no decline in Secchi depth/transparency
Water quality: nutrients	Maintain the concentration of nutrients in the water column at sufficiently low levels to support the habitat and its typical species
Water quality: phytoplankton biomass	Maintain appropriate water quality to support the habitat, including high chlorophyll a status

Water quality: phytoplankton composition	Maintain appropriate water quality to support the habitat, including high phytoplankton composition status
Water quality: attached algal biomass	Maintain trace/absent attached algal biomass (
Water quality: macrophyte status	Maintain high macrophyte status
Acidification status	Maintain appropriate water and sediment pH, alkalinity, and cation concentrations to support the habitat, subject to natural processes
Water colour	Maintain appropriate water colour to support the habitat
Dissolved organic carbon (DOC)	Maintain appropriate organic carbon levels to support the habitat
Turbidity	Maintain appropriate turbidity to support the habitat
Fringing habitat: area and condition	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3160

5.1.1.3.2 [7230] Alkaline fens

Description from SSCO document

According to the SSCO document for Bellacorick Bog Complex SAC (NPWS 2017), this QI habitat: Alkaline fens has not been mapped in detail for Bellacorick Bog Complex SAC and thus the total area of the qualifying habitat in the SAC is unknown. The habitat is documented to occur throughout the SAC but is most well-developed along the eastern margin. Maintenance of groundwater, surface water flows and water table levels within natural ranges is essential for this wetland habitat.

According to the Article 17 reporting (NPWS, 2019) the main pressures facing the habitat in Ireland are land abandonment (and associated succession), overgrazing, drainage, and pollution. The Overall Status is assessed as Bad with a deteriorating trend due to losses of area and habitat quality, as well as the pressures and threats faced by the habitat.

Targets and Attributes

Table 5-4 Targets and Attributes for [[7230] Alkaline fens

Attribute	Target
Habitat area	Area stable or increasing, subject to natural processes
Habitat distribution	No decline, subject to natural processes
Ecosystem function: soil nutrients	Maintain soil nutrient status within natural range
Ecosystem function: peat formation	Maintain active peat formation, where appropriate
Ecosystem function: hydrology	Maintain appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat
Ecosystem function: water quality	Maintain appropriate water quality, particularly nutrient levels, to support the natural structure and functioning of the habitat
Community diversity	Maintain variety of vegetation communities, subject to natural processes
Vegetation composition: number of positive indicator species (brown mosses)	Number of brown moss species present at each monitoring stop is at least one
Vegetation composition: number of positive indicator species (vascular plants)	Number of positive vascular plant indicator species present at each monitoring stop is at least two for small-sedge flushes and at least three for black bog-rush (Schoenus nigricans) flush and bottle sedge (Carex rostrata) fen
Vegetation composition: cover of positive indicator species	Total cover of brown moss species and positive vascular plant indicator species at least 20% for small-sedge flushes and at least 75% cover for black bog-rush (Schoenus nigricans) flush and bottle sedge (Carex rostrata) fen
Vegetation composition: negative indicator species	Total cover of negative indicator species less than 1%
Vegetation composition: nonnative species	Cover of non-native species less than 1%
Vegetation composition: native trees and shrubs	Cover of scattered native trees and shrubs less than 10%

Vegetation composition: soft rush and common reed cover	Total cover of soft rush (Juncus effusus) and common reed (Phragmites australis) less than 10%
Vegetation structure: height	Proportion of live leaves and/or flowering shoots of vascular plants that are more than 5cm above the ground surface should be at least 50%
Physical structure: disturbed bare ground	Cover of disturbed bare ground less than 10%
Physical structure: drainage	Area showing signs of drainage from heavy trampling, tracking or ditches less than 10%
Physical structure: tufa formations	Disturbed proportion of vegetation cover where tufa is present is less than 1%
Indicators of local distinctiveness	No decline in distribution or population sizes of rare, threatened, or scarce species associated with the habitat

5.1.2 Killala Bay/Moy Estuary SAC [000458]

The potential for impacts on this SAC were identified in **Section 4.1 above**. The identified pathways for effect include the following:

- Downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SAC, via the Cloonaghmore River which may result in pollution to surface waters, adversely impacting the aquatic influenced QI habitats and species within the SAC, via the deterioration of water quality, in the absence of mitigation.

Table 5-5 below lists the qualifying features of this European Site and determines, in the light of their Conservation Objectives, whether there is any complete source-pathway-receptor chain, by which adverse effects may occur

5.1.2.1 Identification of Individual Qualifying Features with the Potential to be Affected.

Table 5-5 Assessment of Qualifying features of Killala Bay/ Moy Estuary SAC potentially affected.

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
[1014] Narrow-mouthed Whorl Snail *Vertigo angustior*	To maintain the favourable conservation condition of Narrow-mouthed Whorl Snail in Killala Bay/Moy Estuary SAC,	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. As per Map 8 in the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI species Narrow-mouthed Whorl Snail (*Vertigo angustior)* is mapped approx. 21km southeast of the Proposed Wind Farm Development site. Indirect impacts on this QI species can be ruled out due to the buffering distance of approx 21km from the Proposed Wind Farm Development site, and the absence of suitable habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this species as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No
[1095] Sea Lamprey Petromyzon *marinus*	To maintain the favourable conservation condition of Sea Lamprey in Killala Bay/Moy Estuary SAC,	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this SAC only covers the estuarine portion of the River Moy. The adjacent River Moy SAC (site code: 2298) encompasses the freshwater elements of sea lamprey habitat. Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. There is downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SAC, via the Cloonaghmore River, which crosses the grid connection route in two places, flowing in a northerly direction before discharging into Killala Bay after approx 7km.	Yes

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
		As such, taking a precautionary approach, the construction, operational and decommissioning phases of the Proposed Wind Farm Development may result in pollution to surface waters, adversely impacting this coastal QI species: Sea Lamprey (Petromyzon *marinus)* via the deterioration of water and habitat quality, in the absence of mitigation. **A complete source-pathway-receptor chain for adverse effects on this species was identified and it is assessed further in this NIS.**	
[1130] Estuaries	To maintain the favourable conservation condition of Estuaries in Killala Bay/Moy Estuary SAC,	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat: Estuaries area was estimated as 736ha using OSi data and the defined Transitional Water Body area under the Water Framework Directive and is mapped approx 3km from the proposed grid connection route, as per Map 3. There is downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SAC, via the Cloonaghmore River, which crosses the grid connection route in two places, flowing in a northerly direction before discharging into Killala Bay after approx 7km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the Proposed Wind Farm Development may result in pollution to surface waters, adversely impacting this coastal influenced QI habitat: Estuaries via the deterioration of water quality, in the absence of mitigation. **A complete source-pathway-receptor chain for adverse effects on this habitat was identified and it is assessed further in this NIS.**	Yes

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
[1140] Mudflats and sandflats not covered by seawater at low tide	To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Killala Bay/Moy Estuary SAC,	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. As per Map 4 in the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat: Mudflats and sandflats not covered by seawater at low tide occurs approx 13km southeast of the Proposed Wind Farm Development site. As stated in the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat area was estimated as 1,332ha using OSi data. There is downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SAC, via the Cloonaghmore River, which crosses the grid connection route in two places, flowing in a northerly direction before discharging into Killala Bay after approx 7km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the Proposed Wind Farm Development may result in pollution to surface waters, adversely impacting this coastal influenced QI habitat: Mudflats and sandflats not covered by seawater at low tide via the deterioration of water quality, in the absence of mitigation. **A complete source-pathway-receptor chain for adverse effects on this habitat was identified and it is assessed further in this NIS.**	Yes
[1210] Annual vegetation of drift lines	To maintain the favourable conservation condition of Annual vegetation of drift lines in Killala Bay/Moy Estuary SAC	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat is very difficult to measure in view of its dynamic nature which means that it can appear and disappear within a site from year to year. This habitat was only recorded from Bartragh Island, which is mapped approx. 14km east of the Proposed Wind Farm Development site, as per Map7.	No

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
		However, indirect impacts on the following QI habitat: Annual vegetation of drift lines can be ruled out due to the buffering distance of approx 14km of open sea from the Proposed Wind Farm Development site, the nature and scale of the development and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	
[1310] Salicornia and other annuals colonizing mud and sand	To maintain the favourable conservation condition of Salicornia and other annuals colonizing mud and sand in Killala Bay/Moy Estuary SAC,	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat: Salicornia and other annuals colonizing mud and sand is mapped at two of the four sub-sites surveyed, giving a total estimated area of 0.55ha. However, further unsurveyed areas maybe present within the site. As per Map 6, this QI habitat is mapped approx 3.7km from the proposed grid connection route. However, indirect impacts on the following QI habitat: Salicornia and other annuals colonizing mud and sand can be ruled out due to the buffering distance of approx 3.7km from the proposed grid connection route, the terrestrial nature of this QI habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No
[1330] Atlantic salt meadows (G*lauco-Puccinellietalia maritimae*)	To maintain the favourable conservation condition of Atlantic salt meadows (*Glauco- Puccinellietalia*) in Killala Bay/Moy Estuary SAC	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat: Atlantic salt meadows (G*lauco-Puccinellietalia maritimae*) four sub-sites that supported Atlantic salt meadow were mapped (47.02ha) and additional areas of potential ASM (3.34ha) were identified from an examination	No

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
		of aerial photographs, giving a total estimated area of 50.37ha. however, further unsurveyed areas maybe present within the site. As per Map 6, this QI habitat is mapped approx 3.4km from the proposed grid connection route. However, indirect impacts on the following QI habitat: Atlantic salt meadows (G*lauco-Puccinellietalia maritimae*) can be ruled out due to the buffering distance of approx 3.4km from the proposed grid connection route, the terrestrial nature of this QI habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	
[1365] Harbour Seal *Phoca vitulina*	To maintain the favourable conservation condition of Harbour Seal in Killala Bay/Moy Estuary SAC	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI species the entirety of Killala Bay is a potential Harbour Seal habitat. Their breeding sites are mapped approx 4.3km from the proposed grid connection route, their moulting sites are mapped approx 4.2km from the proposed grid connection route, and their resting sites are mapped approx 4km from the proposed grid connection route, as per Map 9 in the SSCO document. There is downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SAC, via the Cloonaghmore River, which crosses the grid connection route in two places, flowing in a northerly direction before discharging into Killala Bay after approx 7km. As such, taking a precautionary approach, the construction, operational and decommissioning phases of the Proposed Wind Farm Development may result in pollution to surface waters,	Yes

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
		adversely impacting this coastal influenced QI species: Harbour Seal (*Phoca vitulina)* via the deterioration of water and habitat quality, in the absence of mitigation. **A complete source-pathway-receptor chain for adverse effects on this species was identified and it is assessed further in this NIS.**	
[2110] Embryonic shifting dunes	To restore the favourable conservation condition of Embryonic shifting dunes in Killala Bay/Moy Estuary SAC	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat Embryonic shifting dunes is very difficult to measure in view of its dynamic nature and was only recorded at Bartragh Island and Ross, giving a total estimated area of 1.56ha. Accretion was noted from the western end of Bartragh Island. Embryo dune habitat is restricted to a small area on the seaward edge at Ross. According to Map 7 in the SSCO, this QI habitat is mapped approx 3.4km from the proposed grid connection route. However, indirect impacts on the following QI habitat: Embryonic shifting dunes can be ruled out due to the buffering distance of approx. 3.4km from the proposed grid connection route, the terrestrial nature of this QI habitat and the absence of a complete source- pathway-receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No
[2120] Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')	To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria (*white dunes) in Killala Bay/Moy Estuary SAC	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat: Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes') was mapped at three sub-sites to give a total estimated area of 12.75ha. Habitat is very difficult to measure in view of its dynamic nature.According to	No

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
		Map 7 in the SSCO, this QI habitat is mapped approx 3.5km from the proposed grid connection route. However, indirect impacts on the following QI habitat: Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes') can be ruled out due to the buffering distance of approx 3.5km from the proposed grid connection route, the terrestrial nature of this QI habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	
[2130] *Fixed coastal dunes with herbaceous vegetation ('grey dunes')	To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation (grey dunes) in Killala Bay/Moy Estuary SAC,	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat: Fixed coastal dunes with herbaceous vegetation ('grey dunes') is mapped at three sub-sites to give a total estimated area of 259.46ha. According to Map 7 in the SSCO, this QI habitat is mapped approx 4km from the proposed grid connection route. However, indirect impacts on the following QI habitat: Fixed coastal dunes with herbaceous vegetation ('grey dunes') can be ruled out due to the buffering distance of approx 4km from the proposed grid connection route, the terrestrial nature of this QI habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	No
[2190] Humid dune slacks	To maintain the favourable conservation condition of Humid	This SAC is located approx. 13km southeast of the Proposed Wind Farm Development site, and approx 1.1km from the grid connection. According to the SSCO document for Killala	No

Qualifying feature	Conservation Objective (NPWS, Version 1, October 2012), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
	dune slacks in Killala Bay/Moy Estuary SAC	Bay/ Moy Estuary SAC (NPWS 2012), this QI habitat: Humid dune slack was mapped at two sub-sites, giving a total estimated area of 5.09ha. According to Map 7 in the SSCO, this QI habitat is mapped approx 4.1km from the proposed grid connection route. However, indirect impacts on the following QI habitat: Humid dune slacks can be ruled out due to the buffering distance of approx 4.1km from the proposed grid connection route, the terrestrial nature of this QI habitat and the absence of a complete source- pathway- receptor chain. As such, no further assessment is required. **No complete source- pathway- receptor chain for any effect on this habitat as a result of the Proposed Wind Farm Development was identified. No further assessment is required.**	

5.1.2.2 Site Specific Pressures and Threats

As per the Natura 2000 Data Form, the site-specific threats, pressures, and activities with potential to impact on the European Site were reviewed and considered in relation to the Proposed Windfarm Development. These are provided in **Table 5.6 below.**

Table 5-6 Site-specific threats, pressures, and activities of Killala Bay/ Moy Estuary SAC

Rank	Threats and Pressures
High	Camping and caravans
	Diffuse pollution to surface waters due to household sewage and waste waters
	Skiing complex
	Urbanised areas, human habitation
	Walking, horse-riding, and non-motorised vehicles
Medium	Flooding and rising precipitations
Low	Leisure fishing
Rank	**Activities Management**
High	Flooding modifications

Potential pathways for effect with regard to site-specific threats, pressures and activities have been identified in relation to potential for *'Flooding and rising precipitations' and 'Flooding modifications.*

5.1.2.3 Species Specific Information

5.1.2.3.1 [1095] Sea Lamprey (Petromyzon marinus)

Description from SSCO document

According to the SSCO document for Killala Bay/Moy Estuary SAC (NPWS 2012), This SAC only covers the estuarine portion of the River Moy. The adjacent River Moy SAC (site code: 2298) encompasses the freshwater elements of sea lamprey habitat. Artificial barriers can block or cause difficulties to lampreys' upstream migration, thereby limiting species to lower stretches and restricting access to spawning areas. See O'Connor (2004) for further information on artificial barriers in the Moy catchment. Juveniles burrow in areas of fine sediment in still water. Attribute and target based on data from Harvey and Cowx (2003). Important juvenile habitat identified immediately downstream of Ballina (see O'Connor, 2004).

According to the Article 17 reporting (NPWS, 2019) the sea lamprey is listed in the most recent Irish Red Data Book as Near Threatened. Barriers to upstream migration (e.g., weirs) are considered the major impediment to good conservation status for sea lamprey as these limit access to spawning beds and juvenile habitat. The Overall Status of this species is assessed as Bad with a stable trend, unchanged since the last 2013 assessment.

Targets and Attributes

Table 5-7 Targets and Attributes for the *Sea Lamprey* (*Petromyzon marinus*)

Attribute	Target
Distribution: extent of anadromy	No barriers for migratory life stages of lamprey moving from freshwater to marine habitats and vice versa
Population structure of juveniles	At least three age/size groups present
Juvenile density in fine sediment	Juvenile density at least $1/m^2$

5.1.2.3.2 *[1365] Harbour Seal (Phoca vitulina)*

Description from SSCO document

According to the Article 17 reporting (NPWS, 2019) harbour seals occur in estuarine, coastal and fully marine areas and also occupy regular haul-out sites about which animals breed, moult, rest and engage in social activity. Such sites tend to be found in enclosed sheltered bays, although the species may also occur on offshore islands and rocky skerries. Pressures on this species in Irish waters mainly involve commercial vessel-based activities such as local/regional prey removal by fisheries or by-catch in fisheries, or geophysical seismic exploration; other possible impacts may occur from coastal tourism and localised human disturbance at haul-out sites. None of these pressures are considered to be of sufficient magnitude to adversely impact on populations of harbour seals in Irish waters. The Overall Status of the harbour seal in Ireland is considered to be Favourable, given the current knowledge of the species' population size, distribution, ecology and prevailing pressures on the species.

Targets and Attributes

Table 5-8 Targets and Attributes for the *Harbour Seal (Phoca vitulina)*

Attribute	Target
Access to suitable habitat	Species range within the site should not be restricted by artificial barriers to site use. See map 9 for suitable habitat
Breeding behaviour	Conserve the breeding sites in a natural condition
Moulting behaviour	Conserve the moult haul-out sites in a natural condition
Resting behaviour	Conserve the resting haul-out sites in a natural condition.
Disturbance	Human activities should occur at levels that do not adversely affect the harbour seal population at the site

5.1.2.3.3 [1130] Estuaries

Description from SSCO document

According to the SSCO document for Killala Bay/Moy Estuary SAC (NPWS 2012), this habitat area was estimated as 736ha using OSi data and the defined Transitional Water Body area under the Water Framework Directive, estimated by EPA during 2011 intertidal survey. Further the habitat structure was elucidated from intertidal and subtidal surveys undertaken in 2010 (Aquafact, 2011; ASU, 2011).

According to the Article 17 reporting (NPWS, 2019) most of the pressures on estuaries come from various sources of pollution, including domestic wastewater, agriculture, and marine aquaculture. Alien invasive species such as the naturalised Pacific oyster (*Magallana gigas*) are also recognised as a significant pressure. The Overall Status of the habitat is Inadequate and deteriorating. This status is the same as the 2013 assessment; however, the trend has changed, due to more accurate data, from improving to declining. This decline is considered to have been on-going since before the last assessment.

Targets and Attributes

Table 5-9 Targets and Attributes for Estuaries [1130]

Attribute	Target
Habitat area	The permanent habitat area is stable or increasing, subject to natural processes
Community extent	Maintain the extent of the Zostera-dominated community, subject to natural processes.
Community structure: Zostera density	Conserve the high quality of the Zostera-dominated community, subject to natural processes
Community distribution	Conserve the following community types in a natural condition: Muddy sand to fine sand dominated by Hydrobia ulvae, Pygospio elegans and Tubificoides benedii community complex; Estuarine muddy sand dominated by Hediste diversicolor and Heterochaeta costata community complex; and Fine sand dominated by Nephtys cirrosa community complex

5.1.2.3.4 [1140] Mudflats and sandflats not covered by seawater at low tide.

Description from SSCO document

According to the SSCO document for Killala Bay/Moy Estuary SAC (NPWS 2012), this habitat area was estimated as 1,332ha using OSi data, estimated by EPA during 2011 intertidal survey. Further, the habitat structure was elucidated from intertidal survey undertaken in 2010 (ASU, 2011). S

According to the Article 17 reporting (NPWS, 2019) the Overall status of the habitat is Inadequate and deteriorating, the change in trend from improving to deteriorating due to a genuine decline in the habitat since 2013. This was caused partly by pollution from agricultural, forestry and wastewater sources, as well as impacts associated with marine aquaculture, particularly the Pacific oyster (*Magallana gigas*).

Targets and Attributes

Table 5-10 Targets and Attributes for [1140] Mudflats and sandflats not covered by seawater at low tide.

Attribute	Target
Habitat area	The permanent habitat area is stable or increasing, subject to natural processes. S
Community extent	Maintain the extent of the Zostera-dominated community, subject to natural processes.
Community structure: Zostera density	Conserve the high quality of the Zostera-dominated community, subject to natural processes
Community distribution	Conserve the following community types in a natural condition: muddy sand to fine sand dominated by *Hydrobia ulvae, Pygospio elegans* and *Tubificoides benedii* community complex; Estuarine muddy sand dominated by *Hediste diversicolor* and *Heterochaeta costata* community complex and Fine sand dominated *by Nephtys cirrosa* community complex

5.1.3 Killala Bay/Moy Estuary SPA [004036]

The potential for impacts on this SPA were identified in **Section 4.1 above**. The identified pathways for effect include the following:

- Downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SPA, via the Cloonaghmore River, which may result in pollution to surface waters, adversely impacting the supporting habitats for these SCI species within this SPA, via the deterioration of water quality, in the absence of mitigation.

Table 5-11 below lists the qualifying features of this European Site and determines, in the light of their Conservation Objectives, whether there is any complete source-pathway-receptor chain, by which adverse effects may occur.

5.1.3.1 Identification of Individual Qualifying Features with the Potential to be Affected.

Table 5-11 Assessment of Qualifying features of Killala Bay/ Moy Estuary SPA potentially affected.

Qualifying feature	Conservation Objective (NPWS, Version 1, May 2013), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
[A137] Ringed Plover *Charadrius hiaticula*	To maintain the favourable conservation condition of Ringed Plover in Killala Bay/Moy Estuary SPA	This SPA is located approx 10.2km northeast of the Proposed Wind Farm Development boundary, and approx. 2km northeast of the grid connection. There is downstream surface connectivity (approximately 3.5km surface water distance) with this SPA via the watercourses that cross the proposed grid connection route and flow into Killala Bay. Following a precautionary principle, a potential pathway for indirect effects on the SCI supporting wetland habitat was identified in the form of deterioration of water quality and supporting wetland habitat for the listed SCI species during the construction of the proposed grid connection route and during the construction, operational and decommissioning phases of the Proposed Wind Farm Development. in the absence of mitigation. **A complete source-pathway-receptor chain for adverse effects on this SCI species supporting habitat was identified and it is assessed further in this NIS.**	Yes
[A140] Golden Plover *Pluvialis apricaria*	To maintain the favourable conservation condition of Golden Plover in Killala Bay/Moy Estuary SPA,		
A141 Grey Plover *Pluvialis squatarola*	To maintain the favourable conservation condition of Grey Plover in Killala Bay/Moy Estuary SPA		
A144 Sanderling *Calidris alba*	To maintain the favourable conservation condition of Sanderling in Killala Bay/Moy Estuary SPA		
A149 Dunlin *Calidris alpina alpina*	To maintain the favourable conservation condition of Dunlin in Killala Bay/Moy Estuary SPA		
[A157] Bar-tailed Godwit *Limosa lapponica*	To maintain the favourable conservation condition of Bar-tailed		

Qualifying feature	Conservation Objective (NPWS, Version 1, May 2013), were reviewed as part of the assessment and are available at www.npws.ie	Rationale	Potential for Adverse Effects Y/N
	Godwit in Killala Bay/Moy Estuary SPA,		
[A160] Curlew *Numenius arquata*	To maintain the favourable conservation condition of Curlew in Killala Bay/Moy Estuary SPA		
A162 Redshank *Tringa totanus*	To maintain the favourable conservation condition of Redshank in Killala Bay/Moy Estuary SPA		
A999 Wetlands	To maintain the favourable conservation condition of wetland habitat in Killala Bay/Moy Estuary SPA A as a resource for the regularly occurring migratory waterbirds that utilise it.		

5.1.3.2 Site Specific Pressures and Threats

As per the Natura 2000 Data Form, the site-specific threats, pressures, and activities with potential to impact on the European Site were reviewed and considered in relation to the Proposed Wind Farm Development. These are provided in **Table 5.12 below.**

Table 5-12 Site-specific threats, pressures, and activities of Killala Bay/ Moy Estuary SPA

Rank	Threats and Pressures
Medium	Fertilisation
	Leisure fishing
	Urbanised areas, human habitation
	Walking, horse-riding, and non-motorised vehicles
Rank	**Activities, Management**
Medium	Leisure fishing

Potential pathways for effect with regard to site-specific threats, pressures and activities have been identified in relation to potential for *'Fertilisation and Leisure fishing'.*

5.1.3.3 Species Specific Information for the listed SCI Species of *Killala Bay/ Moy Estuary SPA*

Description from SSCO document

According to the Site Synopsis for Killala Bay/ Moy Estuary SPA, the site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Ringed Plover, Golden Plover, Grey Plover, Sanderling, Dunlin, Bar-tailed Godwit, Curlew and Redshank. The E.U. Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland & Waterbirds.

The site is very important for wintering waterfowl and provides excellent feeding grounds for the birds, as well as high-tide roosts. Eight species have populations of national importance, i.e., Ringed Plover (245), Golden Plover (2,361), Grey Plover (221), Sanderling (123), Dunlin (2,073), Bar-tailed Godwit (366), Curlew (731) and Redshank (372) - all figures are mean peaks for the five-year period 1995/96 to 1999/2000). A range of other species occurs, including Light-bellied Brent Goose (170), Shelduck (64), Wigeon (339), Teal (236), Red-breasted Merganser (44), Redthroated Diver (15), Oystercatcher (531), Lapwing (1,854) and Greenshank (24). The site is also used by Mallard (92), Turnstone (50), Grey Heron (21) and Cormorant (40). Substantial numbers of gulls are present at the site during winter, including Black-headed Gull (338), Common Gull (368), Herring Gull (336) and Great Blackbacked Gull (120).

Killala Bay/Moy Estuary SPA is of high ornithological importance as it supports eight species that have populations of national importance, including a very substantial population of Grey Plover (3.4% of the all-Ireland total). The presence of Red throated Diver, Golden Plover and Bar-tailed Godwit is of particular note as these species are listed on Annex I of the E.U. Birds Directive. Killala Bay/Moy Estuary is a Ramsar Convention site.

Targets and Attributes

Table 5-13 Targets and Attributes for the listed SCI species of Killala Bay/ Moy Estuary SPA

Attribute	Target
Population trend	Long term population trend stable or increasing
Distribution	No significant decrease in the range, timing, or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation

5.1.3.3.2 A999 Wetlands

Description from SSCO document

The wetland habitat area was estimated as 3204ha using OSi data and relevant orthophotographs.

Targets and Attributes

Table 5-14 Targets and Attributes for Wetlands (A999)

Attribute	Target
Habitat Area	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 3204 hectares, other than that occurring from natural patterns of variation

5.2 Baseline Hydrology

The baseline hydrology of the EIAR site and surrounding area has been fully assessed and this assessment is provided in full in Appendix 2 to this NIS. The relevant Sections of the hydrological assessment, which describe the baseline hydrological environment, are provided below:

'*At the regional scale, the Wind Farm Site occupies headwater subcatchments of the Owenmore and Ballinglen Rivers. (Figure 9-2), the Owenmore River drains to Tullaghan Bay, approximately 27 km straight-line distance to the southwest of the Site. The Ballinglen River drains to Bunatrahir Bay, approximately 8 km straight-line distance to the northeast of the Site. The Owenmore River catchment encompasses a total area of approximately 300 km2 and the Ballinglen River catchment encompasses a total area of approximately 44 km2'*.

'*The grid connection route from the Wind Farm Site follows existing roads that pass through subcatchments of the Glencullin, Ballinglen, and Cloonaghmore Rivers (Figure 9-2). The Glencullin River discharges to Bunatrahir Bay while the Cloonaghmore and Moyne Rivers discharges to Killala Bay'.*

A regional hydrology map is attached as Figure 9.2, Chapter 9 of the EIAR, provided in Appendix 3 of this NIS.

'*The headwaters of the Owenmore and Ballinglen Rivers within the Wind Farm Site are (Figure 9-3): The Altderg River, which incorporates the drainages of the Glenora River from the east and Fiddaunfrankagh Stream from the north. The Altderg River flows south and merges with Inagh River to become the Oweninny River which continues south to become the Owenmore River after its merger with Sheskin River. The Keerglen River, which flows east to Ballinglen River. The Keerglen River is fed by several small, unnamed streams which flow south from within the eastern part of Glenora Forest'.*

'The headwaters of the Glencullin River, which includes the Sralagagh River, also originate within Glenora Forest but are outside the Wind Farm Site (Figure 9-3)'.

'All of the named headwater streams in Glenora Forest originate as a series of bog seeps and springs at higher elevation. The seeps and springs are clearly marked as 'rises' on the 6-inch sheets from OSI which show the original, natural drainage pattern in the area in the mid-19th Century'.

'The Wind Farm Site is drained as part of ongoing forestry management. Drainage ditches serve to lead greenfield and road runoff to local water courses. Within forestry plantations, furrows between rows of plantations (Photo1) and fire breaks (Photo 2) serve to direct greenfield runoff to drains, water courses directly, and also to bog areas in topographic depressions on lower grounds.

'The streams within the Wind Farm Site are small, generally less than 3 m wide (and mostly less than 1 m wide) and up to 2 m deep (below ground surface)'.

Section 9.3 Chapter 9 of the EIAR (see Appendix 3) provides details of the local and regional hydrology in relation to all elements of the proposed development, grid connection, amenity area and car park.

5.3 Additional Baseline Surveys

A comprehensive survey of the biodiversity within the EIAR Site Boundary was undertaken on various dates in 2021, 2022 and 2023. Additional faunal signs/sightings were also recorded during other surveys including habitat assessments, bat surveys and bird surveys. The site was also visited on numerous additional occasions during the undertaking of bat surveys throughout 2021-2023.

5.3.1 Invasive species survey

During the multi-disciplinary walkover surveys carried out in 2021,2022, and 2023 within the EIAR Site Boundary, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

5.4 Additional Baseline Survey Results

5.4.1 Invasive species

During 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. Rhododendron was recorded from two areas within the EIAR Site Boundary, in the vicinity of T12 and between T8 and T11. Best practice invasive species management measures have been incorporated into the Biodiversity Management Plan, available in Appendix 6-6 of the EIAR accompanying this application. The implementation of these measures will ensure that there is no potential for impact on downstream ecological receptors.

No additional species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended) were recorded during the survey.

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6. ASSESSMENT OF POTENTIAL EFFECTS & ASSOCIATED MITIGATION

This Natura Impact Statement presents the data and information on the Proposed Wind Farm Development and provides an analysis comprising the scientific examinations of the Proposed Wind Farm Development and its implications for the European sites referred to above in view of their conservation objectives, and provides an analysis of whether the Proposed Wind Farm Development, in light of best scientific information, individually or in combination with other plans or projects, would adversely affect the integrity of a European Designated Site. . Potential adverse effects are assessed in view of best scientific knowledge, based on objective information in relation to the Proposed Wind Farm Development including the proposed avoidance, reduction, and preventive measures.

The following sections provide a review of the potential impact pathways for each of the EU Designated Sites identified for which potential pathway for effects have been identified (**Section 4.1 and 5.1**). Mitigation measures for the avoidance of impact are then provided, followed by an assessment of potential effects, post implementation of the mitigation measures.

Taking a precautionary approach, the Proposed Wind Farm Development has the potential to cause deterioration in water quality and alteration of local hydrology via groundwater and surface water pathways (the latter where the proposed grid connection route crossings watercourses) during the construction, operational and decommissioning phase of the Proposed Wind Farm Development in the absence of mitigation.

6.1 Deterioration of Water Quality

There is downstream surface water connectivity between the Proposed Wind Farm and Bellacorick Bog Complex SAC, via the Owenmore River, and there is further downstream surface water connectivity between the proposed grid connection route and Killala Bay/ Moy Estuary SAC and Killala Bay/ Moy Estuary SPA, via the Cloonaghmore River.

As such, the Proposed Wind Farm Development has the potential to cause deterioration in surface water quality during the construction, operational and decommissioning phase of the development due to the release of pollutants including suspended solids and hydrocarbons, potentially affecting the following QIs and SCIs in the form of deterioration of water and habitat quality in the absence of mitigation. Without mitigation, potential effects on water quality will be indirect, negative, moderate, reversible and of high probability (as described in section 9.4.2 of Chapter 9, available in appendix 3).

Bellacorick Bog Complex SAC [001922]

- [3160] Natural dystrophic lakes and ponds
- [7230] Alkaline Fens

Killala Bay/ Moy Estuary SAC [000458]

- [1095] Sea Lamprey (*Petromyzon marinus*)
- [1365] Harbour Seal (*Phoca vitulina*)
- [1130] Estuaries
- [1140] Mudflats and sandflats not covered by seawater at low tide.

Killala Bay/ Moy Estuary SPA [004036]

- [A999] Wetlands

The below subsections describe the mitigation measures incorporated into the Proposed Wind Farm Development for the protection of water quality during the construction, operation, and decommissioning phases.

6.2 Mitigation

Apart from the new watercourse crossings and upgrade of existing watercourse crossings (and associated sections of existing forestry tracks) which are described in Section 9.2.2, Chapter 9, Appendix 3, all other areas of the Proposed Wind Farm Development infrastructure are away from areas on the site that have been determined to be hydrologically sensitive. The footprint of the Proposed Wind Farm Development has been specifically designed to avoid the large watercourses within the EIAR Site Boundary (i.e., all significant infrastructure has been located over 50 metres from EPA mapped watercourses),

A description of the various construction methods employed at watercourse crossings are described in, Section 2.2.10.2 of this NIS, Section 4.7, Chapter 4 of the EIAR, and in Chapter 9 – Hydrology and Hydrogeology of the EIAR (included as Appendix 2 of this NIS).

6.2.1 Mitigation employed to prevent Impacts on Water Quality

The prevention of impacts on water quality was considered in the design of all elements of the project and at all stages of the Proposed Wind Farm Development from pre-construction and site set up through to eventual decommissioning. The environmental management framework to be adhered to during the construction phase of the development, including comprehensive detail regarding site set up, pollution prevention and hydrocarbon management, and incorporating the mitigating principles to ensure no adverse impact on the integrity of European Sites as described in the CEMP (Appendix 1 to this NIS). All measures for the protection of water quality during the project design as well as construction, operational and decommissioning phases of the Proposed Wind Farm Development are set out in the following subsections.

6.2.1.1 Mitigation by design

The design of the Proposed Wind Farm Development, as described in Chapter 4 of the EIAR accompanying this application, sets out very clearly how the wind farm including the grid connection has been designed and will be operated in accordance with best industry practice to avoid any significant effects outside the site including the prevention of impacts on watercourses. This design includes suitable precautionary mitigation to make certain that the Proposed Wind Farm Development will not adversely affect the integrity of European sites.

The development has been designed to avoid effects on the watercourses that provide connectivity to relevant European Sites. This section demonstrates how this has been achieved.

- The Proposed Wind Farm Development has been designed so that all infrastructure, except for access roads, is located over 50 metres from watercourses significant watercourses i.e., those mapped by the EPA[3].
- The upgrade of existing access tracks and construction of new tracks will involve some works within 50m of watercourses and new watercourse crossings. However, no instream works are proposed, and a suite of measures are in place to avoid any adverse effects on watercourses. These measures are described in full in the Chapter 9 '*Hydrology and Hydrogeology*' of the EIAR that is included in full as Appendix 2 of this NIS. They are also described in Section 2.2.10.3 of this NIS.
- No vehicle or plant movement or stockpiling of construction materials or construction waste will take place within a 50-metre buffer zone around watercourses during the windfarm construction and no vegetation will be removed from within this zone.
- New site access roads have been designed to minimise excavation arisings, see Section 4.3.2.1 of the EIAR.
- The use of floating roads will result in no excavation and thus no peat arisings are generated. This will further minimise potential for suspended solids generation.
- The development has been designed to maintain a drainage neutral situation to avoid drainage related impacts (See Chapter 9: Water- appendix 2).
- Hard standing areas have been designed to the minimum size necessary to accommodate the turbine model that is selected.

In addition to the above, Fehily Timoney & Company (FT) undertook the peat stability assessment (included as Appendix 8-1 of the accompanying EIAR) following the principles in Peat Landslide Hazard and Risk Assessments: Best Practice Guide for Proposed Electricity Generation Developments (Scottish Executive, 2nd Edition, 2017). The Peat Hazard and Risk Assessment Guide (PHRAG) is used in this report as it provides best practice methods to identify, mitigate and manage peat slide hazards and associated risks in respect of consent applications for electricity generation projects.

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[3] *EPA, 2020, Online map viewer, https://gis.epa.ie/EPAMaps/*

The following summary of the PSA is provided in Section 1 of the same report:

*In summary, the Glenora Wind Farm site has an acceptable margin of safety and is considered to be at **low** risk of peat failure taking into account the proposed mitigation measures and construction controls set out in this report are implemented and is suitable for the Proposed Development.*

6.2.1.2 Construction Phase Mitigation

Mitigation measures have been incorporated into the Proposed Wind Farm Development for the prevention of water pollution. The Proposed Wind Farm Development includes a detailed drainage plan that is included as part of the planning application drawing pack. This plan and all the associated measures have been taken into account in this assessment. The drainage philosophy overall is to minimise waters arising on site, to adequately treat any water that may arise and to ensure that the hydrological function of the watercourses on the site and in the wider catchment are not affected by the proposed works. This philosophy including all associated mitigation measures to protect local surface water quality are fully described in the Construction and Environmental Management Plan (CEMP) and Chapter 9 ('Water' Chapter) of the EIAR, included as Appendix 1 and Appendix 2 respectively.

The Inland Fisheries Ireland (2016): *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*; and the Scottish Natural Heritage (SNH) *Good Practice During Wind Farm Construction* (SNH, 2019, 4th Edition) will also be adhered to.

All detailed mitigation measures for the protection of water quality are fully described below and in Section 4.7 of the accompanying EIAR, section 3.2 of the CEMP (included as an Appendix 1) and Section 9.5, Chapter 9 of the EIAR (provided here in Appendix 2). The following subsections summarize the mitigation measures proposed for the construction phase of the Proposed Wind Farm Development.

6.2.1.2.1 Site Drainage

The proposed site drainage features for this site are outlined in Section 4.7 of the EIAR. The following sections give an outline of drainage management arrangements in terms of pre-construction, construction and operational phases of the Proposed Development.

Pre-Construction Site Drainage

There is an existing drainage network across the site. There are three main watercourses which drain the proposed development site and there are numerous manmade drains that are in place predominately to drain the forestry plantations. This existing drainage system will continue to function as it is during the pre-construction phase.

Prior to commencement of works in sub-catchments across the site, main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.

Drainage and associated pollution control measures will be implemented onsite in conjunction with the main construction works. Where possible drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.

Construction Phase Drainage

The Project Hydrologist will attend the site to set out and assist with the implementation of the proposed drainage controls as outlined in Section 2.5 of the SWMP and shown in the drainage design drawings included in Appendix A of the SWMP. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site.

The implementation of a Schedule of Works Operation Record (SOWOR) will continue through the construction phase of the project. The SOWOR provides number of abandonment triggers which will ensure that site management are well informed as to the level of incident that will require the abandonment of works. The various triggers both pre-commencement and abandonment ensure best practice in terms of water quality management is maintained prior to commencement and during the various felling and construction phases.

Best practice and practical experience on other similar projects suggest that in addition to the drainage plans that are included in and as part of this application, there are additional site-based decisions that can only be made in the field through interaction between the Site Construction Manager, the Project Hydrologist and the Project Geotechnical Engineers. The mechanisms for interaction between these are outlined within Section 4 of this CEMP, which is available in appendix 1.

In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures outlined in Section 6 below, and to ensure protection of all watercourses.

6.2.1.2.2 Forestry Felling

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Keyhole felling to facilitate construction works will take place prior to groundworks commencing.

Water protection measures will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses. These measures are derived from best practice guidance documents as outlined in Section 3.2.3 above. The water protection measures to be adopted during felling operations are set out as follows:

- Machine combinations (i.e. hand-held or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance;
- Trees will be cut manually inside the 50m buffer and using machinery to extract whole trees only;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicles through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and will avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the peat disposal areas.;
- In areas particularly sensitive to erosion or where felling inside the 50 metre buffer is required, double or triple sediment traps will be installed.

- Double silt fencing will also be put down slope of felling areas which are located inside the 50 metre buffer zone;
- All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall (refer to Section 3.2.4.2.2 above) ;
- Timber will be stacked in dry areas, and outside a local 50 metre watercourse buffer. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- No crossing of streams by machinery will be permitted and only travel perpendicular to and away from streams will be allowed;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, trained personnel will be used where refuelling is required;
- A permit to refuel system will be adopted at the site; and,
- Branches, logs or debris will not be allowed to build up in aquatic/buffer zones (refer to Table 3-1 below). All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

Table 6-1 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) will be appointed to oversee the keyhole and extraction works. The ECoW will be experienced and competent, and will have the following functions and operate their record using a Schedule of Works Operation Record (SOWOR), as proposed in the planning application:

- Attend the site for the setup period when drainage protection works are being installed, and be present on site during the remainder of the forestry keyhole felling works.
- Prior to the commencement of works, review and agree the positioning by the Operator of the required Aquatic Buffer Zones (ABZs – refer to Table 3-1 above), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below).

- Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in site operations, prior to the commencement of the works.
- Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix C (Site Monitoring Form (Visual Inspections)) of the *Forestry & Freshwater Pearl Mussel Requirements.*
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
    - Surface water samples will be collected upstream and downstream of the keyhole felling site at suitable sampling locations.
    - Sampling will be taken from the stream / river bank, with no in-stream access permitted.
    - The following minimum analytical suite will be used:
        - pH,
        - Electrical Conductivity,
        - Temperature
        - Total Suspended Solids, Biochemical Oxygen Demand, Total Phosphorus, Ortho-Phosphate, Total Nitrogen, and Ammonia.
- Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions.
- Prepare and maintain a contingency plan.
- Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed.
- Prepare and maintain a Water Protection Measure Register. This document is to be updated weekly by the ECoW.

6.2.1.2.3 Borrow Pit Drainage

While surface water will be contained in the borrow pits area, the design proposal is to control the level of water in the borrow pit area by creating a single point outlet from the basin-like area that will ensure the water does not overtop the pit area. Run-off from the proposed borrow pit area will be controlled via a single outlet that will be installed at the edge of the borrow pit. The single outfall point will be constructed to manage runoff from the borrow pit and its immediate surrounds. Interceptor drains will already have been installed upgradient of the borrow pit area before any extraction begins.

During the construction phase of the project, it will be necessary to keep the borrow pit area free of standing water while rock is still being extracted. This will be achieved by using a mobile pump, which will pump water into the same series of drains, settlement ponds and level spreader, which will receive the water from the single outlet.

6.2.1.2.4 Peat Placement Area Drainage

During the initial placement of excavated material at the peat placement area, silt fences, straw bales and biodegradable matting will be used to control surface water runoff from the repository area. 'Siltbuster' treatment trains will be employed in the unlikely event that previous treatment is not to a high quality.

Drainage from the repository area will ultimately be routed to an oversized swale and a stilling ponds designed for a 24 hour retention time, and for a 1 in 10 year return period, before being discharged to the on-site drains.

The repository area will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised peat/subsoil reinstatement areas will no longer be a potential source of silt laden runoff.

6.2.1.2.5 Floating Road Drainage

Where sections of floating road are to be installed, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths. Large surface water drainage pipes will be placed to form the cross-drains below the level of the proposed road sub-base. These drainage pipes will be extended each side of the proposed road and cable trench construction corridor, along the paths of the existing drains.

With the exception of the installation of cross drains under the floating road corridor, minimal additional drainage will be installed to run parallel to the roads, in order to maintain the natural hydrology of the peatland areas over which the roads will be floated.

6.2.1.2.6 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Will any rainfall cause runoff from the excavated material, the material will be contained in the downgradient cable trench. Excess subsoil will be removed from the cable trench works area immediately upon excavation, and in the case of the Proposed Development, will be transported to one of the peat repository areas, the on-site borrow pit or used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 2.5 of the SWMP will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

6.2.1.2.7 Refuelling, Fuel and Hazardous Materials

The following mitigation measures will be implemented in full to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. On-site refuelling will occur at a controlled fuelling station;
- On-site refuelling will take place using a mobile double skinned fuel bowser;
  - The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery

is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the wind farm.
  - The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages.
  - The fuel bowser will be parked on a level area in the construction compound when not in use.
  - Only designated trained and competent operatives, with a permit to refuel, will be authorised to refuel plant on site.
  - Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
- Onsite refuelling will be carried out by trained personnel only;
- A permit to fuel system will be put in place;
- Taps, nozzles or valves associated with refuelling equipment 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;
- Fuels volumes stored on site will be minimised. The fuel storage areas, within the temporary construction compounds, will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical control buildings (at the substation compound) will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be developed (refer to Section 5 of this CEMP). Spill kits will be available to deal with any accidental spillage in and outside the refuelling area.

6.2.1.2.8 Cement Based Products Control Measures

The following mitigation measures will be implemented in full to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site;
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures.
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. A dedicated concrete wash out area will be established with signage to allow the wash out of concrete delivery vehicle chutes before exiting the site. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. (A dedicated concrete washout area will be established to allow washout of concrete truck chutes before leaving site.)
- Use weather forecasting to plan dry days for pouring concrete;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, and proposed to be built using

straw bales and lined with an impermeable membrane. below. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and will be broken up and disposed of along with other construction waste (refer to Section 3.9 below).

The 50m wide river/stream buffer zone will be in place for the duration of the construction phase. No construction activity will occur within the buffer zone with the exception of bridge and culvert construction. The buffer zone will:

- Prevent any cement-based products accidentally entrained in the construction phase drainage system entering directly into watercourses, achieved in part by ending drain discharge outside the 50m buffer zone and allowing percolation across the vegetation of the buffer zone;
- Provide a buffer against accidental direct pollution of surface waters by any pollutants, or by pollutants entrained in surface water run-off.


Plate 6-1 Typical concrete shoot wash out areas

6.2.1.2.9 Peat Stability Management

Based on the mitigation measures given in the FT's Peat and Spoil Management Plan and Peat Stability Assessment (Appendix 3 of this NIS and Appendix 8-1 of the EIAR, respectively) report being strictly adhered to during construction and the detailed peat stability assessment carried out, it has been showed that the site has an acceptable margin of safety.

The risk assessment at each turbine location identified a number of control measures to further reduce the potential risk of peat failure. Access roads to turbines will be subject to the same relevant control measures that apply to the nearest turbine as detailed in the FT Peat Stability Assessment Report.

The following measures which will be implemented in full during the construction phase of the project will assist in the management of the risks for this site.

The following measures which will be implemented in full during the construction phase of the project will assist in the management of the risks for this site.

- Appointment of experienced and competent contractors;
- The site will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a localised peat movement);
- Undercutting of slopes and unsupported excavations will not occur;
- A managed robust drainage system as set out above;
- Prevent placement of loads/overburden on marginal ground;

- Set up, maintain and report findings from monitoring systems (as outlined in the Geotechnical and Peat Stability Assessment);
- Ensure construction method statements are developed and agreed before commencement of construction and are followed by the contractor; and,
- Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction.
- Maintain hydrology of area as far as possible by maintaining existing drains to water pressures in the peat to avoid peat becoming “boyant”.
- Use of experienced geotechnical staff for site investigations
- Use of experienced contractors and trained operators to carry out the work.
- Detailed ground investigation to determine peat, mineral soil and bedrock condition and properties.
- Potential requirement for small buttress on upslope side of access road to retain peat will any instability be noted.

6.2.1.2.10 Dust Control

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e., soil, sand, peat, etc. and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction site traffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures that will be implemented in full to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- The designated public roads outside the site and along the main transport routes to the site will be regularly inspected by the Environmental Clerk of Works (ECoW) for cleanliness, and cleaned as necessary;
- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind;
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary;
- All construction related traffic will have speed restrictions on un-surfaced roads to 15 kph;
- Daily inspection of construction sites to examine dust measures and their effectiveness.
- When necessary, sections of the haul route will be swept using a truck mounted vacuum sweeper; and,
- All vehicles leaving the construction areas of the site will pass through a wheel washing area prior to entering the local road network.

6.2.1.2.11 Monitoring

As described in the CEMP, see Appendix 1 of the NIS, daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work should immediately be stopped, and a geotechnical assessment undertaken.

Turbidity monitors, or sondes, will be installed at locations surrounding the wind farm site. The sondes will provide continuous readings for turbidity levels in the watercourse. This equipment will be supplemented by daily visual monitoring at their locations. This will be supplemented by field chemistry measurements. The likely suite of determinants will include:

- pH (field measured)
- Electrical Conductivity (field measured)
- Temperature (field measured)
- Dissolved Oxygen (field measured)
- Total Phosphorus
- Chloride
- Nitrate
- Nitrite
- Total Nitrogen
- Ortho-Phosphate
- Ammonia N
- Biochemical Oxygen Demand
- Total Suspended Solids

The above measures will both determine that the proposed mitigation measures are working as planned as well as informing the need for any alterations to the onsite mitigation and drainage design. All such measures will be overseen and implemented by a dedicated project Environmental Clerk of Works.

6.2.1.3 Operation Phase Mitigation

The operational phase drainage measures incorporated into the Proposed Wind Farm Development design will remain in place for the duration of the project to avoid any potential operational phase run-off from hard stands. Details of all proposed drainage measures incorporated into the Proposed Wind Farm Development are fully described in Section 4.7, Chapter 4 of the EIAR, Section 9.5.4 and Chapter 9 (Appendix 2) and the Surface Water Management Plan available in Appendix 4-4 of the EIAR. The below measures are a summary of the main water protection measures incorporated into the design of the Proposed Wind Farm Development. They will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Some interceptor drains will be left in place, upgradient of the proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader.
- Swales/roadside drains will remain in place to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling;
- Check dams will be put in place at regular intervals along interceptor drains and swales/roadside drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds, along with the entire drainage network, will be ongoing through the construction period.

With the implementation of the proposed wind farm drainage measures as outlined above, there will be no potential for impact on downstream watercourses and thus no potential for adverse effect on downstream EU designated sites.

6.2.1.4 Decommissioning Phase Mitigation

The wind turbines proposed as part of the Proposed Development are expected to have a lifespan of 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Development will be decommissioned fully. The onsite substation will remain in place as it will be under the ownership of the ESB and will form a permanent part of the national electricity grid.

Upon decommissioning of the Proposed Development, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and will be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration. Site roadways will be left in situ, for future forestry operations. The amenity and recreation infrastructure will also be left in-situ. Underground cables, including grid connection, will be removed and the ducting left in place.

7. ASSESSMENT OF RESIDUAL ADVERSE EFFECTS

The potential for residual adverse effects on each of the individual relevant Qualifying Features of the Screened In European Sites following the implementation of mitigation, is assessed in this section of the report.

Based on the above, in view of best scientific knowledge, on the basis of objective information, there is no potential for adverse effect on the identified QIs/SCIs and their associated targets and attributes, or on any European Site Potential pathways for effect have been robustly blocked through measures to avoid impacts and the incorporation of best practice/mitigation measures into the project design.

Taking cognisance of measures to avoid impacts and best practice/mitigation measures incorporated into the project design which are considered in the preceding section, the Proposed project will not have an adverse effect on the integrity of any European Site.

The proposed project will not prevent the QIs/SCIs of European Sites from achieving/maintaining favourable conservation status in the future as defined in Article 1 of the EU Habitats Directive (92/43/EEC), A definition of Favourable Conservation Status is provided below:

> *'Conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2; The conservation status will be taken as 'favourable' when:*
>
> - *Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
> - *The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
> - *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.'*

Based on the above, it can be concluded in view of best scientific knowledge, on the basis of objective information that the Proposed project will not adversely affect the Qualifying Interests/Special Conservation Interests associated with any European Site.

8. ASSESSMENT OF CUMULATIVE EFFECTS

A search and review in relation to plans and projects that may have the potential to result in cumulative and/or in-combination impacts on European Sites was conducted. This assessment focuses on the potential for cumulative in-combination effects on the European Sites where potential for adverse effects was identified in Section 4 of this report. This included a review of online Planning Registers, development plans and other available information and served to identify past and future plans and projects, their activities and their predicted environmental effects. A list of the plans and projects considered is provided in **Appendix 5.**

Assessment material for this in-combination impact assessment was compiled on the relevant developments within the vicinity of the Proposed Wind Farm Development and was verified on the 21/11/2023. The material was gathered through a search of relevant online Planning Registers, reviews of relevant documents, planning application details and planning drawings, and served to identify past and future projects, their activities and their environmental impacts. All relevant projects were considered in relation to the potential for in-combination effects. All relevant data was reviewed (e.g., individual EISs/EIARs, layouts, drawings etc.) for all relevant projects where available. The plans and projects considered include those listed in **Appendix 5**.

The dominant land uses in the area were also considered in the assessment, these included forestry, pastoral agriculture and turbary.

Following the detailed assessment provided in the preceding sections, it is concluded that, the Proposed Wind Farm Development will not result in any residual adverse effects on any of the European Sites, their integrity or their conservation objectives when considered on its own. There is therefore no potential for the Proposed Wind Farm Development to contribute to any cumulative adverse effects on any European Site when considered in-combination with other plans and projects.

In the review of the projects that was undertaken, no connection, that could potentially result in additional or cumulative impacts was identified. Neither was any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the Proposed Wind Farm Development.

Taking into consideration the reported residual impacts from other plans and projects in the area and the predicted impacts with the current proposal, no residual cumulative impacts have been identified with regard to any European Site.

9. CONCLUDING STATEMENT

This NIS has provided an assessment of all potential direct or indirect adverse effects on European Sites.

Where the potential for any adverse effect on any European Site has been identified, the pathway by which any such effect may occur has been robustly blocked through the use of avoidance, appropriate design and mitigation measures as set out within this report and its appendices. The measures ensure that the construction and operation of the Proposed Wind Farm Development does not adversely affect the integrity of European sites.

Therefore, it can be objectively concluded that the Proposed Wind Farm Development individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site

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APPENDIX 1

CONSTRUCTION AND ENVIROMENTAL MANAGEMENT PLAN

Construction and Environmental Management Plan

Proposed Glenora Wind Farm

DOCUMENT DETAILS

Client:	**Glenora Wind Farm Development Activity Company**
Project Title:	**Proposed Glenora Wind Farm**
Project Number:	**201120**
Document Title:	**Construction and Environmental Management Plan**
Document File Name:	**CEMP F – 2023.12.13 - 201120**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

MKO Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Final	13/12/2023	JF	EM

Table of Contents

1. INTRODUCTION

This Construction and Environmental Management Plan (CEMP) has been developed by MKO on behalf of Glenora Wind Farm Designated Activity Company (DAC) who intend to apply to An Bord Pleanála for planning permission for the construction of a wind energy development, comprising 22 no. wind turbines and associated infrastructure in Glenora and adjacent townlands near, Ballycastle, Co. Mayo (the "Proposed Development").

The CEMP has been prepared in conjunction with the Environmental Impact Assessment Report (EIAR) and the Natura Impact Statement (NIS) which will accompany the planning application for the Proposed Development to be submitted to the competent authorities. Should the Proposed Development secure planning permission, the CEMP will be updated, in line with all conditions and obligations which apply to any grant of permission. The CEMP will be read in conjunction with the EIAR and planning drawings. The CEMP will also require updating by the selected contractor in order to identify, assess and satisfy the contract performance criteria as set out by the various stakeholders. The CEMP due to its structure and nature will also require constant updating and revision throughout the construction period as set out below. Therefore, this is a working document and will be developed further prior to and during the construction phase of the Proposed Development.

Triggers for updates to the CEMP will comprise:

- When there is a perceived need by the Applicant to improve performance in an area of environmental impact taking into account monitoring results;
- As a result of changes in environmental legislation applicable and relevant to the Proposed Development.
- Where the outcomes from auditing establish a need for change.
- Where Work Method Statements identify changes to a construction methodology to address high environmental risk; and
- As a result of an incident or complaint occurring that necessitates an amendment.

This plan provides the environmental management framework to be adhered to during the pre-commencement and construction phases of the Proposed Development and it incorporates the mitigating principles to ensure that the work is carried out in a way that minimises the potential for any environmental impacts to occur. This document will be a key contract document that the contractor will be required to implement to ensure protection of the environment.

This report is intended as a single, amalgamated document that can be used during the future phases of the project, as a single consolidated point of reference relating to all construction, environmental and drainage requirements for the Planning Authority, developer, and contractors alike.

1.1 Scope of the Construction and Environmental Plan

This report is presented as a guidance document for the pre-commencement and construction phases of the Proposed Development. Where the term 'site' is used in the CEMP it refers to all works associated with the Proposed Development (refer to Section 1.4.1 in Chapter 1 of the EIAR). The CEMP outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner.

The report is divided into nine sections, as outlined below:

- Section 1 provides a brief introduction as to the scope of the report.

- Section 2 outlines the Site and Proposed Development details, detailing the targets and objectives of this plan along with providing an overview of construction methodologies that will be adopted throughout the project.
- Section 3 sets out details of the environmental controls that will be implemented on site. Site drainage measures, peat stability monitoring measures and a waste management plan are also included in this section.
- Section 4 sets out a fully detailed implementation plan for the environmental management of the project outlining the roles and responsibilities of the project team.
- Section 5 outlines the Emergency Response Procedure to be adopted in the event of an emergency in terms of site health and safety and environmental protection.
- Section 6 consists of a summary table of all mitigation proposals to be adhered to during the Proposed Development, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 7 consists of a summary table of all monitoring requirements and proposals to be adhered to during the Proposed Development, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.
- Section 8 sets out a programme for the timing of the works.
- Section 9 outlines the proposals for reviewing compliance with the provisions of this report.

2. SITE AND PROJECT DESCRIPTION

2.1 Site Location

The core of the Proposed Development site is located approximately 6km southwest of Ballycastle Co. Mayo.

Access to the Proposed Development site, for Light Goods Vehicles (LGV), Heavy Goods Vehicles (HGV) and abnormal loads (e.g. turbine components) will be via an existing forestry access road, in the northeast of the site, off a local public road which in turn is accessed from the R314 Regional Road.

It is intended to connect the Proposed Development to the national electricity grid via a 110kV underground cable which will connect the Glenora Wind Farm 110kV substation to the existing Tawnaghmore 110kV substation, located 14km southeast of the intended on-site 110kV substation, in the townland of Tawnaghmore Upper, Co. Mayo. The grid connection cabling route will measure approximately 28km in length. Neither the on-site substation nor the grid connection cabling route form part of the planning application, however, they are assessed in this EIAR.

Works required along the intended turbine delivery route, between Galway Port and the local road in the townland of Ballyglass, Co. Mayo, do not form part of the planning application, however, they have been assessed as part of this EIAR.

A full and detailed description of the Proposed Development (Glenora Wind Farm) for the purposes of the planning application and the additional elements that form part of the overall project, assessed in this EIAR, is contained in Chapter 4 of this EIAR. For the purposes of this EIAR, the wind farm, substation, grid connection and turbine delivery route accommodation works are collectively referred to as the “Proposed Development”. The substation and grid connection are included in the Proposed Development for the purposes of the assessment in the EIAR, however it is not included in the planning application.

The townlands within which the project (i.e. the main proposed wind farm site, the on-site substation the grid connection cabling route and turbine delivery route accommodation works) is located are listed in Table 1-1. All townlands are located in Co. Mayo.

Table 2-1 Townlands within which the Proposed Development is located.

Townlands within which the Proposed Development is located:	
Proposed Wind Farm Development	
Glenora	Lugnalettin
Altderg	Ballykinlettragh
Keerglen	Ballyglass
Glencullin	Aghoo
Killeena	Ballycastle
Intended Wind Farm Substation Location and Grid Connection Cabling Route	
Glenora	Glencullin

Sralagagh East	Aghoo
Killeena	Ballyglass
Ballycastle	Ballinglen
Annagh More	Anna Beg
Creevagh Beg	Creevagh More
Farmhill	Kincon
Ardnagor	Kinnavally
Rathnadoffy	Ballinagavna
Lecarrowanteean	Ballygowan
Kilogunra	Knockaunderry
Cloonalough	Coolcran
Cloonmaan	Farragh
Cloonfadda	Cloonawilin
Magherabrack	Mullafarry
Lisglennon	Tawnaghmore Upper
Intended Turbine Delivery Route Accommodation Works	
Ballyglass East	

2.2 Description of the Development

The proposed wind farm development comprises the construction of 22 No. wind turbines and all associated works. The proposed turbines will have a total tip height of 162 metres above the top of the foundation. The applicant is seeking a ten-year planning permission. The full description of the proposed wind farm development, as per the public planning notices, is as follows:

The Proposed Development comprises:

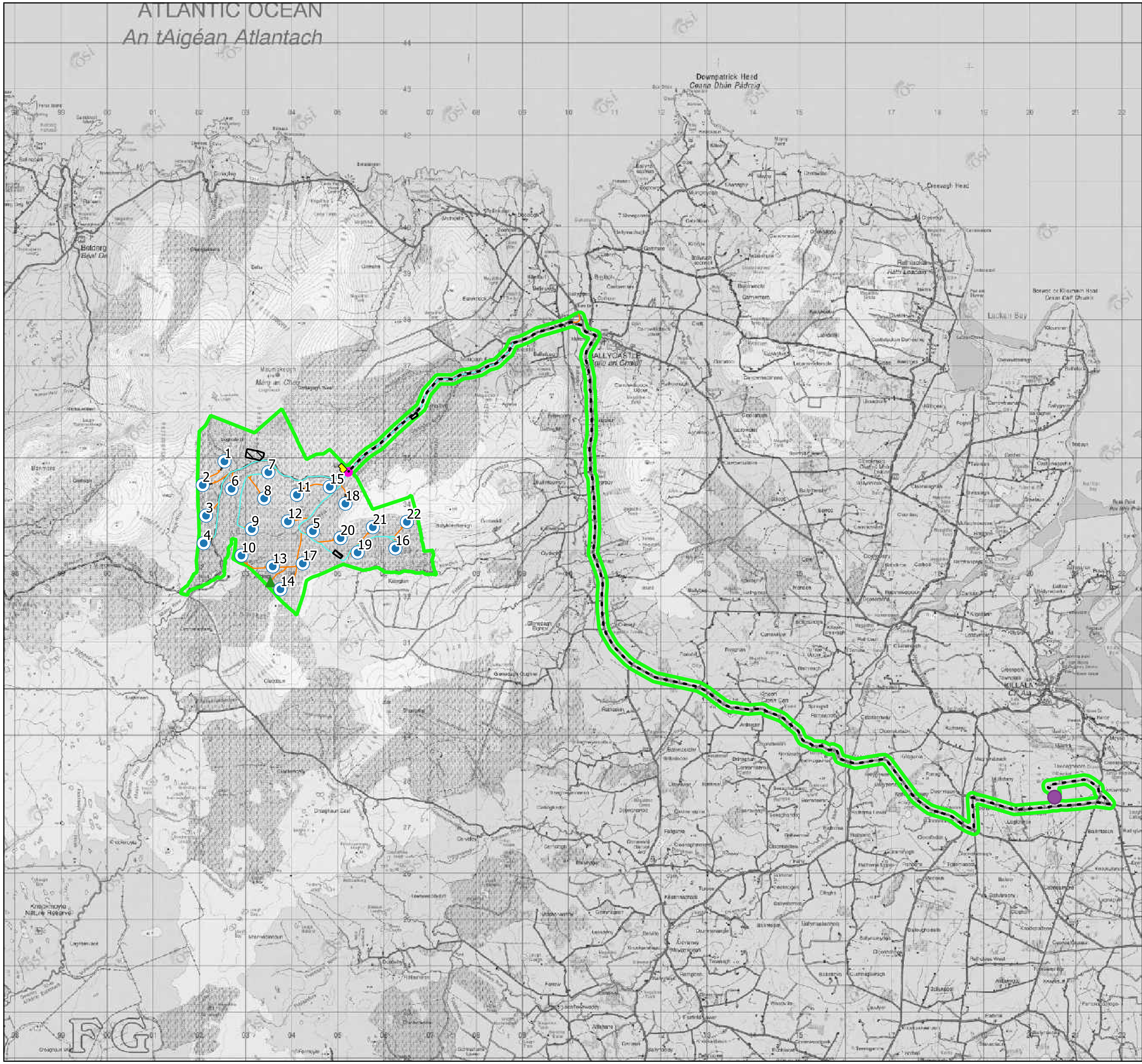
1. *The construction of 22 no. wind turbines and all associated hard-standing areas with the following parameters:*
    a. *A total blade tip height of 180m,*
    b. *Hub height of 99m, and*
    c. *Rotor diameter of 162m.*
2. *1 no. permanent Meteorological Anemometry Masts with a height of 99 m and associated hardstanding area;*
3. *Upgrade of existing tracks and roads, provision of new permanent site access roads and upgrade of 1 no. existing site entrance including the provision of 1 no. security cabin with automatic traffic barriers;*

4. *Temporary widening of sections of public road in the townland of Ballyglass;*
5. *The provision of a new temporary roadway in the townland of Ballyglass to facilitate the delivery of turbine components and other abnormal loads;*
6. *1 no. wind farm operation and maintenance control building in the townland of Glenora;*
7. *3 no. borrow pits.*
8. *13 no. permanent peat placement areas.*
9. *5 no. temporary construction compounds with temporary site offices and staff facilities;*
10. *Permanent recreation and amenity works, including marked trails, seating areas, amenity car park, and associated amenity signage;*
11. *Site drainage;*
12. *Site Signage;*
13. *Ancillary forestry felling to facilitate construction and operation of the proposed development;*
14. *All works associated with the habitat enhancement and biodiversity management within the proposed wind farm site;*
15. *All associated site development works and ancillary infrastructure.*

This application is seeking a ten-year permission and 35 year operational life from the date of commissioning of the renewable energy development.

All elements of the Proposed Development described in the list above together with the entire turbine delivery route, the intended on-site electricity substation and grid connection route have been assessed in this EIAR and are described in detail in Chapter 4 of the EIAR.

The layout of the Proposed Development is shown on Figure 2-1a and 2-1b.



Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Met Mast
- Proposed Borrow Pit Locations
- Proposed New Roads
- Proposed Upgrades to Existing Roads
- Proposed Security Cabin Location
- Proposed Substation
- Proposed Grid Connection Route
- Tawnaghmore Substation

Drawing Title	Proposed Site Layout
Project Title	Glenora Wind Farm
Drawn By: JF	Checked By: EMC
Project No.: 201120	Drawing No.: Fig. 2-1a
Scale: 1:80,000	Date: 2023-12-05

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Map Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Proposed Met Mast
- Proposed Borrow Pit Locations
- Proposed New Roads
- Proposed Upgrades to Existing Roads
- Proposed Security Cabin Location
- Proposed Substation
- Proposed Grid Connection Route

N

Drawing Title	
Core of the Proposed Site Layout	
Project Title	
Glenora Wind Farm	
Drawn By: JF	Checked By: EMC
Project No.: 201120	Drawing No.: Fig. 2-1b
Scale: 1:20,000	Date: 2023-12-05

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2.3 Targets and Objectives

In so far as the designs that have been completed to date, or are to be further completed in future, the construction phase works are designed to approved standards, which include specified materials, standards, specifications and codes of practice. The design of the project has considered environmental issues and this is enhanced by the works proposals.

The key site targets are as follows;

- Ensure construction works and activities are completed in accordance with mitigation and best practice approach presented in the EIAR, NIS and associated planning documentation;
- Ensure construction works and activities are completed in accordance with all planning documents for the development;
- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community;
- Ensure construction works and activities have minimal impact on the natural environment;
- Adopt a sustainable approach to construction; and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Using recycled materials if possible, e.g. excavated stone, overburden and peat material;
- Ensure sustainable sources for materials supply where possible;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Avoidance of vandalism;
- Keeping all watercourses free from obstruction and debris;
- Correct implementation of the sustainable drainage system (SuDS) drainage design principles;
- Keep impact of construction to a minimum on the local environment, watercourses, and wildlife;
- Correct fuel storage and refuelling procedures to be followed;
- Good waste management and house-keeping to be implemented;
- Air and noise pollution prevention to be implemented;
- Monitoring of the works and any adverse effects that it may have on the environment. Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Comply with all relevant water quality legislation listed throughout this document; and,
- Ensure a properly designed, constructed and maintained drainage system appropriate to the requirements of the site is kept in place at all times.

2.4 Construction Methodology Overview

2.4.1 Introduction

An experienced main contractor will be appointed for the civil works for the construction phase of the Proposed Development. The appointed contractor for the works will be required to comply with this CEMP and any revisions made to this document in the preparation of method statements for the various elements of the construction phase of the proposed development. An overview of the proposed Construction and Demolition Methodologies is provided below.

2.4.2 Overview of Proposed Construction Methodology

The proposed anticipated construction methodology is summarised under the following main headings:

- Temporary Construction Compounds;
- Borrow Pits;
- Peat Placement Areas
- Tree Felling;
- Site Drainage Systems;
- Site Access Roads;
- Turbine and Meteorological Mast Foundations;
- Crane Hardstands;
- Onsite Electricity Substation, Control Buildings;
- Site Underground Cabling
- Grid Connection Construction Methodology
  - Existing Underground Services
  - Joint Bays
- Culvert Crossings on the Wind Farm Site
- Watercourse Crossings
- Operation and Maintenance Control Building

2.4.3 Temporary Construction Compounds

There are five temporary construction compounds proposed for the site. The location of the compounds are shown in Figure 2-1b. It is proposed to construct the compounds as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds (refer to Section 3.2.2 below) will be installed around the perimeter;
- The compound will be established using a similar technique as the construction of the excavated site roads as discussed in Section 2.4.8 below;
- Prior to the commencement of groundworks and where required by the Project Geotechnical Engineer, a layer of geogrid will be installed and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc.
- If necessary, the compound will be fenced and secured with locked gates, although fencing would only be utilised where significant risk of danger to third parties or vandalism is envisaged; and,
- Upon completion of the project, all compounds except for the primary construction compound (CC1) 2.7km from the substation will be decommissioned by backfilling the area with the material arising during excavation, landscaping with peat material as required.
- One half of Construction Compound no.1 will be utilised as an amenity car park upon the commissioning of the proposed wind farm.
- The other half of Construction Compound no. 1 will be used as the location for the Operation and Maintenance building (refer to Section 2.4.X below).
- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor as required and will be removed from the site on completion of the construction phase.

- The water supply to the site will be from a temporary water storage tank which will be filled using a mobile water tank which will source water locally as required.

2.4.4 Borrow Pit

It is proposed to develop three on-site borrow pits. The location of the borrow pits are shown in Figure 2-1b. The borrow pit will be excavated and backfilled, as outlined in Appendix 4-2 Peat and Spoil Management Plan, as follows:

- The rock within the proposed borrow pit footprints will be removed by either breaking or blasting depending on its excavatability, which will be determined from a confirmatory ground investigation carried out at the proposed borrow pits. The ground investigation will comprise rotary core drilling with associated engineering logging including rock quality designation and strength and durability testing. From site observations of rock exposures breaking is most likely to be suitable to remove the rock, however at depth some blasting may also be required.
- It is proposed to construct the borrow pits so that the base of the borrow pits are below the level of the adjacent section of access road.
- Slopes within the excavated rock formed around the perimeter of the borrow pits will be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes will be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.
- The stability of the rock faces within the borrow pits will be inspected by the Project Geotechnical Engineer upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock, in line with best practice guidelines.
- It will be necessary to construct rock buttresses founded on in-situ rock within the borrow pits to create individual cells (up to 6 no. depending on the borrow pit). The cells will be opened in sequence and filled as needed. The rock buttresses will be constructed of rock fill from the borrow pit excavation, placed and compacted in layers. The founding stratum for each rock buttress will be inspected and approved by the Project Geotechnical Engineer.
- The rock buttresses will be constructed in stages to allow infilling of peat and spoil within cells. The buttress will be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat and spoil.
- Infilling of the peat and spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress, allowing the borrow pit to be developed and infilled in cells. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be reinstated safely.
- A number of rock buttresses to form cells within the borrow pits will be required to ensure access for trucks and excavators can be achieved. See Drawings P20-312-0600-GLEN-0009 to 0011 for the location of the rock buttresses. The locations of the rock buttresses shown on Drawings P20-312-0600-GLEN-0009 to 0011 for the borrow pit are indicative only and may change subject to local conditions encountered on site during construction, or as a result of the confirmatory ground investigation.
- The rock buttresses will be wide enough (up to 4m) to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The permanent side slopes of the rock buttress will be constructed at 40 to 60 degrees.
- A rock buttress will be required on the downslope side of the borrow pits to safely retain the infilled peat and spoil. The height of the berm constructed will be greater

than the height of the reinstated peat and spoil to prevent any surface peat and spoil run-off. A berm of up to 8m in height will be constructed.
- The rock buttress will be founded on mineral soil or bedrock i.e., competent strata. Either material will be suitable provided a minimum shear strength of 75kPa is achieved (if the overburden material is cohesive). The founding stratum for the rock buttress will be inspected and approved by the Project Geotechnical Engineer.
- A level surface in the underlying mineral soil or bedrock will be prepared before placing and compacting the rock fill used to construct the perimeter berms.
- In order to prevent water retention occurring behind the buttresses, the buttress will be constructed of coarse boulder fill with a high permeability. The buttress will be constructed of well graded granular rock fill of 100mm up to 500mm in size. In addition, drains will be placed through the buttresses to allow excess water to drain.
- A layer of geotextile will be placed on the inside face of the perimeter berm to act as a seperatopr layer between the berm and the placed peat/spoil, to prevent the placed peat/spoil infilling any voids on the inside face of the berm, maintaining the permeability of the berm.
- The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil will be required.
- The surface of the placed peat and spoil will be shaped following backfill using excavators to allow efficient run-off of surface water from the placed arisings towards the perimeter of the borrow pit.
- As the berms are slightly higher than the retained peat, drains will be provided at regular intervals through the berms, at the same level as the top of the peat surface, to prevent ponding of water around the edges of the repositories. These drains will be 150mm diameter flexible plastic drainage pipe or equivalent.
- A layer of geogrid to strengthen the surface of the placed peat and spoil within the borrow pits will be required.
- An interceptor drain will also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.
- Temporary control of groundwater within the borrow pits will be required and exact measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations will be required during construction.
- Settlement ponds will be constructed at the lower side/outfall location of the borrow pits.
- The acrotelm will be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the peat and spoil within the borrow pits.
- Supervision by the Project Geotechnical Engineer will be carried out for the development of the borrow pits.
- All the above-mentioned general guidelines and requirements will be implemented by the Contractor during construction.

Post-construction, the borrow pit areas will be permanently secured and a stock-proof fence will be erected around the borrow pit areas to prevent access to these areas. Appropriate health and safety signage will also be erected on this fencing and at locations around the fenced area.

2.4.5 Peat Placement Areas

A number of areas within the site have been identified as suitable for the placement of peat and are shown in Figure 2-1b. The peat placement areas are located adjacent to the hardstands and foundations of 9 no. turbine bases and hardstands (14 no. individual peat placement areas proposed). These areas have been selected based on a combination of the depth of peat, the recorded peat strength in the area and the slope angle. A check of peat stability in each area was also undertaken, allowing for the additional loading from 1.3m of stored peat and these results are included in the Peat Stability Assessment Report (FT, 2023).

The placement of peat and spoil within the repository area will be undertaken as follows:

- Excavated peat will be placed/spread across the clearfell areas around 9 no. of the proposed turbines. These locations are shown in Drawing P20-312-0600-GLEN-0005.
- The peat placed within the areas shown on Drawing P20-312-0600-GLEN-0005 will be restricted to a maximum height of 1.3m. Weak/liquified peat will be placed within the proposed borrow pits and not stored within these areas.
- The placement of excavated peat will be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the placement areas will require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.
- Where there is any doubt as to the stability of the peat surface then no material will be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.
- It will be ensured that the surface of the placed peat will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the peat placement area progresses. This will reduce the likelihood of debris run-off and reduce the risk of instability of the placed peat.
- Finished/shaped side slopes in the placed peat and spoil will be not greater than 1 (v): 4 (h). This slope inclination will be reviewed during construction, as appropriate.
- The acrotelm will be placed on the finished surface with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat and spoil within the placement areas.
- Movement monitoring instrumentation will be placed around the areas where peat has been placed. The locations where monitoring is required will be identified by the Project Geotechnical Engineer on site.
- Supervision by the Project Geotechnical Engineer will be carried out for the works.
- An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.
- All the above mentioned general guidelines and requirements will be undertaken by the Contractor during construction.

2.4.6 Tree Felling

The majority of the site (63.9%) currently comprises commercial coniferous forestry plantation. As part of the Proposed Development, tree felling will be required within and around the development footprint to allow the construction of turbine bases, access roads and the other ancillary infrastructure.

A total of 116 hectares of forestry will be permanently felled within and around the footprint of the Proposed Development in order to facilitate infrastructure construction and turbine erection.

The tree felling activities required as part of the Proposed Development will be the subject of a Limited Felling Licence (LFL) application to the Forest Service in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments.

The estimated 116 hectares that will be permanently felled for the footprint of the turbines and the other infrastructure and turbine erection will be replaced or replanted on a hectare for hectare basis as a condition of any felling licence that might be issued in respect of the proposed wind farm development. Replanting is a requirement of the Forestry Act and is primarily a matter for the statutory licensing processes that are under the control of the Forest service.

The proposed methodology for the forestry felling activities is as follows:

Felling works will conform to current best practice Forest Service policies and strategic guidance documents as well as Coillte produced guidance documents, including the specific guidelines listed below, to ensure that the felling works provides minimal potential impacts to the receiving environment.

- 'Standards for Felling and Reforestation' (Department of Agriculture, Food and the Marine, 2019)
- 'Forest Operations & Water Protection Guidelines' (Coillte, 2009)
- 'Methodology for Clear Felling Harvesting Operations' (Coillte, 2009)
- 'Forestry and Water Quality Guidelines' (Forest Service, 2000)
- 'Forestry Biodiversity Guidelines' (Forest Service, 2000)
- 'Forestry Protection Guidelines' (Forest Service, 2002)
- 'Forestry Harvesting and Environmental Guidelines' (Forest Service, 2000)

The proposed methodology that will be implemented for the forestry felling activities is as follows:

- The extent of all necessary forestry felling areas will be identified and demarcated with markings on the ground in advance of any felling commencing.
- All roads and culverts will be inspected by the Environmental Clerk of Works (ECoW) and contractor prior to any machinery being brought on site to commence the felling operation.
- Existing drains that drain an area to be felled towards surface watercourses will be blocked, and temporary silt/sediment traps (i.e., check dam / silt fence) will be constructed to ensure collection of all silt within felling areas. These temporary silt traps will be cleaned out and backfilled once felling works are complete. This ensures there is no residual collected silt remaining in blocked drains after felling works are completed.
- New collector drains and sediment traps will be installed during ground preparation to intercept water upgradient of felling areas and divert it away. Collector drains will be excavated at an acute angle to the contour (0.3%-3% gradient), to minimise flow velocities.
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated.
- Sediment removed from traps will be carefully disposed of in the peat repository areas.
- Machine combinations (i.e., hand-held or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance; however, the general proposed machine combination will comprise a harvester and a low-ground pressure harvester with a 14-tonne bunk capacity.
- Trees will be cut manually inside the 50m construction watercourse buffer and using machinery to extract whole trees only;
- Brash mats will be put in place to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur.
- Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.
- No tracking of vehicles through watercourses will occur. Vehicles will only use existing road infrastructure and established watercourse crossings.
- Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations.
- Extraction routes, and hence brash mats, will be aligned parallel to the ground contours where possible.
- Harvested timber will be stacked in dry areas, and outside any 50-metre watercourse buffer zone prior to removal off site.

2.4.7 Site Drainage Systems

The early establishment of temporary drainage facilities will manage the risk of impacts on watercourses on and adjacent to the site during construction. In addition, construction operations will adopt best working practices which are outlined in Section 3.2.3 below. The development of the site will be phased accordingly. The construction of the drainage will start from the downstream sections and progress upstream, connecting conveyance systems with other drainage features as each development phase progresses. They will be designed with sufficient flexibility to respond to an early phase incoming flow during the construction phase.

Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated, and settlement ponds constructed to eliminate any suspended solids within surface water running off the site. Surface water management and drainage design is dealt with in Section 3.2, Section 4.7 of the EIAR and in the Surface Water Management Plan (included as Appendix 4-4 of the EIAR).

2.4.8 Site Access Roads

The road construction design has taken into account the following key factors as stated in the Fehily Timoney & Company's (FT) Peat & Spoil Management Plan in Appendix 4-2 of the EIAR:

- Buildability considerations
- Maximising use of existing infrastructure
- Minimise excavation arisings
- Serviceability requirements for construction and wind turbine delivery and maintenance vehicles
- Requirement to minimise disruption to peat hydrology

Whilst the above key factors are used to determine the road design the actual construction technique employed for a particular length of road are determined on the prevailing ground conditions encountered along that length of road.

The proposed upgrade to existing roadways and construction of new roadways will incorporate passing bays to allow traffic to pass easily while traveling around the site.

The 3 no. road construction types proposed are as follows:

- Upgrading of Existing Access Roads
- Construction of new excavated roads through peat
- Construction of new floated roads over peat

The locations where the above construction types are proposed is shown in Table 2-1 of the Peat & Spoil Management Plan. This document is included as Appendix 4-2 of this EIAR.

2.4.8.1 Upgrades to Existing Roads or Tracks

It is proposed to utilise the existing road network at the Proposed Development site as much as possible (15.4km is proposed to be used). The general construction methodology for upgrading of existing sections of excavated and floating roads or tracks, as presented in FTC's Peat & Spoil Management Plan in Appendix 4-2, is summarised below. This methodology includes procedures that will be included in the construction methodology to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in Chapter 4 and 9 of the EIAR.

- Access road construction will be to the line and level requirements as per design/planning conditions.
- For upgrading of existing excavated access roads (Type A) the following guidelines will be implemented in full:
    - Excavation of the widened section of access road will take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.
    - Benching of the excavation may be required between the existing section of access road and the widened section of access road where the depth of excavation exceeds 500mm.
    - The surface of the existing access track will be overlaid with up to 500mm of selected granular fill.
    - Access roads will be finished with a layer of capping across the full width of the track.
    - A layer of geogrid/geotextile will be implemented at the surface of the existing access road and at the base of the widened section of access road (to be confirmed by the designer).
    - For excavations in peat, side slopes will be not greater than 1(v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.
- The finished road width will have a running width of 5m, with wider sections on bends and corners.
- On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.
- At transitions between new floating and existing excavated roads a length of about 10 to 20m will have all peat excavated and replaced with suitable fill. The surface of this fill will be graded to accommodate wind turbine construction and delivery traffic.

2.4.8.2 Construction of New Excavated Roads

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site. The proposed locations for new access roads on site are shown in Figure 2-1b.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in willow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

- Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.
- Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.
- Excavation of roads will be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.
- Road construction will be carried out in sections of approximately 50m lengths i.e., no more than 50m of access road will be excavated without re-placement with stone fill.
- Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pits. All peat placement areas will be upslope of founded roads/hardstands and will be inspected by the Projects Geotechnical Engineer before material is stored in the area.
- Excavation of materials with respect to control of peat stability:

  - Where acrotelm (top about 0.3 to 0.4m of peat) is required for landscaping it will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.
  - Where possible, the acrotelm will be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.
  - All catotelm peat (peat below about 0.3 to 0.4m depth) will be transported immediately on excavation to the designated peat placement areas.
- Excavated side slopes in peat will not be greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.
- End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the adjacent peat, is limited.
- The excavated access road will be constructed with a minimum of 800mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works.
- Access roads will be finished with a layer of capping across the full width of the roads.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum where cohesive material is present to prevent mixing of the underlying material with the granular fill.
- Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 2m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.
- A final surface layer will be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.
- The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis (by the Site manager/ECoW/Project Geotechnical Engineer) during the works, particularly before/following trafficking by heavy vehicular loads.

2.4.8.3 Construction of New Floated Roads Over Peat

In a number of areas across the site of the Proposed Development it will be necessary to construct floating roads over peat. The use of new floated access tracks will be limited on site to areas of flatter terrain, i.e., less than a 3-degree slope.

The general construction methodology for the construction of floating, as presented in FTC's Peat and Spoil Management Plan in Appendix 4-2 of the EIAR, is summarised below.

- Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.
- Base geogrid will be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
- Construction of road will be in accordance with appropriate design from the designer.
- The make-up of the new floated access road will be up to 1,000mm thickness of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator.
- Granular fill will be placed in layers and compacted in accordance with the TII Specification for Road Works.

- Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.
- The finished road width will have a running width of 5m, with wider sections on bends and corners.
- Stone delivered to the floating road construction areas will be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat will not be carried out.
- To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road will be tipped over at least 10m length of constructed floating road.
- Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road will carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.
- Following end-tipping a suitable bulldozer will be employed to spread and place the tipped stone over the base geogrid along the line of the road.
- A final surface layer will be placed over the full width of the floating road to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

2.4.8.4 General Construction Guidelines for Access Roads

The following general construction guidelines will be implemented for the access roads on site.

- Where an open ditch is present alongside an existing/proposed floating access track, the ditch will need to be filled prior to upgrading/constructing the access track. The ditch will be filled with suitable drainage stone. As applicable, a perforated pipe will be laid into a ditch prior to filling so as to maintain water flow within the ditch.
- Where existing drainage crosses the road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded access road. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.
- No excavations (e.g., drainage, peat cuttings) will be carried out within 5m distance of a completed floated access road edge, or at a distance determined following site inspection. The presence of excavations can destabilise the road. Temporary excavations will be excavated in short lengths and backfilled as soon as practicable.
- Floating roads will not be constructed on areas of sidelong ground.
- No stockpiling of materials will take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.
- End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.
- Due to the nature of floating road construction, it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2m). These surveys points will be surveyed on a weekly basis, and more frequently when construction activities are ongoing in the area.
- The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.
- In the event of excessive vertical displacement of the road during/following construction then mitigation measures will be required to ensure the stability of the road. This will include:

    - Introduction of pressure berms either side of the road (that are 2m to 5m wide by 0.5m deep stone layer).
    - Where peat is relatively willow then excavate peat and replace with suitable fill.
    - Slowing the rate of construction.
- Settlement of a floated access road is expected and will likely be in order of several 100mm in the deeper peat area; as such it will be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of the settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works, the road will be re-levelled using crushed stone.

2.4.9 Turbine and Meteorological Mast Foundations

The wind turbines and meteorological mast foundations will be a reinforced concrete base designed to Eurocode 2/BS8110. Foundation loads will be provided by wind turbine and mast supplier, and factors of safety will be applied to these in accordance with European design regulations. The turbine will be anchored to the foundation using a bolt assembly which will be cast into the concrete. The meteorological mast is a free-standing structure which is also anchored to the reinforced concrete foundation. It is proposed that the foundations for both the turbines and the meteorological mast will be ground bearing foundations and that the formation level of the turbine foundations will be on the lower mineral subsoil or bedrock. For completeness and depending on findings of the confirmatory ground investigations, reinforced concrete-piled foundations have also been considered. Turbine bases will measure 25 metres in diameter, while the meteorological mast base will measure 25 square metres. They will be formed a minimum of one metre below the base of the peat layer on stiff subsoil material or bedrock, or at a suitable level directed by the Geotechnical Engineer/Designer. The foundations will be constructed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter;
- Where practical, the peat will be stripped over the area of the excavation and stored locally for reuse, the subsoil will be excavated and stored to one side for reuse during the landscaping around the finished turbine;
- No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practices;
- All groundwater and surface water arising from turbine base excavation will be pumped to the dirty water system prior to discharge from the works area;
- Soil excavation will be observed by a qualified archaeologist in accordance with a scheme of archaeological monitoring to identify any significant remains as they come to light and,
- The foundation excavation will be raised to formation level by compacted layers of well graded granular material, spread and compacted to provide a hard area for the turbine foundation.

Standard excavated reinforced concrete bases will be completed as follows:

- A layer of concrete blinding will be laid 75mm thick directly on top of the newly exposed formation, tamped and finished with a screed board to leave a flat level surface. The concrete will be protected from rainfall during curing and all surface water runoff from the curing concrete will be prevented from entering surface water drainage directly;
- High tensile steel reinforcement will be fixed in accordance with the designer's drawings & schedules. The foundation anchorage system will be installed, levelled and secured to the blinding using steel box section stools;

- Ductwork will be installed as required, and formwork erected around the steel cage and propped from the backside as required;
- The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base. These checks will be passed to turbine manufacturer for their approval;
- Concrete will be placed using a concrete pump and compacted using vibrating pokers to the levels and profile indicated on the drawings. Upon completion of the concreting works the foundation base will be covered and allowed to cure;
- Steel shutters will be used to pour the circular chimney section;
- Earth wires will be placed around the base; and,
- The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the vegetable soil set aside during the excavation.
- Soil, rock and other materials excavated during construction will be managed in line with the recommendations/ best practice guidelines outlined in Section 4.3.4 of Chapter 4 of the EIAR.

Reinforced concrete piled foundations will be completed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter;
- No material will be removed from site and placement areas will be stripped of vegetation prior to placement in line with best working practices;
- A piling platform for the piling rig will be constructed. This will be done by laying geotextile on the existing surface and a stone layer will then be placed on top of the geotextile by an excavator and compacted in order to give the platform sufficient bearing capacity for the piling rig.
- The piling rig, fitted with an auger, will then bore through the soft material with a sleeve fitted around the auger to prevent the sidewalls of the peat from collapsing. The borehole is then extended to a suitable depth into the subsoil/bedrock.
- When the auger and the sleeve are removed high tensile steel cages will be lowered into the boreholes. These steel cages will extrude above the level of the top of the concrete pile.
- As the auger is removed concrete is pumped into the borehole.
- Reinforcing steel on the top of the pile will tie to the foundation base steel.
- The procedure for standard excavated reinforced concrete bases as outlined below can be applied from here.

2.4.10 Crane Hardstands

All crane pads will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads (refer to Section 2.4.8.2 above) and will measure approximately to the turbine manufacturer’s requirements. The position of the crane pads varies between turbine locations depending on topography, position of the site access road, and the turbine position.

2.4.11 Onsite Electricity Substation and Control Building

Once tree felling as described in Section 2.4.2.3, above, is completed, the onsite substation will be constructed by the following methodology:

- The area of the onsite substation will be marked out using ranging rods or wooden posts and the soil and overburden stripped and removed to nearby temporary storage area for later use in landscaping. Any excess material will be sent to one of the on-site peat repositories or the proposed borrow pit, for reinstatement purposes.

- The dimensions of the onsite substation area have been designed to meet the requirements of the ESB and the necessary equipment to safely and efficiently operate the proposed wind farm;
- A control building will be built within the onsite substation compound;
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix;
- The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- The roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled and sealed against the weather.
- The electrical equipment will be installed and commissioned.
- Perimeter fencing will be erected.
- The construction and components of the substation will be to Eirgrid specifications.

2.4.12 Site Underground Cabling

The transformer in each turbine is connected to the substation through a network of buried electrical cables. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the substation compound. The ground is trenched typically using a mechanical excavator. The top layer of soil is removed and saved so that it is replaced on completion. The cables are bedded with suitable material unless the ground conditions are such that no bedding is required. The depth of the cables are to meet all national and international requirements and will generally be up to 1.3 m below ground level, depending on the ground conditions that are encountered. A suitable marking tape is installed between the cables and the surface. On completion the ground will be reinstated as per its original condition. The route of the cables will generally follow the access tracks to each turbine location.

Clay plugs will be installed at regular intervals of not greater than 50 metres along the length of the trenches where required to prevent the trenches becoming conduits for runoff water. While the majority of the cable trenches will be backfilled with native material, clay subsoils of low permeability will be used to prevent conduit flow in the backfilled trenches. Backfill material will be imported onto the site will sufficient volumes not be encountered during the excavation phase of roadway and turbine foundation construction.

2.4.13 Grid Connection Construction Methodology

The underground cabling (UGC) works will consist of the installation of ducts in an excavated trench to accommodate power cables, and a fibre communications cable to allow communications between the proposed 110kV Glenora Wind Farm substation and 110kV Tawnaghmore substation.

The proposed UGC will consist of 6 no. ducts to accommodate 3 No. 160mm diameter HDPE power cable ducts and 2 No. 125mm diameter HDPE communications duct to be installed in an excavated trench, typically 600mm wide by 1,315mm deep, with variations on this design to adapt to bridge crossings, service crossings and watercourse crossings, etc. The power cable ducts will accommodate 1 No. power cables per duct. The communications duct will accommodate a fibre cable to allow communications between the proposed Glenora Wind Farm substation and the existing Tawnaghmore 110kV substation. The inclusion 1 No. earth continuity conductor duct will also be required.

The ducts will be installed, the trench reinstated in accordance with the specifications of the Roads Department of Mayo County Council where installed in public roads and reinstated in accordance with the landowner's requirements where installed in private lands., The installation of the electrical cabling/fibre cable will be pulled through in one section in approximately 700/800m section lengths. Construction methodologies to be implemented and materials to be used will ensure that the UGC is installed in accordance with the requirements and specifications of Eirgrid.

The underground cable required to facilitate the grid connection will be laid beneath the surface of the site and/or public road using the following the methodology summarised below, and outlined in detail in TLI Group's Glenora Wind Farm 110kV Grid Connection – Construction Methodology included as Appendix 4-5 of this EIAR:

- The Contractor, and their appointed Site Manager, will prepare a targeted Method Statement concisely outlining the construction methodology and incorporating all mitigation and control measures included within the EIAR and as required by planning conditions where relevant;
- All existing underground services along the UGC route will be confirmed prior to the commencement of construction works;
- Traffic management measures will be implemented in accordance with those included in Section 14.1 of the EIAR, and a detailed Traffic Management Plan will be prepared and agreed with Mayo County Council;
- The excavated trench will be approximately 825mm in width and approximately 1315mm deep both within the public road network and within private lands.
- The 160mm diameter HDPE cable ducting will be placed into the prepared trench, inspected and backfilled as per Figure 3 and Figure 4 of Appendix 4-5 Construction Methodology
- Excavated material will be temporarily stockpiled onsite for re-use during reinstatement. Stockpiles will be restricted to less than 2m in height. Stockpiles will be located a minimum of 50m from surface water features and all stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW);
- Excavated material will be employed to backfill the trench where appropriate and any surplus material will be transported to the proposed on-site borrow pits;
- Any earthen (sod) banks to be excavated will be carefully opened with the surface sods being stored separately and maintained for use during reinstatement;
- The excavated trench will be dewatered if required, from a sump installed within the low section of the opened trench. Where dewatering is required, dirty water will be fully and appropriately attenuated, through silt bags, before being appropriately discharged to vegetation or surface water drainage feature (please refer to Chapter 9 of the EIAR);
- Where required, grass will be reinstated by either seeding or by replacing with grass turves;
- No more than a 100m section of trench will be opened at any one time. The second 100m will only be excavated once the majority of reinstatement has been completed on the first;
- The excavation, installation and reinstatement process will take on average of 1 no. day to complete a 100m section;
- Where the cable is being installed in a roadway, temporary reinstatement may be provided to allow larger sections of road to be permanently reinstated together;
- Works will only be conducted in normal working hours of Monday to Friday 07:00 to 19:00 and Saturday 07:00 to 13:00, with no works on Sundays or Bank holidays except in exceptional circumstances or in the event of an emergency.
- Following the installation of ducting, pulling the cable will take approximately 1 no. day between each joint bay, with the jointing of cables taking approximately 1 week per joint bay location.

Plate 2-1 Cable Trench View

2.4.13.1 Existing Underground Services

In order to facilitate the installation of the proposed UGC, it may be necessary to relocate existing underground services such as water mains or existing cables. In advance of any construction activity, the contractor will undertake additional surveys of the proposed route to confirm the presence or otherwise of any services. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works.

If existing low voltage underground cables are found be present, a trench will be excavated, and new ducting and cabling will be installed along the new alignment and connected to the network on either end. The trench will be backfilled with suitable material to the required specification. Warning strip and marking tape will be laid at various depths over the cables as required. Marker posts and plates will be installed at surface level to identify the new alignment of the underground cable, the underground cables will then be re-energised.

In the event that water mains are encountered the water supply will be turned off by the utility so work can commence on diverting the service. The section of existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the utility standards.

2.4.13.2 Joint Bays

Joints Bays are to be installed approximately every 700m - 850m along the UGC route to facilitate the jointing of 2 No. lengths of UGC. Joint Bays are typically 2.5m x 6m x 2.05m pre-cast concrete structures installed below finished ground level. Joint Bays will be located in the non-wheel bearing strip of roadways, however given the narrow profile of local roads this may not always be possible.

In association with Joint Bays, Communication Chambers are required at every joint bay location to facilitate communication links between the proposed Glenora Wind Farm substation and the existing 110kV substation at Tawnaghmore. Earth Sheath Link Chambers are also required at every joint bay along the cable route. Earth Sheath Links are used for earthing and bonding cable sheaths of underground power cables, so that the circulating currents and induced voltages are eliminated or reduced. Earth Sheath Link Chambers and Communication Chambers are located in close proximity to Joint Bays. Earth

Sheath Link Chambers and Communication Chambers will typically be pre-cast concrete structures with an access cover at finished surface level.

The precise siting of all joint bays, earth sheath link chambers, and communication chambers is subject to approval by ESBN. Marker posts will be used on non-roadway routes to delineate the duct route and joint bay positions. The marker posts will consist of a corrosion-proof aluminium triangular danger sign, with a 750mm base, and with a centred lightning symbol, on engineering grade fluorescent yellow background. They will be installed inadequately sized concrete foundations and will also be placed where the cable has not been buried to the standard depth, due to existing road conditions. Drawings of the joint bays and communication chambers are included within this planning package.

The precise siting of all Joint Bays, Earth Sheath Link Chambers and Communication Chambers, within the curtilage of the public road, is subject to approval by ESBN and EirGrid.

2.4.13.3 Grid Connection Watercourse/Culvert Crossings

There is a total of 10 bridge crossings along the proposed cable route including 10 No. HDD crossings. The proposed underground cable will also encounter 30 no. culvert crossings along the proposed cable route. A schedule of the culverts identified and the proposed crossing method to be implemented is detailed in Appendix 4-6 of this EIAR and the locations are shown on the site layout drawings included in Appendix 4-1. Where the cable route intersects with existing watercourses, a detailed construction method statement will be prepared by the Contractor prior to the commencement of construction and is to be approved by the Local Authority and relevant environmental agencies. The cable will be located within the bridge deck where there is sufficient depth and width available on the bridge, where there is insufficient depth and width available horizontal directional drilling (HDD) may be employed as an alternative.

It is proposed to cross existing culverts using open trenching with either an undercrossing or an overcrossing, depending on the depth of the culvert. A confirmatory site survey of all culverts will be completed as part of the next phase of the project prior to construction to confirm the findings of the design phase surveys.

Inland Fisheries Ireland have published guidelines relating to construction works along water bodies entitled "*Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites*", and these guidelines will be adhered to during the construction of the proposed development.

2.4.13.3.1 *Horizontal Directional Drilling*

It is proposed to implement Horizontal Directional Drilling (HDD) for 10 no. crossings. However, following confirmatory site investigations prior to construction it may be necessary to utilise HDD for additional crossings.

Horizontal Direction Drilling (HDD) is a method of drilling under obstacles such as bridges, culverts, railways, water courses, etc. in order to install cable ducts under the obstacle. This method is employed where installing the ducts using standard installation methods is not possible. The proposed HDD methodology is as follows: -

- A works area of circa .40 square metres will be fenced on both sides of the river crossing.
- The drilling rig and fluid handling units will be located on one side of the bridge and will be stored on double bunded 0.5mm PVC bunds which will contain any fluid spills and storm water run-off.
- Entry and exit pits (1m x 1m x 2m) will be excavated using an excavator, the excavated material will be temporarily stored within the works area and used for reinstatement or disposed of to a licensed facility.

- A 1m x 1m x 2m steel box will be placed in each pit. This box will contain any drilling fluid returns from the borehole.
- The drill bit will be set up by a surveyor, and the driller will push the drill string into the ground and will steer the bore path under the watercourse.
- A surveyor will monitor drilling works to ensure that the modelled stresses and collapse pressures are not exceeded.
- The drilled cuttings will be flushed back by drilling fluid to the steel box in the entry pit.
- Once the first pilot hole has been completed a hole-opener or back reamer will be fitted in the exit pit and will pull a drill pipe back through the bore to the entry side.
- Once all bore holes have been completed, a towing assembly will be set up on the drill and this will pull the ducting into the bore.
- The steel boxes will be removed, with the drilling fluid disposed of to a licensed facility.
- The ducts will be cleaned and proven and their installed location surveyed.
- The entry and exit pits will be reinstated to the specification of ESB Networks, EirGrid and Mayo County Council.
- A transition coupler will be installed at either side of the bridge/following the horizontal directional drilling as per ESBN and EirGrid requirements, this will join the HDD ducts to the standard ducts.

A joint bay or transition chamber will be installed on either side of the bridge following the horizontal directional drilling as per ESB/Eirgrid requirements.

2.4.14 Culvert Crossings on the Wind Farm Site

Culverts will be required where site roads, crane pads and turbine pads cross main forestry drainage networks.

Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. Smaller water crossings will simply consist of an appropriately sized pipe buried in the sub-base of the road at the necessary invert level to ensure ponding or pooling doesn't occur above or below the culvert and water can continue to flow as necessary.

All culverts will be inspected weekly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance. Any watercourse crossings required will be installed outside of the salmonid spawning season, October to June in any year, in accordance with Inland Fisheries Ireland best practice (IFI, 2016). This will ensure no potential impacts on salmonid spawning habitat.

All of the above works will be supervised by the Environmental Clerk of Works and the project hydrologist.

2.4.15 Watercourse Crossings

It is proposed to construct new, clear-span crossings watercourse crossings along the wind farm access roads at 2 no. locations within the wind farm site. The locations of these crossings are shown on the layout drawings included in Appendix 4-1 of this EIAR. The clearspan watercourse crossing methodologies presented below will ensure that no instream works are necessary.

The construction methodology for the installation of a pre-cast concrete clear-span watercourse crossing will be implemented as follows:

- The access road on the approach either side of the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- A foundation base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the opposite side of the watercourse for excavation and foundation installation will require the installation of pre-cast concrete slab across the watercourse to provide temporary access for the excavator. Plant and equipment will not be permitted to track across the watercourse.
- Once the foundation base has been completed, the pre-cast concrete box culvert will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse.
- Where the box culvert is installed in sections, the joints will be sealed to prevent granular material entering the watercourse,
- Once the crossing is in position stone backfill will be placed and compacted against the structure up to the required level above the foundations.

When the concrete beams are cured the filling and compaction of the road will be completed. The road finish level will be decided by the Project Engineer.

The watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material.

Proposed Mitigation Measures for watercourse crossings are detailed below as detailed in Section 9.3 of the EIAR and will be implemented as follows:

- All stream crossings will be bottomless-box or clear span culverts. Existing banks will remain undisturbed.
- Where proposed underground cabling routes follow an existing road or a road proposed for upgrade, cables will pass over or below the culvert within the access road.
- All guidance/mitigation measures proposed by the OPW and IFI are incorporated into the design of proposed crossings.
- As a further precaution, near-stream construction work will only be carried out during the period permitted by IFI for in-stream works according to the guidance document "Guidelines on protection of fisheries during construction works in and adjacent to waters" (IFI, 2016). The relevant period is July to September inclusive, i.e. the typically drier summer period. Any deviation that may be temporarily necessary will be done in discussion with the IFI.
- During near-stream construction works (mainly roads), double-row silt fences will be emplaced immediately downgradient of the construction area for the duration of the construction phase.
- All new river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

All of the above works will be supervised by the Environmental Clerk of Works and the project hydrologist.

2.4.16 Operation and Maintenance Control Building

The Operation and Maintenance Control Building will be constructed using the following methodology:

- A control building will be built within the onsite substation compound.
- The foundations will be excavated down to the level indicated by the designer and appropriately shuttered reinforced concrete will be laid over it. An anti-bleeding admixture will be included in the concrete mix.
- The block work walls will be built up from the footings to DPC level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors.
- The block work will then be raised to wall plate level and the gables & internal partition walls formed. Scaffold will be erected around the outside of the building for this operation.
- The roof slabs will be lifted into position using an adequately sized mobile crane.
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, tiled, and sealed against the weather.
- Perimeter fencing will be erected.
- The internal layout and components will be finished to the wind farm operator's design specifications.

3. ENVIRONMENTAL MANAGEMENT

3.1 Introduction

This CEMP includes all best practice measures required to construct the proposed renewable energy development. The drainage proposals will be developed further prior to the commencement of construction however, any such improvements will be in line with the principles set out here and will also be in full compliance with the planning consent and mitigation measures as presented in the EIAR, NIS and all other relevant planning documents. The following sections give an overview of the drainage design, dust and noise control measures and a waste management plan for the site.

While the drainage design measures are presented in Chapter 4 of the EIAR and the drainage management measures and water quality and monitoring measures are included in this CEMP, the Surface Water Management Plan compiles all of these into a single document. The SWMP is an accompanying document for this CEMP and is included as Appendix 4-4 of the EIAR.

3.2 Protecting Water Quality

3.2.1 Good Environmental Management During Construction

Timing of works can strongly influence the potential for damaging the freshwater environment. Operations during wetter periods of the year pose a significantly greater risk of causing erosion and siltation, which can be particularly severe following major rainfall or snowmelt events. Traditionally, wind farm construction undertaken during the drier summer months will result in significantly less erosion and siltation. Construction activities in the hydrological buffer zones will be avoided during or after prolonged rainfall or an intense rainfall event and work will cease entirely near watercourses when it is evident that water quality could potentially be impacted. Given that this site has an established drainage network and existing watercourse crossing points, there will be no adverse impacts on watercourses.

3.2.2 Site Drainage Principles

The site drainage features have been outlined in Chapter 4, Section 4.7 of the EIAR in addition to the drainage design and management for the Proposed Development. The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the Proposed Development. The Proposed Development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and its associated rivers and lakes, and consequently no impact on downstream catchments and ecological ecosystems.

No routes of any natural drainage features will be altered as part of the Proposed Development. Turbine locations and associated new roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones around the existing natural drainage features have been used to inform the layout of the Proposed Development.

Existing artificial drains in the vicinity of existing site roads will be maintained in their present location where possible. If it is expected that these artificial drains will receive drainage water from works areas, check dams will be added (as specified below) to control flows and sediment loads in these existing artificial drains. If road widening or improvement works are necessary along the existing roads, where possible, the works will take place on the opposite side of the road to the drain.

3.2.3 Best Practice Guidance

The drainage design has been prepared based on experience of the project team of other renewable energy sites in peat-dominated environments, and in accordance with a number of best practice guidance documents.

There is no one guidance document that deals with drainage management and water quality controls for wind farms and other renewable energy developments. However, a selection of good practice approaches have been adopted in preparation of this drainage design, and these are taken from the various best practice guidance documents listed below. These relate to infrastructure and operational works on forested sites, forest road design, water quality controls for linear projects, forestry road drainage and management of geotechnical risks. To achieve best practice in terms of water protection through construction management all drainage management is prepared in accordance with guidance contained in the following:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- Forest Service, (2000): Code of Best Forest Practice – Ireland. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the design, construction and management of forest roads;
- MacCulloch (2006): Guidelines for risk management of peat slips on the construction of low volume low cost roads over peat (Frank MacCulloch Forestry Civil Engineering Forestry Commission, Scotland);
- National Roads Authority (2005): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (September 1996);
- Eastern Regional Fisheries Board: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works Adjacent to Waters;
- Scottish Natural Heritage, 2010: Good Practice During Wind Farm Construction;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA Report No. C648 (2006): CIRIA (Construction Industry Research and Information Association) guidance on 'Control of Water Pollution from Linear Construction Projects';
- CIRIA Report Number C532 (2001): Control of water pollution from construction sites - Guidance for consultants and contractors.; and,
- Control of water pollution from linear construction projects -Technical guidance. CIRIA C648 London, 2006.

3.2.4 Site Drainage Design and Management

The proposed site drainage features for this site are outlined in Section 4.7 of the EIAR. The following sections give an outline of drainage management arrangements in terms of pre-construction, construction and operational phases of the Proposed Development.

3.2.4.1 Pre-Construction Drainage

There is an existing drainage network across the site. There are three main watercourses which drain the proposed development site and there are numerous manmade drains that are in place predominately to drain the forestry plantations. This existing drainage system will continue to function as it is during the pre-construction phase.

Prior to commencement of works in sub-catchments across the site, main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.

Drainage and associated pollution control measures will be implemented onsite in conjunction with the main construction works. Where possible drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.

3.2.4.2 Construction Phase Drainage

The Project Hydrologist will attend the site to set out and assist with the implementation of the proposed drainage controls as outlined in Section 2.5 of the SWMP and shown in the drainage design drawings included in Appendix A of the SWMP. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site.

The implementation of a Schedule of Works Operation Record (SOWOR) will continue through the construction phase of the project. The SOWOR provides number of abandonment triggers which will ensure that site management are well informed as to the level of incident that will require the abandonment of works. Refer to Appendix B of the SWMP. The various triggers both pre-commencement and abandonment ensure best practice in terms of water quality management is maintained prior to commencement and during the various felling and construction phases.

Best practice and practical experience on other similar projects suggest that in addition to the drainage plans that are included in and as part of this application, there are additional site-based decisions that can only be made in the field through interaction between the Site Construction Manager, the Project Hydrologist and the Project Geotechnical Engineers. The mechanisms for interaction between these are outlined within Section 4 of this CEMP.

In relation to decisions that are made on site it is important to stress that these will be implemented in line with the associated drainage controls and mitigation measures outlined in Section 6 below, and to ensure protection of all watercourses.

3.2.4.2.1 Preparative Site Drainage Management

All materials and equipment necessary to implement the drainage measures outlined above will be brought on-site in advance of any works commencing.

An adequate quantity of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.

3.2.4.2.2 Pre-emptive Site Drainage Management

The works programme for the initial construction stage of the development will also take account of weather forecasts and predicted rainfall in particular. Large excavations and movements of peat/subsoil or vegetation stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

The following forecasting systems are available and will be used on a daily basis at the site to direct proposed construction activities:

- General Forecasts: Available on a national, regional and county level from the Met Eireann website (www.met.ie/forecasts). These provide general information on weather patterns including rainfall, wind speed and direction but do not provide any quantitative rainfall estimates;
- MeteoAlarm: Alerts to the possible occurrence of severe weather for the next 2 days. Less useful than general forecasts as only available on a provincial scale;
- 3-hour Rainfall Maps: Forecast quantitative rainfall amounts for the next 3 hours but does not account for possible heavy localised events;
- Rainfall Radar Images: Images covering the entire country are freely available from the Met Eireann website (www.met.ie/latest/rainfall_radar.asp). The images are a composite of radar data from Shannon and Dublin airports and give a picture of current rainfall extent and intensity. Images show a quantitative measure of recent rainfall. A 3-hour record is given and is updated every 15 minutes. Radar images are not predictive; and,
- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

Using the threshold rainfall values, listed below, will allow work to be safely controlled (from a water quality perspective) in the event of forecasting of an impending high rainfall intensity event.

Works will be suspended if forecasting suggests either of the following is likely to occur:

- >10 mm/hr (i.e. high intensity local rainfall events);
- >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or,
- >half monthly average rainfall in any 7 days.

Prior to works being suspended the following control measures will be completed:

- Secure all open excavations;
- Provide temporary or emergency drainage to prevent back-up of surface runoff; and,
- Avoid working during heavy rainfall (listed above) and for up to 24 hours after heavy events to ensure drainage systems are not overloaded.

3.2.4.2.3 *Reactive Site Drainage Management*

The detailed drainage plan prepared for the site has provided for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat potentially silt-laden water from the works areas, will be monitored continuously by the Environmental Clerk of Works (ECoW) on-site. The ECoW or project hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to the situation on the ground at a particular time.

In the unlikely event that works are giving rise to siltation of watercourses, the ECoW or project hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures, as outlined in Section 2.5 above, will be installed in advance of works recommencing.

3.2.4.3 Operational Phase Drainage Management

The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described below:

- Some interceptor drains will be left in place, upgradient of the proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader.
- Swales/road side drains will remain in place to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to stilling ponds for sediment settling;
- Check dams will be put in place at regular intervals along interceptor drains and swales/roadside drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from (refer to Appendix 9-3 of this EIAR), but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds, along with the entire drainage network, will be ongoing through the construction period.

In the operational phase of the wind farm, the reliance on the drainage system summarised above will become reduced as areas naturally revegetate. Once areas revegetate, this will result in a resumption of the natural drainage management that will have existed prior to any construction.

3.2.5 Forestry Felling

Tree felling to facilitate the Proposed Development will not be undertaken simultaneously with construction groundworks. Keyhole felling to facilitate construction works will take place prior to groundworks commencing.

Water protection measures will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses. These measures are derived from best practice guidance documents as outlined in Section 3.2.3 above. The water protection measures to be adopted during felling operations are set out as follows:

- Machine combinations (i.e. hand-held or mechanical) will be chosen which are most suitable for ground conditions at the time of felling, and which will minimise soils disturbance;
- Trees will be cut manually inside the 50m buffer and using machinery to extract whole trees only;
- Checking and maintenance of roads and culverts will be on-going through any felling operation. No tracking of vehicles through watercourses will occur, as vehicles will use road infrastructure and existing watercourse crossing points. Where possible, existing drains will not be disturbed during felling works;
- Ditches which drain from the proposed area to be felled towards existing surface watercourses will be blocked, and temporary silt traps will be constructed. No direct discharge of such ditches to watercourses will occur. Drains and sediment traps will be installed during ground preparation. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and will avoid being placed at right angles to the contour;
- Sediment traps will be sited in drains downstream of felling areas. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in the peat disposal areas.;
- In areas particularly sensitive to erosion or where felling inside the 50 metre buffer is required, double or triple sediment traps will be installed.
- Double silt fencing will also be put down slope of felling areas which are located inside the 50 metre buffer zone;
- All drainage channels will taper out before entering the aquatic buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone. On erodible soils, silt traps will be installed at the end of the drainage channels, to the outside of the buffer zone;
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled;
- Brash mats will be used to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion occurring, extraction will be suspended during periods of high rainfall (refer to Section 3.2.4.2.2 above) ;
- Timber will be stacked in dry areas, and outside a local 50 metre watercourse buffer. Straw bales and check dams to be emplaced on the down gradient side of timber storage/processing sites;
- Works will be carried out during periods of no, or low rainfall, in order to minimise entrainment of exposed sediment in surface water run-off;
- Checking and maintenance of roads and culverts will be on-going through the felling operation;
- No crossing of streams by machinery will be permitted and only travel perpendicular to and away from streams will be allowed;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse. Mobile bowser, drip kits, trained personnel will be used where refuelling is required;

- A permit to refuel system will be adopted at the site; and,
- Branches, logs or debris will not be allowed to build up in aquatic/buffer zones (refer to Table 3-1 below). All such material will be removed when harvesting operations have been completed, but care will be taken to avoid removing natural debris deflectors.

Table 3-1 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

3.2.5.1 Forestry Felling Drainage Management

Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) will be appointed to oversee the keyhole and extraction works. The ECoW will be experienced and competent, and will have the following functions and operate their record using a Schedule of Works Operation Record (SOWOR), as proposed in the planning application:

- Attend the site for the setup period when drainage protection works are being installed, and be present on site during the remainder of the forestry keyhole felling works.
- Prior to the commencement of works, review and agree the positioning by the Operator of the required Aquatic Buffer Zones (ABZs – refer to Table 3-1 above), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below).
- Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in site operations, prior to the commencement of the works.
- Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix C (Site Monitoring Form (Visual Inspections)) of the *Forestry & Freshwater Pearl Mussel Requirements.*
- Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures.
- Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements:
    - Surface water samples will be collected upstream and downstream of the keyhole felling site at suitable sampling locations.
    - Sampling will be taken from the stream / river bank, with no in-stream access permitted.
    - The following minimum analytical suite will be used:
        - pH,
        - Electrical Conductivity,
        - Temperature
        - Total Suspended Solids, Biochemical Oxygen Demand, Total Phosphorus, Ortho-Phosphate, Total Nitrogen, and Ammonia.
- Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions.
- Prepare and maintain a contingency plan.

- Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed.
- Prepare and maintain a Water Protection Measure Register. This document is to be updated weekly by the ECoW.

3.2.6 Borrow Pit Drainage

While surface water will be contained in the borrow pits area, the design proposal is to control the level of water in the borrow pit area by creating a single point outlet from the basin-like area that will ensure the water does not overtop the pit area. Run-off from the proposed borrow pit area will be controlled via a single outlet that will be installed at the edge of the borrow pit. The single outfall point will be constructed to manage runoff from the borrow pit and its immediate surrounds. Interceptor drains will already have been installed upgradient of the borrow pit area before any extraction begins.

During the construction phase of the project, it will be necessary to keep the borrow pit area free of standing water while rock is still being extracted. This will be achieved by using a mobile pump, which will pump water into the same series of drains, settlement ponds and level spreader, which will receive the water from the single outlet.

3.2.7 Peat Placement Area Drainage

During the initial placement of excavated material at the peat placement area, silt fences, straw bales and biodegradable matting will be used to control surface water runoff from the repository area. 'Siltbuster' treatment trains will be employed in the unlikely event that previous treatment is not to a high quality.

Drainage from the repository area will ultimately be routed to an oversized swale and a stilling ponds designed for a 24 hour retention time, and for a 1 in 10 year return period, before being discharged to the on-site drains.

The repository area will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff. Once re-vegetated and stabilised peat/subsoil reinstatement areas will no longer be a potential source of silt laden runoff.

3.2.8 Floating Road Drainage

Where sections of floating road are to be installed, cross drains will be installed beneath the road construction corridor to maintain existing clean water drainage paths. Large surface water drainage pipes will be placed to form the cross-drains below the level of the proposed road sub-base. These drainage pipes will be extended each side of the proposed road and cable trench construction corridor, along the paths of the existing drains.

With the exception of the installation of cross drains under the floating road corridor, minimal additional drainage will be installed to run parallel to the roads, in order to maintain the natural hydrology of the peatland areas over which the roads will be floated.

3.2.9 Cable Trench Drainage

Cable trenches are typically developed in short sections, thereby minimising the amount of ground disturbed at any one time and minimising the potential for drainage runoff to pick up silt or suspended solids. Each short section of trench is excavated, ducting installed and bedded, and backfilled with the appropriate materials, before work on the next section commences.

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Will any rainfall cause runoff from the excavated material, the material will be contained in the downgradient cable trench. Excess subsoil will be removed from the cable trench works area immediately upon excavation, and in the case of the Proposed Development, will be transported to one of the peat repository areas, the on-site borrow pit or used for landscaping and reinstatements of other areas elsewhere on site.

On steeper slopes, silt fences, as detailed in Section 2.5 of the SWMP will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

3.3 Refuelling, Fuel and Hazardous Materials

The following mitigation measures will be implemented in full to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. On-site refuelling will occur at a controlled fuelling station;
- On-site refuelling will take place using a mobile double skinned fuel bowser;
    - The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the wind farm.
    - The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages.
    - The fuel bowser will be parked on a level area in the construction compound when not in use.
    - Only designated trained and competent operatives, with a permit to refuel, will be authorised to refuel plant on site.
    - Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.
- Onsite refuelling will be carried out by trained personnel only;
- A permit to fuel system will be put in place;
- Taps, nozzles or valves associated with refuelling equipment 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;
- Fuels volumes stored on site will be minimised. The fuel storage areas, within the temporary construction compounds, will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical control buildings (at the substation compound) will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be developed (refer to Section 5 of this CEMP). Spill kits will be available to deal with any accidental spillage in and outside the refuelling area.

3.4 Cement Based Products Control Measures

The following mitigation measures will be implemented in full to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site;
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures.
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. A dedicated concrete wash out area will be established with signage to allow the wash out of concrete delivery vehicle chutes before exiting the site. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed.
- Use weather forecasting to plan dry days for pouring concrete;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, and proposed to be built using straw bales and lined with an impermeable membrane. below. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and will be broken up and disposed of along with other construction waste (refer to Section 3.9 below).

The 50m wide river buffer zone will be in place for the duration of the construction phase. No construction activity will occur within the buffer zone with the exception of bridge and culvert construction. The buffer zone will:

- Prevent any cement-based products accidentally entrained in the construction phase drainage system entering directly into watercourses, achieved in part by ending drain discharge outside the 50m buffer zone and allowing percolation across the vegetation of the buffer zone;
- Provide a buffer against accidental direct pollution of surface waters by any pollutants, or by pollutants entrained in surface water run-off.

Plate 3-1 Typical concrete shoot wash out areas

3.5 Peat Stability Management

Peat instability or failure refers to a significant mass movement of a body of peat that would have an adverse impact on wind farm development and the surrounding environment. Peat failure excludes localised movement of peat that could occur below an access road, creep movement or erosion type events. In the absence of appropriate mitigation, the consequence of peat failure at the study area may result in:

- Death or injury to site personnel;
- Damage to machinery;
- Damage or loss of access tracks;
- Drainage disrupted;
- Site works damaged or unstable;
- Contamination of watercourses, water supplies by sediment particulates; and,
- Degradation of the environment.

3.5.1 General recommendations for Good Construction

Based on the mitigation measures given in the FT's Peat Management Plan (Appendix 4-2 of the EIAR) and Geotechnical and Peat Stability Assessment Report (Appendix 8-1 of the EIAR) report being strictly adhered to during construction and the detailed peat stability assessment carried out, it has been showed that the site has an acceptable margin of safety.

The risk assessment at each turbine location identified a number of control measures to further reduce the potential risk of peat failure. Access roads to turbines will be subject to the same relevant control measures that apply to the nearest turbine as detailed in the FT Peat Stability Assessment Report.

The following measures which will be implemented in full during the construction phase of the project will assist in the management of the risks for this site.

- Appointment of experienced and competent contractors;
- The site will be supervised by experienced and qualified personnel;
- Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a localised peat movement);
- Undercutting of slopes and unsupported excavations will not occur;
- A managed robust drainage system as set out above;
- Prevent placement of loads/overburden on marginal ground;
- Set up, maintain and report findings from monitoring systems (as outlined in the Geotechnical and Peat Stability Assessment);
- Ensure construction method statements are developed and agreed before commencement of construction and are followed by the contractor; and,
- Revise and amend the Construction Risk Register as construction progresses to ensure that risks are managed and controlled for the duration of construction.
- Maintain hydrology of area as far as possible by maintaining existing drains to water pressures in the peat to avoid peat becoming "boyant".
- Use of experienced geotechnical staff for site investigations
- Use of experienced contractors and trained operators to carry out the work.
- Confirmatory ground investigation to determine peat, mineral soil and bedrock condition and properties.
- Uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge will be avoided. All water discharged from excavations during work will be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.
- All excavations will be suitably supported to prevent collapse and development of tension cracks.

- Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.
- Installation and regular monitoring of geotechnical instrumentation during construction in areas of possible poor ground, such as deeper peat deposits.
- Site reporting procedures will be implemented to ensure that working practices are suitable for the encountered ground conditions. Ground conditions will be assessed by a suitably experienced geotechnical engineer.
- Regular briefing of all site staff (e.g., toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by the Contractor and Project Geotechnical Engineer will be undertaken and will include an assessment of ground stability conditions (e.g., cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g., blocked drains, absence of water in previously flowing drains, springs, etc.).

3.5.2 Peat and Spoil Usage in Restoration of the Borrow Pit

The general construction methodology for the construction of the borrow pits, as presented in FT's Peat & Spoil Management Plan in Appendix 4-2 of the EIAR, is outlined in Section 2.4.4 above. This methodology includes procedures that will be implemented as part of the construction phase to minimise any adverse impact on peat stability.

3.5.3 Placement of Excavated Material in Peat Placement Areas

The placement of peat and spoil, excavated during the construction phase of the proposed development, as presented in FT's Peat & Spoil Management Plan in Appendix 4-2 of the EIAR, is outlined in Section 2.4.5 above. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

3.6 Dust Control

Construction dust can be generated from many on-site activities such as excavation and backfilling. The extent of dust generation will depend on the type of activity undertaken, the location, the nature of the dust, i.e., soil, sand, peat, etc. and the weather. In addition, dust dispersion is influenced by external factors such as wind speed and direction and/or, periods of dry weather. Construction sittraffic movements also have the potential to generate dust as they travel along the haul route.

Proposed measures that will be implemented in full to control dust include:

- Any site roads with the potential to give rise to dust will be regularly watered, as appropriate, during dry and/or windy conditions;
- The designated public roads outside the site and along the main transport routes to the site will be regularly inspected by the Environmental Clerk of Works (ECoW) for cleanliness, and cleaned as necessary;
- Material handling systems and material storage areas will be designed and laid out to minimise exposure to wind;
- Water misting or sprays will be used as required if particularly dusty activities are necessary during dry or windy periods;
- Water misting or bowsers will operate on-site as required to mitigate dust in dry weather conditions;
- The transport of soils or other material, which has significant potential to generate dust, will be undertaken in tarpaulin-covered vehicles where necessary;

- All construction related traffic will have speed restrictions on un-surfaced roads to 15 kph;
- Daily inspection of construction sites to examine dust measures and their effectiveness.
- When necessary, sections of the haul route will be swept using a truck mounted vacuum sweeper; and,
- All vehicles leaving the construction areas of the site will pass through a wheel washing area prior to entering the local road network.

3.7 Noise Control

The operation of plant and machinery, including construction vehicles, is a source of potential impact that will require mitigation at all locations within the site. Proposed measures that will be implemented in full to control noise include:

- Diesel generators will be enclosed in sound proofed containers to minimise the potential for noise impacts;
- Plant and machinery with low inherent potential for generation of noise and/or vibration will be selected. All construction plant and equipment to be used on-site will be modern equipment and will comply with the European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations;
- Regular maintenance of plant will be carried out in order to minimise noise emissions. Particular attention will be paid to the lubrication of bearings and the integrity of silencers;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the works;
- Compressors will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools will be fitted with suitable silencers;
- Machines, which are used intermittently, will be shut down during those periods when they are not in use;
- Training will be provided by the ECoW to drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation; and,

3.8 Invasive Species Management

A baseline invasive species survey was carried out at the site to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) by a suitably qualified ecologist. No invasive species were recorded within the EIAR site boundary, , nor were they recorded along and the turbine delivery route.

If the presence of such species is found at or adjacent to the site by the Project Ecologist, particularly in areas where its excavation may be required, an invasive species management plan will be prepared for the site to prevent the introduction or spread of any invasive species within the footprint of the works. An invasive species management plan, if required, will set out best practice control methods as summarised in the following sections.

3.8.1 Site Management

Careful preparation of the site and planning of the works is crucial to successful treatment of invasive species. The following list of guidelines, which is not exhaustive, will be followed by all on-site personnel. Only those who have been inducted into biosecurity measures on-site may enter the contaminated zones within the works areas. Will any risk of contaminated material escaping be observed by the site supervisor, the management plan for the site must be amended by an appropriately qualified person to mitigate against the risk.

3.8.2 Establish Good Site Hygiene

The following measures are proposed will be implemented in full to establish good site hygiene to ensure the control of any potential spread of invasive species during construction works:

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs will be erected.
- A designated wash-down area will be created, where power-washed material from machinery can be contained, collected and disposed of with other contaminated material. This area will contain a washable membrane or hard surface.
- Stockpile areas will be chosen to minimise movement of contaminated soil.
- Stockpiles will be marked and isolated.
- Contaminated areas which will not be excavated will be protected by a root barrier membrane if they are likely to be disturbed by machinery. Root barrier membranes will be protected by a layer of sand above and below and topped with a layer of hardcore.
- The use of vehicles with caterpillar tracks within contaminated areas will be avoided to minimise the risk of spreading contaminated material.
- An suitably qualified ecologist will be on site to monitor and oversee the implementation of invasive species management plans.

Plant and equipment which is operated within an area for the management of materials in contaminated areas will be decontaminated prior to relocating to a different works area. The decontamination procedures will take account of the following:

- Personnel may only clean down if they are familiar with the plant and rhizome material and can readily identify it.
- Decontamination will only occur within designated wash-down areas.
- Vehicles will be cleaned using stiff-haired brush and pressure washers, paying special attention to any areas that might retain rhizomes e.g. wheel treads and arches.
- All run-off will be isolated and treated as contaminated material. This will be disposed of in already contaminated areas.

3.9 Waste Management

This section of the CEMP provides a waste management plan (WMP) which outlines the best practice procedures during the excavation and construction phases of the project. The WMP will outline the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the Proposed Development. Disposal of waste will be seen as a last resort.

3.9.1 Legislation

The Waste Management Act 1996 and its subsequent amendments provide for measures to improve performance in relation to waste management, recycling and recovery. The Act also provides a regulatory framework for meeting higher environmental standards set out by other national and EU legislation.

The Act requires that any waste related activity has to have all necessary licenses and authorisations. It will be the duty of the Waste Manager on the site of the development to ensure that all contractors hired to remove waste from the site have valid Waste Collection Permits. It will then be necessary to ensure that the waste is delivered to a licensed or permitted waste facility. The hired waste contractors and subsequent receiving facilities must adhere to the conditions set out in their respective permits and authorisations.

The Environmental Protection Agency provides a document entitled, ‘Best Practice Guidelines for the Preparation of Resource & Waste Management Plans for Construction and Demolition Projects’ (2021).

It is important to emphasise that no demolition will take place at this site, however, this document was referred to throughout the process of completing this WMP.

3.9.2 Waste Management Hierarchy

The waste management hierarchy sets out the most efficient way of managing in the following order:

Prevention and Minimisation:

The primary aim of the WMP will be to prevent and thereby reduce the amount of waste generated at each stage of the project.

Reuse of Waste:

Reusing as much of the waste generated on site as possible will reduce the quantities of waste that will have to be transported off site to recovery facilities or landfill.

Recycling of Waste:

There are a number of established markets available for the beneficial use of Construction and Demolition waste such as using waste concrete as fill for new roads.

At all times during the implementation of the WMP, disposal of waste to landfill will be considered only as a last resort.

3.9.3 Construction Phase Waste Management

3.9.3.1 Description of the Works

The construction of the development will involve the construction of 22 no. turbines, new and upgrade of site access roads, internal cabling and the underground cable route, substation, control buildings and all associated infrastructure.

The turbines will be manufactured off site and delivered to site where on site erection will occur.

The turbine foundations will consist of stone from the local quarries and a concrete base which will contain reinforcing steel. These concrete foundations will be shuttered with steel formwork specifically designed for the works and re-usable off site on similar projects.

The construction of the extension to the substation will comprise of a concrete foundation with concrete masonry blocks and a timber roof structure with roof tile or slate covering. The roof structure will be made up of prefabricated roof trusses manufactured off site to minimise timber cutting on site.

The site roads will be constructed with rock won from on-site borrow pits.

The waste types arising from the construction phase of the development are outlined in Table 3-2 below.

Table 3-2 Expected waste types arising during the Construction Phase

Material Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Cardboard	Boxes, cartons	15 01 01
Composite packaging	Containers	15 01 05
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert materials	Sand, stones, plaster, rock, blocks	17 01 07
Mixed municipal waste	Daily canteen waste from construction workers, miscellaneous	20 03 01
Plastic	PVC frames, electrical fittings	17 02 03
Plastic packaging	Packaging with new materials	15 01 02
Tiles and ceramics	Slates and tiles	17 01 03
Wooden packaging	Boxes, pallets	15 01 03

Hazardous wastes that may occur on site during the construction phase of the development may include oil, diesel fuel, chemicals, paints, preservatives etc. All hazardous wastes will be stored in bunded containers/areas before being collected by an authorised waste contractor and brought to an EPA licensed waste facility. As mentioned above, hazardous wastes will be kept separate from non-hazardous wastes so that contamination does not occur.

3.9.3.2 Waste Arising and Proposals for Minimisation, Refuse and Recycling of Construction Waste

Construction waste will arise on the project mainly from excavation and unavoidable construction waste including material surpluses and damaged materials and packaging waste.

Appropriate measures will be taken to ensure excess waste is not generated during construction, including:

- Ordering of materials will be on an 'as needed' basis to prevent over supply to site. Co-ordination is required with suppliers enabling them to take/buy back surplus stock.
- Purchase of materials pre-cut to length to avoid excess scrap waste generated on site.
- Request that suppliers use least amount of packaging possible on materials delivered to the site.
- Ensuring correct storage and handling of goods to avoid unnecessary damage that would result in their disposal.
- Ensuring correct sequencing of operations.
- Use reclaimed materials in the construction works.

Hazardous waste will be kept separate from all other construction waste to prevent contamination and removed appropriately.

3.9.3.3 Waste Arising from Construction Activities

All waste generated on site will be contained in waste skips at a waste storage area on site. This waste storage area will be kept tidy with skips clearly labelled to indicate the allowable material to be disposed of therein.

The expected waste volumes generated on site are unlikely to be large enough to warrant source segregation at the wind farm site. Therefore, all wastes streams generated on site will be deposited into a single waste skip. This waste material will be transferred to a Materials Recovery Facility (MRF) by a fully licensed waste contractor where the waste will be sorted into individual waste streams for recycling, recovery or disposal.

The waste generated from the turbine erection will be limited to the associated protective covers which are generally reusable. Considering the specialist nature of this packaging material the majority will be taken back by suppliers for their own reuse. Any other packaging waste generated from the turbine supply will be deposited into the on-site skips and subsequently transferred to the MRF.

It is not envisaged that there will be any waste material arising from the materials used to construct the site roads as only the quantity of stone necessary will be sourced from local quarries and brought on site on an ‘as needed’ basis.

Site personnel will be instructed at induction that under no circumstances can waste be brought to site for disposal in the on-site waste skip. It will also be made clear that the burning of waste material on site is forbidden.

3.9.3.4 Reuse

Many construction materials can be reused a number of times before they have to be disposed of:

- Concrete can be reused as aggregate for roads cable trench backfilling material.
- Plastic packaging etc. can be used to cover materials on site or reused for the delivery of other materials.
- Excavated material can be reused for reinstatement of the areas around turbine foundations and adjacent to site roads.

3.9.3.5 Recycling

If a certain type of construction material cannot be reused onsite, then recycling is the most suitable option. The opportunity for recycling on site will be restricted to the associated packaging from the wind turbines.

All waste that is produced during the construction phase including dry recyclables will be deposited in the on-site skip initially and sent for subsequent segregation at a remote facility. The anticipated volume of all waste material to be generated at the development is low which provides the justification for adopting this method of waste management.

3.9.4 Implementation

3.9.4.1 Roles and Responsibilities

Prior to the commencement of the development a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the development adheres to the management plan.

3.9.4.2 Training

It is important for the Construction Waste Manager to communicate effectively with colleagues in relation to the aims and objectives of the waste management plan. All employees working on site during the construction phase of the project will be trained in materials management and thereby, will be able to:

- Distinguish reusable materials from those suitable for recycling;
- Ensure maximum segregation at source;
- Co-operate with site manager on the best locations for stockpiling reusable materials;
- Separate materials for recovery; and
- Identify and liaise with waste contractors and waste facility operators.

3.9.4.2.1 *Record Keeping*

The WMP will provide systems that will enable all arisings, movements and treatments of construction waste to be recorded. This system will enable the contractor to measure and record the quantity of waste being generated. It will highlight the areas from which most waste occurs and allows the measurement of arisings against performance targets. The WMP can then be adapted with changes that are seen through record keeping.

The fully licensed waste contractor employed to remove waste from the site will be required to provide documented records for all waste dispatches leaving the site. Each record will contain the following:

- Consignment Reference Number
- Material Type(s) and EWC Code(s)
- Company Name and Address of Site of Origin
- Trade Name and Collection Permit Ref. of Waste Carrier
- Trade Name and Licence Ref. of Destination Facility
- Date and Time of Waste Dispatch
- Registration no. of Waste Carrier vehicle
- Weight of Material
- Signature of Confirmation of Dispatch detail
- Date and Time of Waste Arrival at Destination
- Site Address of Destination Facility

3.9.4.3 Waste Management Plan Conclusion

The WMP will be properly adhered to by all staff involved in the project which will be outlined within the induction process for all site personnel. The waste hierarchy will always be employed when designing the plan to ensure that the least possible amount of waste is produced during the construction phase. Reuse of certain types of construction wastes will cut down on the cost and requirement of raw materials therefore further minimising waste levels.

This preliminary WMP has been prepared to outline the main objectives that are to be adhered to for the preparation of a more detailed WMP to be completed after the planning phase of the Proposed Development.

4. ENVIRONMENTAL MANAGEMENT IMPLEMENTATION

4.1 Roles and Responsibilities

The Site Supervisor/Construction Manager and/or Environmental Clerk of Works (ECoW) are the project focal point relating to construction-related environmental issues.

In general, the ECoW will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The ECoW will act as the regulatory interface on environmental matters by reporting to and liaising with Mayo County Council and other statutory bodies as required.

The ECoW will report directly to the Site Supervisor/Construction Manager. An ECoW, Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure provides a "triple lock" review/interaction by external specialists. An organogram structure for the construction stage is as follows:

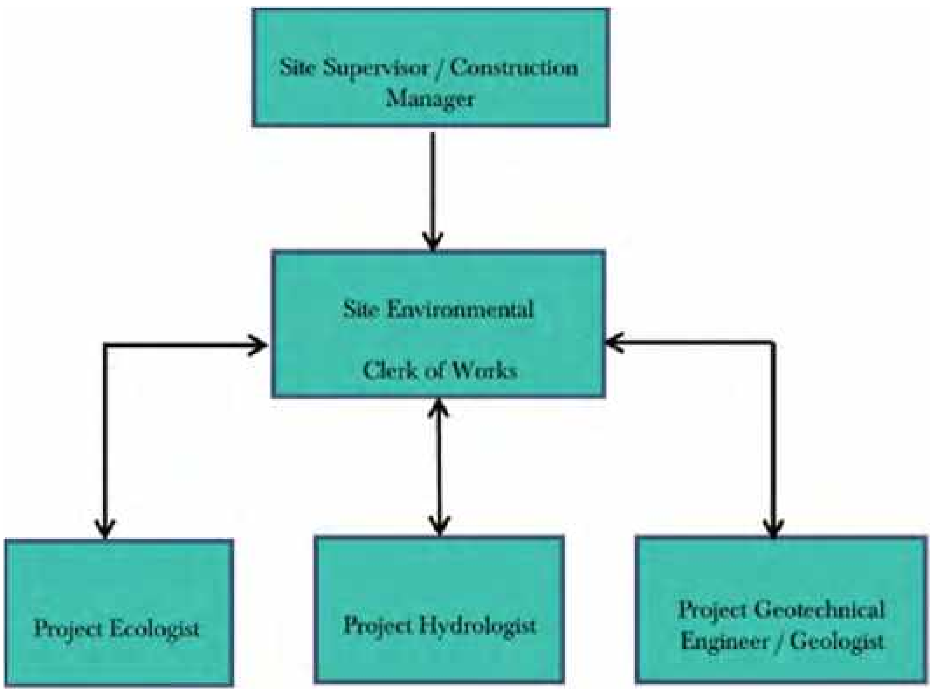

Figure 4-1 Site Management Chain of Command

Any requirement of the granted permission, for the works to be supervised by an engineer with professional indemnity insurance, who upon completion of the works, including site stability, will certify the said works, will be adhered to. Such an engineer will be appointed to oversee and supervise the construction phase of the project.

4.1.1 Construction Manager /Site Supervisor

The Construction Manager / Site Supervisor will have overall responsibility for the organisation and execution of all related environmental activities as appropriate, in accordance with regulatory and project environmental requirements. The duties and responsibilities of the Site Supervisor/Construction Manager will include:

- Ensure that all works are completed safely and with minimal environmental risk;
- Approve and implement the CEMP and supporting environmental documentation, and ensure that all environmental standards are achieved during the construction phase of the project;
- Take advice from the Environmental Clerk of Works on legislation, codes of practice, guidance notes and good environmental working practice relevant to their work;
- Ensure compliance through audits and management site visits;
- Ensure timely notification of environmental incidents; and,
- Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

Ensure that all construction activities are planned and performed such that minimal risk to the environment is introduced.

4.1.2 Environmental Clerk of Works

The main contractor will be required to engage a qualified Environmental Engineer, Environmental Scientist, or equivalent, with experience in wind farm construction to fulfil the role of Environmental Clerk of Works (ECoW), and to monitor all site works and to ensure that methodologies and mitigation are followed throughout construction to avoid negatively impacting on the receiving environment.

The ECoW will report to the Site Supervisor/Construction Manager. The responsibilities and duties of the ECoW will include the following:

- Preparation and update of the CEMP as required, and supporting environmental documentation and review/approval of contractor method statements;
- Undertake inspections and reviews to ensure the works are carried out in compliance with the CEMP;
- Monitor the implementation of the CEMP, particularly all proposed/required Environmental Monitoring;
- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period;
- Advise site management/contractor/sub-contractors on:
    - Prevention of environmental pollution and improvement to existing working methods;
    - Changes in legislation and legal requirements affecting the environment;
    - Suitability and use of plant, equipment and materials to prevent pollution;
    - Environmentally sound methods of working and systems to identify environmental hazards;
- Ensure the specified mitigation measures are initiated and adhered to during the construction phase;
- Liaise with Project Ecologist, Project Hydrologist, Project Geotechnical Engineer and any other members of the project team to ensure regular site visits and audits/inspections are completed;
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents;
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by e-mail;
- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties; and,

- Identify environmental training requirements and arrange relevant training for all levels of site based staff/workers.

The level, detail and frequency of reporting expected from the ECoW for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.

4.1.3 Project Ecologist

The Project Ecologist will report to the ECoW and is responsible for the protection of sensitive habitats and species encountered during the construction phase of the proposed renewable energy development. The Project Ecologist will not be full time on site but will visit the site at least once a month during construction.

The responsibilities and duties of the Project Ecologist will include the following:

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with Environmental Clerk of Works, oversee and provide advice on all relevant ecology mitigation measures set out in the EIAR and planning permission conditions;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Carry out ecological monitoring and survey work as may be required by the planning authority.

Carry out ecological monitoring and survey work as may be required by the planning authority.

4.1.4 Project Hydrologist

The Project Hydrologist will report to the ECoW and is responsible for inspection and review of drainage and water quality aspects associated with construction of the proposed renewable energy development. The Project Hydrologist will not be full time on site but will visit the site at least once a month during construction and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Project Hydrologist will include the following:

- Assist in compiling a detailed drainage design before construction commences and attend the site to set out and assist with micro siting of drainage controls. This will be completed over several site visits at the start of the construction phase;
- Review and input to the final construction phase CEMP in respect of drainage and water quality management;
- Following the initial stage of drainage construction regular site visits will be required, at least once a month, to complete hydrological and water quality audits and reviews and report any issues noted to the Site Supervisor/Construction Manager; and,
- Complete ongoing inspection and monitoring of the development, particularly in areas of drainage control, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, and in relevant planning conditions.

4.1.5 Project Geotechnical Engineer/Geologist

The Geotechnical Engineer or Project Geologist will report to the ECoW and is responsible for inspection and review of geotechnical aspects associated with construction of the proposed renewable energy development. The Geotechnical Engineer will not be full time on site but will visit site at least once a month during the construction phase and on a weekly basis during site preparation/groundworks.

The responsibilities and duties of the Geotechnical Engineer or Geologist will include the following:

- Visit site regularly, or at least once a month during the construction phase, to complete geotechnical audits and reviews and report any issues to the Site Supervisor/Construction Manager;
- Ensuring that identified hazards are listed in the Construction Risk Register and that these are subject to ongoing monitoring; and,
- Ongoing inspection and monitoring of the development, particularly in areas of peatland and the temporary stockpile areas, through all phases of construction (including pre, during and post construction) and ensure construction is carried out as specified in the EIAR, NIS and in relevant planning conditions.

4.2 Water Quality and Monitoring

The methodology for water quality monitoring before, during and after the construction phase of the proposed development is outlined in detail in Section 4 of the Surface Water Management Plan which is included as Appendix 4-4 of the EIAR.

This document includes details in relation to baseline monitoring, daily visual inspections, continuous monitoring, monthly laboratory analysis, field monitoring and reporting.

5. EMERGENCY RESPONSE PLAN

An Emergency Response Plan (ERP) is presented in this section of the CEMP. It provides details of procedures to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

5.1 Overview

The Emergency Response Plan (ERP) is presented in this section of the CEMP. It provides details of procedures to be adopted in the event of an emergency. The site ERP includes details on the response required and the responsibilities of all personnel in the event of an emergency. The ERP will require updating and submissions from the contractor/PSCS and suppliers as the project progresses. Where sub-contractors that are contracted on site are governed by their own emergency response procedure a bridging arrangement will be adopted to allow for inclusion of the sub-contractor's ERP within this within this document.

This is a working document that requires updating throughout the various stages of the project.

5.1.1 Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Site Supervisor/Construction Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 5-1. In a situation where the Site Supervisor/ Construction Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command outlined in Figure 5-1. This will be updated throughout the various stages of the project.

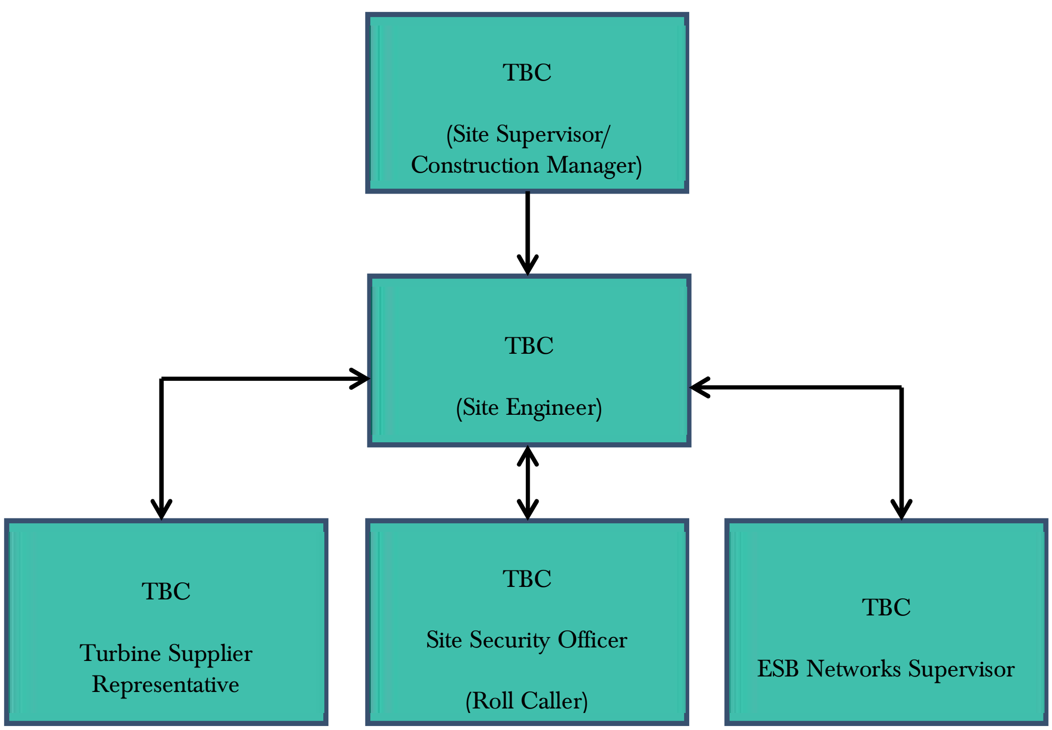

Figure 5-1 Emergency Response Procedure Chain of Command

5.1.2 Hazard Identification

In order to establish the type and scale of potential emergencies that may occur, the following hazards have been identified as being potential situations that may require an emergency response in the event of an occurrence.

Table 5-1 Hazards associated with potential emergency situations.

Hazard	Emergency Situation
Construction Vehicles: Dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/Portable Tools	Entanglement, amputation or electrical shock associated with portable tools
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services
Fire	Injury to operative through exposure to fire
Falls from heights including falls from scaffold towers, scissor lifts, ladders, roofs and turbines	Injury to operative after a fall from a height
Sickness	Illness unrelated to site activities of an operative e.g. heart attack, loss of consciousness, seizure
Turbine Specific Incident	This will be included when the upon agreement and section of the final turbine type

In the event of an emergency situation associated with, but not restricted to, the hazards outlined in Table 5-1 the Site Supervisor/Construction Manager will carry out the following:

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/fog-horn that activates an emergency evacuation on the site. The Site Supervisor/Construction Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare **and if there are no injured personnel at the scene that require assistance** . The Site Supervisor/Construction Manager will be required to use their own discretion at that point. In the case of fire, the emergency evacuation of the site will proceed, without exception. The site evacuation procedure is outlined in Section 5.1.3.
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g. if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone. If delegating the task, ensure that the procedures for contacting the emergency services as set out in Section 5.3 is followed.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g. cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g. ESB Networks the numbers for which as provided in Section 5.4.
- Contact the next of kin of any injured personnel where appropriate.

5.1.3 Site Evacuation/Fire Drill

A site evacuation/fire drill procedure will provide basis for carrying out the immediate evacuation of all site personnel in the event of an emergency. The following steps will be taken:

- Notification of the emergency situation. Provision of a siren or fog-horn to notify all personnel of an emergency situation.
- An assembly point will be designated in the construction compound area and will be marked with a sign. All site personnel will assemble at this point.
- A roll call will be carried out by the Site Security Officer to account for all personnel on site.
- The Site Security Officer will inform the Site Supervisor/Construction Manager when all personnel have been accounted for. The Site Supervisor/Construction Manager will decide the next course of action, which be determined by the situation that exists at that time and will advise all personnel accordingly.

All personnel will be made aware of the evacuation procedure during site induction. The Fire Services Acts of 1981 and 2003 require the holding of fire safety evacuation drills at specified intervals and the keeping of records of such drills

5.2 Environmental Emergency Response Procedure

5.2.1 Excessive Peat Movement

Where there is excessive peat movement or continuing peat movement recorded at a monitoring location, or identified at any location within the site, but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following will be carried out.

- All construction activities will cease within the affected area.
- Increased monitoring at the location will be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.
- Re-commencement of limited construction activity will only start following a cessation of movement and the completion of a geotechnical risk assessment by a geotechnical engineer.

5.2.2 Onset of Peat Slide

Where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following will be carried out.

- On alert of a peat slide incident, all construction activities will cease and all available resources will be diverted to assist in the required mitigation procedures.
- Where considered possible action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain, the possible short run-out length to watercourses, speed of movement and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.
- For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff

and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

5.2.3 Spill Control Measures

Every effort will be made to prevent an environmental incident during the construction and operational phase of the project. Oil/fuel spillages are one of the main environmental risks that will exist on the site which will require an emergency response procedure. The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. The following steps provide the procedure to be followed in the event of such an incident:

- Stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers.
- If applicable, eliminate any sources of ignition in the immediate vicinity of the incident.
- Contain the spill using the spill control materials, track mats or other material as required. Do not spread or flush away the spill.
- If possible, cover or bund off any vulnerable areas where appropriate such as drains, watercourses or sensitive habitats.
- If possible, clean up as much as possible using the spill control materials.
- Contain any used spill control material and dispose of used materials appropriately using a fully licensed waste contractor with the appropriate permits so that further contamination is limited.
- Notify the ECoW immediately giving information on the location, type and extent of the spill so that they can take appropriate action.
- The ECoW will inspect the site and ensure the necessary measures are in place to contain and clean up the spill and prevent further spillage from occurring.
- The ECoW will notify the appropriate regulatory body such as Mayo County Council, and the Environmental Protection Agency (EPA), if deemed necessary.

The importance of a swift and effective response in the event of such an incident occurring cannot be over emphasised. Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

- The ECoW will be immediately notified.
- If necessary, the ECoW will inform the appropriate regulatory authority. The appropriate regulatory authority will depend on the nature of the incident.
- The details of the incident will be recorded on an Environmental Incident Form which will provide information such as the cause, extent, actions and remedial measures used following the incident. The form will also include any recommendations made to avoid reoccurrence of the incident.
- If the incident has impacted on an ecologically sensitive receptor, such as a sensitive habitat, protected species or designated conservation site (pSPA or cSAC), the ECoW will liaise with the Project Ecologist.
- If the incident has impacted on a sensitive receptor such as an archaeological feature the ECoW will liaise with the Project Archaeologist.
- A record of all environmental incidents will be kept on file by the ECoW and the Main Contractor. These records will be made available to the relevant authorities such as Mayo County Council, EPA if required.

The ECoW will be responsible for any corrective actions required as a result of the incident e.g. an investigative report, formulation of alternative construction methods or environmental sampling, and will advise the Main Contractor as appropriate.

5.3 Contact the Emergency Services

In the event of requiring the assistance of the emergency services the following steps will be taken:

Stay calm. It is important to take a deep breath and not get excited. Any situation that requires 999/112 is, by definition, an emergency. The dispatcher or call-taker knows that and will try to move things along quickly, but under control.

Know the location of the emergency and the number you are calling from. This may be asked and answered a couple of times but do not get frustrated. Even though many emergency call centres have enhanced capabilities meaning they are able to see your location on the computer screen they are still required to confirm the information. If for some reason you are disconnected, at least emergency crews will know where to go and how to call you back.

Wait for the call-taker to ask questions, then answer clearly and calmly. If you are in danger of assault, the dispatcher or call-taker will still need you to answer quietly, mostly "yes" and "no" questions.

If you reach a recording, listen to what it says. If the recording says your call cannot be completed, hang up and try again. If the recording says all call takers are busy, WAIT. When the next call-taker or dispatcher is available to take the call, it will transfer you.

Let the call-taker guide the conversation. He or she is typing the information into a computer and may seem to be taking forever. There is a good chance, however, that emergency services are already being sent while you are still on the line.

Follow all directions. In some cases, the call-taker will give you directions. Listen carefully, follow each step exactly, and ask for clarification if you do not understand.

Keep your eyes open. You may be asked to describe victims, suspects, vehicles, or other parts of the scene.

Do not hang up the call until directed to do so by the call taker.

Due to the remoteness of the site it may be necessary to liaise with the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This will form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.

5.4 Contact Details

A list of emergency contacts is presented in Table 5-2. A copy of these contacts will be included in the Site Safety Manual and in the site offices and the various site welfare facilities.

Table 5-2 Emergency Contacts

Contact	Telephone no.
Emergency Services – Ambulance, Fire, Gardaí	999/112
Doctor – Ballina Medical Centre	096 80600
Hospital – Mayo General Hospital	094 9021454
ESB Emergency Services	1850 372 999

Contact	Telephone no.
Gas Networks Ireland Emergency	1850 20 50 50
Gardaí – Ballycastle Garda Station.	096 43002
Health and Safety Co-ordinator - Health & Safety Services	TBC
Health and Safety Authority	1890 289 389
Inland Fisheries Ireland (IFI)	1890 347 424
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDS): TBC	TBC
Glenora Wind Farm Designated Activity Company (DAC)	TBC

5.4.1 Procedure for Personal Tracking

All operatives on site without any exception will have to undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.

In the event of a site operative becoming in an emergency situation where serious injury has occurred and hospitalisation has taken place, it will be the responsibility of the Site Manager or next in command if unavailable to contact the next of kin to inform them of the situation that exists.

5.5 Induction Checklist

Table 5-3 provides a list of items highlighted in this ERP which must be included or obtained during the mandatory site induction of all personnel that will work on the site. This will be updated throughout the various stages of the project.

Table 5-3 Emergency Response Plan Items Applicable to the Site Induction Process

ERP Items to be included in Site Induction	Status
All personnel will be made aware of the evacuation procedure during site induction	
Due to the remoteness of the site it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This will form part of the site induction to make new personnel and sub-contractors aware of any such arrangement or requirement if applicable.	
All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

6. MITIGATION MEASURES

All mitigation measures relating to the pre-commencement, construction and operational phases of the Proposed Development were set out in the various sections of the Environmental Impact Assessment Report (EIAR), NIS prepared as part of the planning permission application to An Bord Pleanála.

This section of the CEMP groups together all of the mitigation measures presented in the above documents. The Mitigation Measures are presented in the following pages.

By presenting the mitigation proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits.

Table 6-1 Site Preparation and Mitigation Measures

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			EIAR Chapter 4 – Description of the Proposed Development		
			Pre-Commencement Phase		
MM1	Environmental Management	EIAR Section 4	All proposed activities on the site of the Proposed Development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the Proposed Development and is included in Appendix 4-3 of this EIAR. The CEMP sets out the key environmental considerations to be taken into account by the contractor during construction of the proposed development. The CEMP also details the mitigation measures to be implemented in order to comply with the environmental commitments outlined in the EIAR.		
MM2	Environmental Management	EIAR Section 4	The on-site construction staff will be responsible for implementing the mitigation measures specified in the EIAR and compiled in the Audit Report. Their implementation will be overseen by the ECoW or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. The system of auditing referred to above ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary.		
MM3	Drainage Inspection	CEMP Section 4 SWMP Section 3	Prior to commencement of works in sub-catchments across the site, main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously. Drainage and associated pollution control measures will be implemented onsite in conjunction with the main construction works. Where possible drainage controls will be installed during seasonally dry ground conditions. This will reduce the possibility of impact on surface waters by suspended sediment released during construction and entrained in surface run-off.		
MM4	Concrete Deliveries	EIAR Section 4 CEMP Section 3	The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures.		
MM5	Site Drainage Plan	EIAR Section 4 CEMP Section 4	A detailed drainage design for the Proposed Development, incorporating all principles and measures outlined in Section 4.7 of the EIAR, has been prepared, and is included in Appendix A of Appendix 4-5 of this EIAR.		
MM6	Preparative Site Drainage Management,	CEMP Section 4 SWMP Section 3	All materials and equipment necessary to implement the drainage measures outlined above will be brought on-site in advance of any works commencing. An adequate quantity of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary. The drainage measures outlined in the above will be installed prior to, or at the same time as the works they are intended to drain.		
MM7	Drainage Maintenance	EIAR Section 4 CEMP Section 4	Prior to the commencement of construction an inspection and maintenance plan for the on-site drainage system will be prepared by the ECoW in consultation with the Project Hydrologist. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.		
MM8	Waste Management	EIAR Section 4	Prior to the commencement of the development, a Construction Waste Manager will be appointed by the Contractor. The Construction Waste Manager will be in charge of the implementation of the objectives of the plan, ensuring that all hired waste contractors have the necessary authorisations and that the waste management		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the development adheres to the management plan.		
MM9	Felling	EIAR Section 4, 7	In the interest of breeding birds, construction will not commence during the Breeding Bird season from April to July inclusive. Construction may commence at any stage from August onwards to the end of March, so that construction activities are ongoing by the time the next breeding bird season comes around and can continue throughout the next breeding season. Should any of the species identified as Important Ecological Features be recorded breeding within the given distances of the works area, a buffer zone (using above distances) will 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.		
MM10	Felling Licence	EIAR Section 4 CEMP Section 4	The tree felling activities required as part of the Proposed Development will be the subject of a Limited Felling Licence (LFL) application to the Forest Service in accordance with the "Forestry Act" and the Forestry Regulations 2017 (SI 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments.		
MM11	Peat Management	CEMP Section 2	Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m. Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area. Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.		
MM12	Invasive Species Management	CEMP Section 3	To establish good site hygiene to ensure the control of any potential spread of invasive species during construction works, a risk assessment and method statement must be provided by the Contractor prior to commencing works.		
MM13	Traffic Management	EIAR Section 4	Prior to the Traffic Management Plan being finalised, a full dry run of the transport operation along the proposed route will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the Traffic Management Plan submitted for agreement with the local authority. All turbine deliveries will be provided for in a transport management plan which will have to be prepared in advance of the construction stage, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. Such a transport management plan will be submitted to the Planning Authority for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.		
MM14	Health and Safety	EIAR Section 4	All relevant Site Health & Safety procedures, in accordance with the relevant Health and Safety Legislation and guidance (listed in Section 5.8.2.1 of this EIAR), including the preparation of the Health & Safety Plan, erection of the relevant and appropriate signage on site, inductions and toolbox talks will take place prior to and throughout the construction phase of the proposed development.		
			Construction Phase		
MM15	Wastewater Management	EIAR Section 4	Temporary toilets, located within staff portacabins, will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by a permitted waste collector to wastewater treatment plants.		
MM16	Refuelling	EIAR Section 4 CEMP Section 3	› On-site refuelling of machinery will be carried out at dedicated refuelling locations using a mobile double skinned fuel bowser. The fuel bowser, a double-axle custom-built refuelling trailer will be re-filled off site and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all construction machinery to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. › Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays, spill kits and fuel absorbent mats will be used during all refuelling operations.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Fuels volumes stored on site will be minimised. The fuel storage areas, within the temporary construction compounds, will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor; - The electrical control buildings (at the substation compound) will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor; - The plant used will be regularly inspected for leaks and fitness for purpose; and, - An emergency plan for the construction phase to deal with accidental spillages will be developed (refer to Section 5 of this CEMP). Spill kits will be available to deal with any accidental spillage in and outside the refuelling area.		
MM17	Concrete Deliveries and Management	EIAR Section 4 CEMP Section 3	The following mitigation measures will be implemented in full to avoid release of cement leachate from the site: - No batching of wet-cement products will occur on site; - The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout of trucks and discussing emergency procedures. - Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used; - No washing out of any plant used in concrete transport or concreting operations will be allowed on-site; - Where concrete is delivered on site, only chute cleaning will be permitted, using the smallest volume of water possible. A dedicated concrete wash out area will be established with signage to allow the wash out of concrete delivery vehicle chutes before exiting the site. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. - Use weather forecasting to plan dry days for pouring concrete; - Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event; - The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, and proposed to be built using straw bales and lined with an impermeable membrane. below. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is tankered off-site. Any solid contents that will have been cleaned down from the chute will have solidified and will be broken up and disposed of along with other construction waste (refer to Section 3.9 below). The 50m wide river buffer zone will be in place for the duration of the construction phase. No construction activity will occur within the buffer zone with the exception of bridge and culvert construction. The buffer zone will: - Prevent any cement-based products accidentally entrained in the construction phase drainage system entering directly into watercourses, achieved in part by ending drain discharge outside the 50m buffer zone and allowing percolation across the vegetation of the buffer zone; - Provide a buffer against accidental direct pollution of surface waters by any pollutants, or by pollutants entrained in surface water run-off.		
MM18	Road Cleanliness	EIAR Section 4	A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the Proposed Development.		
MM19	Watercourse Buffers	EIAR Section 4 CEMP Section 3	All discharges from the proposed works areas will be made over vegetation filters at an appropriate distance from natural watercourses. Buffer zones of 50m around rivers and streams, respectively, have been used to inform the layout of the Proposed Development.		
MM20	Water Discharge	EIAR Section 4 CEMP Section 3	There will be no direct discharges to natural watercourses. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at an appropriate distance from natural watercourse and lakes.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM21	Drainage Swales	EIAR Section 4 CEMP Section 3	Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses. Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.		
MM22	Interceptor Drains	EIAR Section 4 CEMP Section 3	Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area. The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike.		
MM23	Check Dams	EIAR Section 4 CEMP Section 3	Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.		
MM24	Level Spreaders	EIAR Section 4 CEMP Section 3	A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.		
MM25	Piped Slope Drains	EIAR Section 4	Piped slope drains will be used to convey surface runoff from diversion drains safely down slopes to flat areas without causing erosion. Once the runoff reaches the flat areas it will be reconverted to diffuse sheet flow. Level spreaders will only be established on slopes of less than 6% in grade. Piped slope drains will be used to transfer water away from areas where slopes are too steep to use level spreaders.		
MM26	Vegetation Filters	EIAR Section 4	Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions. Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration. Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling ponds prior to diffuse discharge to the vegetation filters via a level spreader.		
MM27	Stilling Ponds	EIAR Section 4 CEMP Section 3	Stilling or settlement ponds will be used to attenuate runoff from works areas of the site of the Proposed Development during the construction phase and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase.		
MM28	Dewatering Silt Bag	EIAR Section 4	Dewatering silt bags are an additional drainage measure that can be used downgradient of the stilling ponds at the end of the drainage swale channels and will be located, wherever it is deemed appropriate, throughout the site. The water will flow, via a pipe, from the stilling ponds into the silt bag. The silt bag will allow the water		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			to flow through the geotextile fabric and will trap any of the finer silt and sediment remaining in the water after it has gone through the previous drainage measures. The dewatering silt bags will ensure that there will be no loss of peaty silt into the stream.		
MM29	Siltbuster	EIAR Section 4	A "siltbuster" or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales. Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit.		
MM30	Sedimats	EIAR Section 4	Sediment entrapment mats, consisting of coir or jute matting, will be placed at the outlet of the silt bag to provide further treatment of the water outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. The sedimat will extend to the full width of the outfall to ensure all water passes through this additional treatment measure		
MM31	Culverts	EIAR Section 4	The following mitigation is proposed for completion of wind farm culvert upgrades: › All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse. › The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. › In all cases, culverts will be oversized to allow mammals to pass through the culvert. › Culverts will be installed with a minimum internal gradient of 1% (1 in 100). Smaller culverts will have a smooth internal surface. Larger culverts may have corrugated surfaces which will trap silt and contribute to the stream ecosystem. Depending on the management of water on the downstream side of the culvert, large stone may be used to interrupt the flow of water. › All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance. › It is proposed to construct clear-span crossings watercourse crossings along the wind farm access roads using a bottomless box culvert. The locations of these crossings are shown on the layout drawings included in Appendix 4-1 of this EIAR. The clearspan watercourse crossing methodologies presented below will ensure that no instream works are necessary. › The watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within an acceptable backfill material. › The service crossings will be constructed in accordance with Gas Networks Ireland Code of Practice 2021. These crossing designs will be approved by GNI before works commence on site. › Confirmatory inspections of each proposed new watercourse crossing location will be carried out by the project civil/structural engineer and the project hydrologist prior to the construction of each crossing. › The watercourse crossings will be constructed to the specifications of the OPW bridge design guidelines 'Construction, Replacement or Alteration of Bridges and Culverts - A Guide to Applying for Consent under Section 50 of the Arterial Drainage Act, 1945', and in consultation with Inland Fisheries Ireland. Abutments will be constructed from precast units combined with in-situ foundations, placed within suitable backfill material.		
MM32	Silt Fences	EIAR Section 4	› Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone of a natural watercourse, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the proposed development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the detailed drainage design drawings included in Appendix A of Appendix 4-5 of this EIAR. › The silt fence designs follow the technical guidance document 'Control of Water Pollution from Linear Construction Projects' published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series. › Site fences will be inspected regularly to ensure water is continuing to flow through the fabric, and the fence is not coming under strain from water backing up behind it.		
MM33	Hydrocarbon Interceptors	EIAR Section 4	A suitably sized hydrocarbon interceptor will be installed wherever it is intended to store hydrocarbons and oils (i.e construction compounds and substation compound) or where it is proposed to park vehicles during the construction and operational phases of the proposed development (i.e construction compounds, substation compound and visitor car park).		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM34	Excavation seepages and treatment	EIAR Section 4	› There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. › A five-metre-wide working area will be required around each turbine base, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Some of the material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be sealed using the back of the excavator bucket to ensure no water is trapped within the material and it will be surrounded by silt fences to ensure sediment-laden run-off does not occur. › A two to three-metre-wide working area will be required around each hardstanding area, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets and surrounded by silt fences to ensure sediment-laden run-off does not occur. › Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.		
MM35	Peat Management	EIAR Section 4 CEMP Section 2, 3	› Excavation will take place to a competent stratum beneath the peat. › Prior to commencing the construction of excavated roads, movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m. › Road construction will be carried out in sections of approximately 50m lengths i.e., no more than 50m of access road should be excavated without re-placement with stone fill. › Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pits. All peat placement areas will be upslope of founded roads/hardstands and will be inspected by the Projects Geotechnical Engineer before material is stored in the area. › Excavation of materials with respect to control of peat stability: ○ Where acrotelm (top about 0.3 to 0.4m of peat) is required for landscaping it will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations. ○ Where possible, the acrotelm will be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation. ○ All catotelm peat (peat below about 0.3 to 0.4m depth) will be transported immediately on excavation to the designated peat placement areas. › Excavated side slopes in peat will not be greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction. Where areas of weaker peat are encountered then slacker slopes will be required . Battering of the side slopes of the excavations will be carried out as the excavation progresses. › End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the adjacent peat, is limited. › The excavated access road will be constructed with a minimum of 800mm of selected granular fill. Granular fill to be placed and compacted in layers in accordance with the TII Specification for Road Works. › Access roads will be finished with a layer of capping across the full width of the roads. › A layer of geogrid/geotextile may be required at the surface of the competent stratum where cohesive material is present to prevent mixing of the underlying material with the granular fill › Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e. greater than 2m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability. › A final surface layer will be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic. › Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m. Base geogrid will be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements. › Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road. › Stone delivered to the floating road construction areas will be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat will not be carried out. › To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road will be tipped over at least 10m length of constructed floating road.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road will carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road. › No stockpiling of materials will take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat. › End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited. › In the event of excessive vertical displacement of the road during/following construction then mitigation measures will be required to ensure the stability of the road. This will include: ○ Introduction of pressure berms either side of the road (that are 2m to 5m wide by 0.5m deep stone layer). ○ Where peat is relatively willow then excavate peat and replace with suitable fill. ○ Slowing the rate of construction. › Settlement of a floated access road is expected and will likely be in order of several 100mm in the deeper peat area; as such it will be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of the settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works, the road will be re-levelled using crushed stone.		
MM36	Peat and Spoil Placement Areas	EIAR Section 4 CEMP Section 2	› Excavated peat will be placed/spread across the clearfell areas around 9 no. of the proposed turbines. These locations are shown in Drawing P20-312-0600-GLEN-0005. › The peat placed within the areas shown on Drawing P20-312-0600-GLEN-0005 will be restricted to a maximum height of 1.3m. Weak/liquified peat will be placed within the proposed borrow pits and not stored within these areas. › The placement of excavated peat will be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the placement areas will require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works. › Where there is any doubt as to the stability of the peat surface then no material will be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface. › It will be ensured that the surface of the placed peat will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the peat placement area progresses. This will reduce the likelihood of debris run-off and reduce the risk of instability of the placed peat. › Finished/shaped side slopes in the placed peat and spoil will be not greater than 1 (v): 4 (h). This slope inclination will be reviewed during construction, as appropriate. › The acrotelm will be placed on the finished surface with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat and spoil within the placement areas. › An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.		
Chapter 5: Human Beings					
Pre-Commencement Phase					
MM44	Human Health	EIAR Section 5	Prior to commencement of any works, the occupants of dwellings in the vicinity of the proposed works will be contacted and the scheduling of works will be identified in line with the Engagement plan. Local access to properties will also be maintained throughout any construction works and local residents will also be supplied with the number of the works supervisor in order to ensure that disruption will be kept to a minimum.		
Construction Phase					
MM45	Human Health	EIAR Section 5	The Proposed Development will be constructed, operated and decommissioned in accordance with all relevant Health and Safety Legislation, including: › Safety, Health and Welfare at Work Act 2005 (No. 10 of 2005); › Safety, Health and Welfare at Work (General Application) (Amendment) Regulations 2016 (S.I. No. 36 of 2016); › S.I. No. 528/2021 - Safety, Health and Welfare at Work (Construction) (Amendment) Regulations 2021 and › Safety, Health and Welfare at Work (Work at Height) Regulations 2006 (S.I. No. 318 of 2006). A Health and Safety Plan covering all aspects of the construction process will address the Health and Safety requirements in detail.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			All hazards will be identified, and risks assessed. Where elimination of the risk is not feasible, appropriate mitigation and/or control measures will be established. The contractor will be obliged under the construction contract and current health and safety legislation to adequately provide for all hazards and risks associated with the construction phase of the project. Safepass registration cards are required for all construction, delivery and security staff. Construction operatives will hold a valid Construction Skills Certificate Scheme card where required. The developer will ensure a competent contractor is appointed to carry out the construction works. The contractor will be responsible for the implementation of procedures outlined in the Safety and Health Plan. Public safety will be addressed by restricting site access during construction. Fencing will be erected in areas of the site where uncontrolled access is not permitted. Appropriate warning signs will be posted, directing all visitors to the site manager. Appropriate warning measures including 'goalposts' will be used as appropriate to prevent contact with any overhead lines that traverse the site. The scale and scope of the project requires that a Project Supervisor Design Process (PSDP) and Project Supervisor Construction Stage (PSCS) are required to be appointed in accordance with the provisions of the Health & Safety Authority's '*Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006*'. The PSDP appointed for the construction stage will be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations. These duties include (but are not limited to): › Identify hazards arising from the design or from the technical, organisational, planning or time related aspects of the project; › Where possible, eliminate the hazards or reduce the risks; › Communicate necessary control measures, design assumptions or remaining risks to the PSCS so they can be dealt with in the Safety and Health Plan; › Ensure that the work of designers is coordinated to ensure safety; › Organise co-operation between designers; › Prepare a written Safety and Health Plan; › Prepare a safety file for the completed structure and give it to the client; and › Notify the Authority and the client of non-compliance with any written directions issued. The PSCS appointed for the construction stage will be required to perform his/her duties as prescribed in the Safety, Health and Welfare at Work (Construction) Regulations. These duties include (but are not limited to): › Development of the Safety and Health Plan for the construction stage with updating where required as work progresses; › Compile and develop safety file information › Reporting of accidents / incidents; › Weekly site meeting with PSCS; › Coordinate arrangements for checking the implementation of safe working procedures. Ensure that the following are being carried out: › Induction of all site staff including any new staff enlisted for the project from time to time; › Toolbox talks as necessary; › Maintenance of a file which lists personnel on site, their name, nationality, current Safe Pass number, current Construction Skills Certification Scheme (CSCS) card (where relevant) and induction date; › Report on site activities to include but not limited to information on accidents and incidents, disciplinary action taken and PPE compliance; › Monitor the compliance of contractors and others and take corrective action where necessary; and › Notify the Authority and the client of non-compliance with any written directions issued.		
MM46	Human Health	EIAR Section 5	Signage indicating the designated pedestrian route site along the Western Way will be in place during the construction phase of the development. Likewise, appropriate construction site warning signage and health and safety signage will be in place along the Western Way and on the approach to the construction site at all times during the construction phase to ensure that any potential impacts pertaining to existing amenity access is mitigated against. Furthermore, all health and safety procedures as detailed in Chapter 5 (section 5.10.2.1) will be strictly adhered to ensure not only the safety of construction staff but any users of the Western Way during the construction phase.		
MM47	Human Health	EIAR Section 5	› Local residents will be kept informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern; › The core hours for construction activity will be 07:00 to 19:00 Monday to Friday and 07:00 to 13:00 Saturday. There will be no working on Sundays and Public Holidays;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- Any extraordinary site work occurring outside of the core working hours (for example, crane operations lifting components onto the tower) will be programmed, when appropriate, so that haulage vehicles would not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid anticipated periods of high traffic flows; - All vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance; - Inherently quiet plant will be selected where appropriate and available - all major compressors would be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which would be kept closed whenever the machines are in use; - All ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers; - Machines will be shut down between work periods (or when not in use) or throttled down to a minimum; - All equipment used on site will be regularly maintained, including maintenance related to noise emissions; - Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation; and - All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and if necessary, temporary acoustic screens or enclosures will be provided.		
MM48	Human Health	EIAR Section 5	The majority of aggregate material for the construction of roads and turbine bases will be sourced from the proposed borrow pit located within the main site of the proposed wind farm development, therefore limiting the distance needed to transport this material to the site. Truck wheels will be washed to remove mud and dirt before leaving the site. All plant and materials vehicles will be stored in the compound area or other dedicated areas. Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. Construction traffic will be restricted to defined routes and a speed limit will be implemented. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and the temporary site compound to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff. The active construction area along the intended grid connection route options will be small, ranging from 150-300m in length at any one time. Should separate crews be used during the construction phase they will generally be separated by 1-2km. All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise. Aggregate materials for the construction of the cabling route will be sourced locally to reduce the amount of emissions associated with vehicle movements.		
MM49	Human Health	EIAR Section 5	A traffic management plan (included as Appendix 15-2) will be developed and implemented to ensure any impact is short term in duration and slight in significance along the intended grid connection route. Prior to commencement of any works, the occupants of dwellings in the vicinity of the proposed works will be contacted and the scheduling of works will be identified in line with the Engagement plan. Local access to properties will also be maintained throughout any construction works and local residents will also be supplied with the number of the works supervisor in order to ensure that disruption will be kept to a minimum. In relation to the cable laying works, the works area in any one day will be approximately 100-150m in length and so the potential for significant disruption is limited.		
			Chapter 6: Biodiversity		
			Pre-Commencement Phase		
MM52	Invasive Species Management	EIAR Section 6 CEMP Section 3	A pre-construction invasive species survey will be undertaken a part of the proposed project. This will provide updated data in advance of any construction given the intervention time period between the original survey work and any future grant of permission/ construction. Measures will be in place to prevent the spread of these species during the proposed works. In addition, all necessary precautions will be taken to prevent the introduction of invasive species to the site from elsewhere.		
MM53	Fauna - Badger	EIAR Section 6	- A pre-construction badger survey will be undertaken at the location of the identified sett by a qualified ecologist prior to the commencement of any works to determine if the setts are in use and to identify any additional sett entrances that may have been excavated in the intervening period. - The sett will be monitored for 2 weeks prior to construction using a camera trap to determine if it is in use. - If the sett is found to be in use exclusion measures will be put in place prior to construction in line with NRA (2005b) Guidelines to ensure that the sett is evacuated.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- As per NRA guidelines exclusion from an active sett will only be carried out during the period of July to November inclusive in order to avoid the badger breeding season. - During the breeding season (December to June inclusive) no works will be undertaken within 50m of active setts nor blasting or pile driving within 150m of active setts. - Exclusion zone fencing and appropriate signage will be put in place around the main sett to the south of the substation which lies outside the construction footprint. This will ensure that there will be no vehicles tracking in the area and no temporary storage of construction materials that could impact the sett.		
MM54	Fauna - Otter	EIAR Section 6	Whilst no otter were recorded at the locations of the proposed water crossings during the surveys undertaken, it is noted that this is a mobile species and could potential migrate into the site. As such, prior to the commencement of construction works associated with the installation of watercourse crossings, the following measures will be undertaken for the avoidance of disturbance/displacement and direct mortality and to ensure that no otter holts/breeding sites have been established since the original surveys undertaken (TII, 2008b): - From a precautionary basis, a pre-commencement confirmatory otter survey will be undertaken in accordance with standard best practice guidance prior to the commencement of site works. - Should the surveys identify the presence of an otter holt, the following measures will be undertaken: a National Parks and Wildlife Service and a derogation licence will be applied for (although compliance with such a licence has not been relied on in this assessment). - No works will be undertaken within 150m of any holts at which breeding females or cubs are present. - No wheeled or tracked vehicles (of any kind) will be used within 20m of active, but non-breeding, otter holts. Light work, such as digging by hand or scrub clearance will also not take place within 15m of such holts, except under licence (TII, 2008b). All of the above works will be undertaken or supervised by an appropriately qualified ecologist.		
MM55	Fauna - Bats	Appendix 6-2	NatureScot recommends that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features) is adequate mitigation. This 50m buffer will be implemented from the outset and monitored as per the post construction monitoring. The success of the buffer mitigation will be assessed as part of post construction monitoring and updated where necessary.		
			Construction Phase		
MM56	Fauna - Bats	EIAR Section 6 Appendix 6-2	- Plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (SI 359/1996). - Exterior lighting, during construction, will be designed to minimize light spillage, thus reducing the effect on areas outside the Proposed Development, and consequently on bats i.e. Lighting will be directed away from mature trees/treelines around the periphery of the site boundary to minimize disturbance to bats. Directional accessories can be used to direct light away from these features, e.g. through the use of light shields (Stone, 2013). The luminaries will be of the type that prevent upward spillage of light and minimize horizontal spillage away from the intended lands.		
MM57	Peatland and Associated Habitats	EIAR Section 6	The Proposed Development provides for the restoration of approximately of 40ha of peatland habitat in the northern section of the site, through drain blocking measures and the removal of removal of encroaching conifers (establishing as a result of natural seed dispersal). This is fully described in the Biodiversity Management and Enhancement Plan (BMEP). The BMEP will improve the ecological condition of the existing degraded peatland habitat in the northern section of the site. The location and extent of the habitat enhancement area is mapped in the BMEP, available in Appendix 6-6 of the EIAR.		
MM58	Invasive Species	EIAR Section 6	Good construction site hygiene will be employed to prevent introduction of problematic invasive alien plant species (e.g., Japanese knotweed, Rhododendron, Giant Rhubarb etc.) by thoroughly washing vehicles prior to entering the site. Any soil and topsoil required on the site will be sourced from a stock that has been screened for the presence of any invasive species and where it is confirmed that none are present. The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority – The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads (NRA 2010).		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
MM59	Aquatic Fauna	EIAR Section 6	In relation to new watercourse crossings, Inland Fisheries Ireland (IFI) will be consulted a minimum of four weeks in advance of the installation of pre-cast concrete bottomless box culverts. The Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters; and the Scottish Natural Heritage (SNH) Good Practice During Wind Farm Construction (SNH, 2019, 4th Edition) will also be adhered to. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses (any deviation from this will be done in discussion with the IFI).		
MM60	Flora and Fauna	EIAR Section 6	The Proposed Development has the potential to result in enhancement of the surrounding areas through habitat rehabilitation management (as described in the Biodiversity and Enhancement Management Plan) that will be implemented during the construction phase of the Proposed Development and maintained during the operational phase. Details of the management that will be undertaken are provided in the Biodiversity and Enhancement Management Plan in Appendix 6-6 of the EIAR. These include: › Conifer Felling › Drain Blocking › Removal of Rhododendron › Timing of Works › Vegetation Monitoring › Hydrological Monitoring		
Chapter 7 Birds (Appendix 7-1)					
Pre-Commencement Phase					
MM63	Birds	Appendix 7-1	During the breeding season (March-August) bird monitoring surveys within the proposed wind farm development site will take place to a distance of up to 1 km from the proposed wind farm development site. The purpose of the surveys is to confirm the locations of breeding territories prior to construction to ensure that mitigation is successfully implemented (see Section 5.2) to avoid disturbance effects on breeding activities as a result of the works. The survey for breeding birds on the adjoining bog to the west and southeast will follow methodology of Brown and Shepherd (1993) and will take place in the April to July period (4 visits) in the season before works, including tree felling, commence. This schedule will provide guidance to the contractor on where restrictive zones are likely to be required		
MM64	Birds	Appendix 7-1	As noted in Section 2.9.4 (Breeding Season Distribution and Abundance Surveys), targeted surveys for breeding raptors were not undertaken within the Proposed Development site or within a 2 km radius of the site. Owing to the high conservation status of merlin, and noting the difficulties associated with survey for breeding merlin (as highlighted by Lusby et al. 2011), particular focus will be placed on locating possible territories within a distance of at least 1 km of the works area. The survey, which will take place in the period April to July, prior to any works on site commencing including tree felling, will comprise a combination of traditional search methods (after Hardey et al. 2009) and vantage point watches focused on suitable habitat within 1 km maximum of the vantage point location (see Lusby et al. 2011). The merlin survey will be undertaken by field workers with experience of surveying birds of prey. Survey limitations were also identified with establishing the status of breeding woodcock on site (see Section 2.9.4.3). A full survey for breeding woodcock, following Gilbert et al. (1998), will be undertaken in the breeding season prior to any works, including tree felling, commencing on site.		
Construction Phase					
MM65	Birds	Appendix 7-1	The present study has identified potential significant disturbance effects on various breeding species which are listed as Important Ecological Features as a result of the construction works (see Section 4.2.2). These species are sparrowhawk, buzzard, merlin, kestrel, red grouse, golden plover, and snipe (woodcock, while not recorded, is		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			included as focused baseline survey was not carried out). Best available evidence has been reviewed (see Section 4.2.2) and it is suggested that these species could be disturbed by works, including tree felling, up to and including the at the following distances: - Sparrowhawk 200 m - Buzzard 200 m - Merlin 500 m - Kestrel 200 m - Red Grouse 500 m - Golden Plover 500 m - Snipe 400 m - Woodcock 100 - 200 m Should any of these species be recorded breeding within the given distances of the works area (as established through confirmatory surveys before and/or during construction – see Sections 5.6 & 5.7), a buffer zone (using above distances) will 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, which will apply from March to August (inclusive), will ensure that the works will not have significant adverse effects on the identified IEFs.		
MM66	Birds	Appendix 7-1	A range of passerine bird species breed within the site, including meadow pipit (Red-listed). As noted, (Section 4.2.3), disturbance to, or destruction of, active nests during construction activities could contravene Section 22 of the Wildlife Acts 1976 to 2021. Clearance of trees and ground vegetation will take place outside of the bird breeding season (1st March – 31st August) to minimise the possibility of disturbance and destruction to occupied bird nests during the construction phase. However, it is possible that some ground may still need to be cleared of vegetation during the breeding season or that previously cleared ground will have developed colonising vegetation (such as brambles) which could attract nesting birds such as wren. Such these occurrences arise, the following protocol will be followed: - The area will be surveyed by a qualified ecologist with ornithological experience 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 to prevent disturbance to the nest, the ecologist will evaluate the situation in the context of the conservation status of the species and the stage of breeding, i.e. nest with eggs, nest with young chicks, nest with large young near fledging stage, and will advise on the best approach in the context of the Wildlife Acts. In such cases, the local representative of NPWS will be consulted.		
			EIAR Chapter 8 Land Soils & Geology		
			Construction Phase		
MM69	Earthworks	EIAR Section 8	- Placement of turbines and associated infrastructure in areas with shallower peat has been achieved during the design phase; - Maximum use of the existing road network to reduce peat excavation and borrow pit volumes; - The minimum possible volume of peat and subsoil will be removed to allow for infrastructural work to take place in comparison to the total volume present on the site due to optimisation of the layout by mitigation by design; - Construction of the Proposed Development will be undertaken in Phases, where each Phase comprises works around 5-7 turbines at any one time, allowing borrow pits to be developed and backfilled in stages. - A suitable drainage system to be constructed to ensure continuity of the site hydrology (EIAR Chapter 9). - All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Gravel/rock fill will be used to provide additional support to temporary cuts/excavations where appropriate, as determined by the Project Geotechnical Engineer. Unstable temporary cuts/excavations will not be left unsupported. Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› To mitigate against the compaction of soil at the site, prior to the commencement of any earthworks, the work corridor will be pegged, and machinery will stay within this corridor so that peatland / soils outside the work area is not damaged. Excavations will then be carried out from access tracks as they are constructed in order to reduce the compaction of soft ground. › Soil excavated from trenches along the proposed grid connection route will be taken to a licenced facility for disposal or recycling where required. If feasible, the upper layers of tarmac and asphalt will be excavated separately to the lower engineered fill layers		
MM70	Contamination of Soils	EIAR Section 8	› Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling will occur at a controlled fuelling station; › On site re-fuelling will be undertaken using a double skinned bowser with spill kits on the ready for accidental leakages or spillages; › On site re-fuelling will be undertaken by suitably trained personnel only under a permit to refuel system; › Fuels stored on site will be minimised. Storage areas located at the temporary compounds where required will be bunded appropriately for the fuel storage volume for the time period of the construction and fitted with a storm drainage system and an appropriate oil interceptor; › The electrical substation will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor; › The plant used during construction will be regularly inspected for leaks and fitness for purpose; › All waste tar material arising from the chipping and resurfacing of the public road portion of the temporary construction access road will be removed off-site and taken to licenced waste facility; › An emergency plan for the construction phase to deal with accidental spillages is contained within the Construction and Environmental Management Plan (Appendix 4- 4 of this EIAR). Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.		
MM71	Erosion of soils	EIAR Section 8	Peat removed from turbine locations and access roads will be used for landscaping, spread within the proposed peat placement areas around certain turbines and used to reinstate the 3 no. proposed borrow pits. The acrotelm will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored peat within the borrow pits. Reseeding and spreading/planting of heather and moss cuttings will also be carried out in these areas. These measures will prevent erosion of stored peat in the long term. A full Peat and Spoil Management Plan for the Proposed Development is included as Appendix 4-2 of this EIAR. Any excess temporary mounded peat in storage for long periods will be sealed using the back of an excavator bucket. This will minimise erosion of soil. Silt fences will be installed around stockpiles to limit movement of entrained sediment in surface water runoff. The use of bunds around earthworks and mounds will prevent egress of water from the works. To mitigate against erosion of the exposed soil or rock, all excavations will be constructed and backfilled as quickly as possible, although this will depend on the nature of the excavation – a hardstand excavation can be backfilled immediately, however a turbine base excavation will remain open for a prolonged period of time as the base is constructed. Excavations will stop during or prior to heavy rainfall events. To mitigate against possible contamination of the exposed soils and bedrock, refuelling of machinery and plant will only occur at designated refuelling areas. In order to minimise erosion of mineral subsoils stripping of peat will not take place during extremely wet periods as defined in the Chapter 9 of this EIAR (to prevent increased silt rich runoff). Drainage systems (as described in Section 4.7 of Chapter 4 of this EIAR) will be required to limit runoff impacts during the construction phase. During tree felling, brash mats will be used to support vehicles on soft ground, reducing peat and mineral soil erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.		
MM72	Peat Instability	EIAR Section 8	Firstly, the key mitigation with regard peat stability risk at the Proposed Development site was the carrying out of a robust, multidisciplinary site investigation and peat stability risk assessment carried out in accordance with best practice guidance (PLHRAG, Scottish Government, 2017). Also, the lessons learned from historical peat slide events have been incorporated into the design of this project and the construction methodologies to be implemented. These lessons show that it is important that the existing site drainage is maintained during construction to avoid a similar failure to that on Shass Mountain, which occurred following heavy rainfall, and this is referenced in the Risk Assessments for the turbines/access roads (Appendix 8-1). Based on the control measures given in the FT Peat Stability Assessment (Appendix 8-1) report being strictly adhered to during construction and the detailed stability assessment carried out for the peat slopes which showed that the site has an acceptable margin of safety, there is a low risk of peat instability/failure at the Proposed Development site.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			The risk assessment at each turbine and infrastructure location identified a number of control measures to reduce further the potential risk of peat failure. Access roads to turbines will be subject to the same relevant control measures that apply to the nearest turbine as detailed in the FT Peat Stability Assessment Report. The following measures which will be implemented during the construction phase of the project will assist in the management of the risks for this site. › Appointment of experienced and competent contractors; › The site will be supervised by experienced and qualified personnel, including a Project Geotechnical Engineer; › Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement); › Prevent undercutting of slopes and unsupported excavations. All temporary cuts/excavations will be carried out such that they are stable or adequately supported. Gravel/rock fill will be used to provide additional support to temporary cuts/excavations where appropriate, as determined by the Project Geotechnical Engineer. Unstable temporary cuts/excavations will not be left unsupported. Where appropriate and necessary, temporary cuts and excavations will be protected against the ingress of water or erosion. Open excavations will be inspected on a daily basis. › Excavation will be carried out from access roads or hardstanding areas to avoid tracking of construction plant across areas of soft ground/peat. › Excavations which could have the potential to undermine the up-slope component of an existing slope will be sufficiently supported to resist lateral slippage and careful attention will be given to the existing drainage. › Maintain a managed robust drainage system; › Prevent placement of loads/overburden on marginal ground as detailed in the peat stability assessment report; › Set up, maintain and report findings from monitoring systems (as described in the Peat & Spoil Management Plan, Appendix 8.2); › Undertake strength testing of peat directly prior to access road construction for new access roads, both founded and floating. › Earthworks will not be commenced when heavy or sustained rainfall is forecast. A rainfall gauge will be installed on site to provide a record of rainfall intensity. An inspection of site stability and drainage by the Project Geotechnical Engineer will be carried out on site when a daily rainfall of over 15mm is recorded on site, works will only recommence after heavy rain with the prior approval of the Project Geotechnical Engineer following an inspection. › Engineer and Contractor to ensure that construction method statements are followed; and, › Revise the Geotechnical Risk Register, as necessary as construction progresses.		
EIAR Chapter 9 Hydrology					
Pre-Commencement Phase					
MM75	Clear-felling of Coniferous Plantation	EIAR Section 9	**Mitigation by Avoidance:** There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines". **Mitigation by Design:** Mitigation measures will be implemented wherever clear-felling is planned. The objective will be to mitigate the risk of mobilising suspended solids and nutrients into drains and surface water courses, as follows: › Small felling areas (<25ha), sequencing of felling to avoid intense felling in one subcatchment › Limiting felling areas and sequencing the felling to avoid intense felling in one subcatchment. › Machine combinations (i.e. handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance. › Sediment/Silt traps will be strategically placed downslope within forestry drains near streams before ground preparation. The purpose is to slow water flow, increase residence time, and allow settling of silt. No direct discharge of such ditches to watercourses will occur. › Crossing of streams away from bridges and culverts will not be permitted. Checking and maintenance of roads and culverts will be on-going throughout felling activity. No tracking of vehicles through watercourses will occur. Existing interceptor drains will also not be disturbed. › Clay, soil and silts will be removed from roads during wet periods and dust will be suppressed during dry spells. › Main drains that accommodate the discharge from collector drains will include rock armour, as required, where there are steep gradients. › On steep slopes and where felling inside the 50 metre buffer is required, double or triple sediment traps will be installed. All drainage channels will taper out before entering the buffer zone. This ensures that discharged water fans out over the buffer zone before entering the aquatic zone, with sediment filtered out by ground vegetation within the zone. › Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Machine access will be maintained to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in dedicated disposal areas. › Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Brash management/removal. › Brash mats will be used to support vehicles on soft ground, reducing soil erosion and avoiding the formation of rutted areas. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion, extraction will be suspended during periods of high rainfall. › Timber will be stacked in dry areas and outside a 50 metre buffer. Straw bales and check dams will be emplaced on the downgradient side of timber storage/processing sites. › Works will not be conducted during significant rainfall events (see Section 9.4.2.2) in order to minimise entrainment of exposed sediment in surface water run-off. › Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when tree-felling operations have been completed. **Drain Inspection and Maintenance:** The following items will be carried out during pre-felling inspections and after: › Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines (i.e., hot spot areas). › Inspections of plant and machinery will be conducted prior to any works to assure all are in good condition. › Inspection of drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. The pre-felling inspection will be conducted during rainfall events. › Following tree felling, all main drains will be inspected to ensure that they are functioning. › Extraction tracks nears drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground; Culverts on drains exiting the site will be unblocked. › All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.		
MM76	Earthworks	EIAR Section 9	**Mitigation by Avoidance:** Works areas will be kept at least 50 m from watercourses to the extent possible. The proposed setback distance/buffer will serve to avoid: › Direct physical damage to watercourses and associated releases of sediment. › Direct entry of suspended sediments from earthworks into watercourses. › Direct entry of suspended sediments from the drainage system into watercourses, which is achieved in part by ending drain discharges outside the buffer and allowing percolation across the vegetation within the buffer. Risks and effects of earthworks are made greater during storm events. Hence, earthworks will not be conducted during significant storm events. The works programme for the entire construction stage of the Proposed Development will take account of weather forecasts, notably predicted rainfall. Large excavations and movements of soil/subsoil or vegetation stripping will be scaled back or suspended if heavy rain is forecast. Decisions to suspend works will be made from review of weather forecasts and visual observations, as judged and decided upon by the project hydrologist and/or environmental clerk of works. The checking and communication of weather forecasts are part of the CEMP. Prior to suspending works for climatic reasons, the following control measures will be completed: › Open excavations will be secured. › Temporary or emergency drainage will be provided to prevent back-up of surface runoff in work areas. › Working for up to 12 hours after heavy rainfall events will be avoided to ensure drainage systems are not overloaded. Decisions are subject to visual inspection and judgement by the resident (supervising) engineer. The intent and objective is to control erosion, avoid collapses of embankments, and limit the mobilisation and transport of sediments. **Mitigation by Design:** Key mitigation by design measures that will be implemented comprise source controls, in-line controls and treatment systems, as follows: › Source control measures cover working areas, staging areas and stockpiles. Methods that will be employed are diversion drains, flume pipes, sand bags, oyster bags filled with gravel, and filter fabrics. Flexibility to adapt methods will be required based on location-specific conditions, as judged by supervising engineers from visual inspection. › In-Line controls involve settling of suspended sediments and particulate organic matter with the use of silt fences, straw bales, sand or oyster bags, weirs, baffles, and check dams. Flow limiters and sump pumping systems may be employed where needs arise in order to maintain the hydraulic functioning of the existing drain system.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Treatment systems involve sediment traps and temporary sumps/attenuation ponds. Moreover, soil accumulations will be removed from access roads during wet periods and dust will be suppressed during dry spells. If discharge water fails to be of a high quality during regular inspection, then a filtration treatment system such as a "Siltbuster" or equivalent will be used to filter discharge water before release to watercourses. This applies for the entire construction phase. For discharges near watercourses, within the 50 m buffer, and including discharges of greenfield runoff, double silt fences will be employed. These will be inspected and maintained, and remain in place throughout the entire construction phase. Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, the majority of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats. Sediment entrapment mats, consisting of coir or jute matting, will be placed at the silt bag location to provide further treatment of the outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. Sedimats will extend the full width of the outfall to ensure all water passes through this additional treatment measure. Level spreaders will be designed for each outfall. **Management of Runoff from Peat and Spoil Placement Areas:** Excavated peat and spoil will be used for landscaping, spread within the proposed peat placement areas around certain turbines and used to reinstate the 3 no. borrow pits. A Peat and Spoil Management Plan which describes details of the excavations is presented in **Appendix 4-2**. During the initial placement of peat and spoil, silt fences, straw bales and biodegradable matting will be used to control runoff from reinstatement areas. 'Siltbuster' treatment trains will be employed if previous treatment is not to a high quality, as stated above. Drainage from peat placement areas will ultimately be routed to swales and settlement ponds with storage and settlement designed for a 6-hour duration, 1 in 10 year storm event. Peat and spoil placement areas will be vegetated to reduce sediment entrainment in runoff, which will further help to reduce risks of sediment mobilisation. **Field Inspection:** An inspection and maintenance plan for the construction drainage system will be prepared in advance of commencement of works. Regular inspections of installed drainage systems will be undertaken, especially after heavy rainfall, to check for damage and blockages, and ensure there is no escape or build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling. Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. Checks will be conducted on a daily basis.		
MM77	Culverts	EIAR Section 9	**Mitigation Measures by Avoidance:** Machinery and personnel are kept out of the river directly. Direct in-stream works will be avoided. **Mitigation Measures by Design:** All works will be conducted in accordance with the CEMP which incorporates the best practice IFI "Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters" (IFI, 2016). Related activity incorporates many of the same measures that are presented in Section 9.4.2.2 (earthworks). Moreover: › All stream crossings will be bottomless-box or clear span culverts. Existing banks will remain undisturbed. › Based on IFI (2016), the relevant work period is July to September inclusive, *i.e.,* the relatively drier summer period. Any deviation that may be temporarily necessary will be done in discussion with the IFI. › During near-stream construction works, double-row silt fences will be emplaced immediately downgradient of work areas for the duration of activity. › All new stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent. Underground cabling routes within the Wind Farm Site (e.g. from turbines) will follow access roads and cables will pass within the structure of the road and associated culverts.		
MM78	Grid Connection Installation	EIAR Section 9	In-stream works will be avoided in all cases. With regard to HDD, mitigation measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling will be implemented in full, as follows:		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages. - One or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks. - Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility. - Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.		
MM79	Hydraulic Effects of Drainage	EIAR Section 9	Development footprints have been reduced to a minimum and interceptor drains will be shallow (<1.5 m) which serves to reduce the relative risk of drainage effects. The drainage system will be integrated with the existing drainage network in the forest to the maximum extent possible. All construction works will be supervised.		
MM80	Pumping from Open Pits	EIAR Section 9	**Mitigation by Avoidance:** An upslope interceptor drain will be established upslope of the excavation area to prevent greenfield runoff into the excavations. Berms will also be used, as necessary. **Mitigation by Design:** The water pumped by sump pumps will pass through silt bags before being discharged into the swale. As the water pass through the silt bags, the majority of sediment and organic matter is retained by geotextile fabric. The silt bags will be used with natural vegetation filters or sedimats. The sedimats will be secured to the ground surface using stakes/pegs. They will extend to the full width of the outfall to ensure that all water passes through this treatment measure. Level spreaders will be installed for each outfall. The footprints of excavations for infrastructure foundation works and hardstanding have been planned to be as small as practicable. Excavations will be backfilled after completion of installations, which will serve to restore water levels and drainage patterns, hence reduce the temporary drainage effects.		
MM81	Accidental Spills or Leaks	EIAR Section 9	**Mitigation Measures by Design:** The prevention of, and responses to, accidental spills and leaks of fuel and other chemicals are covered by the CEMP and SWMP. The following mitigation measures will be implemented: - Trained personnel will conduct onsite refuelling only. - Onsite refuelling of machinery will be done by mobile double-skinned fuel bowsers. - Drip trays and fuel absorbent mats will be available and used during all refuelling operations - A permit for the fuel system will be put in place. - Fuels stored onsite will be minimised. Fuel storage areas will be bunded to contain 110%v of the fuel storage volume for the time period of the construction. Rainwater will not be allowed to accumulate within the bund, and will thus be fitted with a storm drainage system and appropriate oil interceptor. - The plant used during construction will be regularly inspected for leaks and fitness for purpose. - Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.		
MM82	Release of Cement-Based Products	EIAR Section 9	**Mitigation Measures by Avoidance:** - Concrete will be delivered in sealed concrete delivery trucks. Batching of wet-cement products will not occur on site. - Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place. - Pre-cast elements for culverts and concrete works will be used. - Concrete trucks will not be washed out on site but will be directed back to their batching plant for washout. **Mitigation Measures by Design:** - Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement-contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined washout ponds. - Where temporary lined impermeable containment areas are used, such containment areas are built using straw bales and lined with an impermeable membrane. These are covered when not in use to prevent rainwater collecting. - Pour sites of cement will be kept free of standing water, and plastic covers will be ready in case of sudden rainfall events.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			Concrete deliveries are often conducted outside of normal working hours in order to limit traffic effects on roads. Concrete pouring for turbine foundations is normally completed in a single day per turbine. The placed concrete begins curing straight away after placement and vibrations, it is solid in 24-48 hours, and it reaches its full strength after 28 days. As such, leakage from the formwork to the surrounding ground is not possible. Risks of pollution will be further reduced as follows: - Concrete will not be transported around the site in open trailers or dumpers so as to avoid spillage while in transport. - All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete locally to the location where it is needed. - Arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, confirming routes, prohibiting on-site washout and discussing emergency procedures. - Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site. - Weather forecasting will be used to assist in planning large concrete pours and large pours will be avoided where prolonged periods of heavy rain is forecast. - Concrete pumps and machine buckets from slewing over watercourses will be restricted while placing concrete. - Excavations will be sufficiently dewatered before concreting begins and dewatering will continue while concrete sets. - Covers will be available for freshly placed concrete to avoid the surface washing away in heavy rain. - Any potential, small surplus of concrete will be disposed of after completion of a pour in suitable locations away from any watercourse or sensitive habitats.		
MM83	Wastewater Management	EIAR Section 9	Wastewater will not be treated or disposed of onsite.		
Chapter 10 Air Quality					
Construction Phase					
MM88	Exhaust Emissions	EIAR Section 10	- All construction vehicles and plant used onsite during the construction phase will be maintained in good operational order. If a vehicle requires repairs this work will be caried out, thereby minimising any emissions that arise. - Turbines components will be transported to the Site on specified routes only, unless otherwise agreed with the Planning Authority. - All machinery will be switched off when not in use. - Users of the Site will be required to ensure that all plant and vehicles are suitably maintained to ensure that emissions of engine generated pollutants is kept to a minimum. - The majority of aggregate materials for the construction of the Proposed Development will be obtained from the borrow pits on site. This will significantly reduce the number of delivery vehicles accessing the site, thereby reducing the amount of emissions associated with vehicle movements. - The Materials Recovery Facility (MRF) facility will be local to the Proposed Development site to reduce the amount of emissions associated with vehicle movements. The nearest licensed waste facility to the Wind Farm Site is located approximately 44km to the southeast of the site of the Proposed Development. - Waste associated with the construction of the underground grid connection cabling route will be disposed of at the closest MRF to where waste is generated along the underground electrical cabling route. There closest licensed waste facilities in the vicinity of the underground electrical cabling route, is located approximately 38km to the south.		
MM89	Dust Emissions	EIAR Section 10 CEMP Section 3	- A wheel wash facility will be installed on the Proposed Development site and will be used by vehicles before leaving site. - In periods of extended dry weather, dust suppression may be necessary along haul roads, site roads, grid route, road widening sections, substation, and construction compounds and around the borrow pit area to ensure dust does not cause a nuisance. If necessary, such as during periods of dry weather, de-silted water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads, turbine bases, borrow pit and site compounds to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff as outlined in the CEMP. - Areas of excavation will be kept to a minimum and stockpiling of excavated material will be minimised by coordinating excavation, placement of material in peat placement areas and restoration of borrow pits. - Turbines components and construction materials will be transported to the site on specified haul routes only, as agreed with the local authority.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as deemed necessary by the construction Site Supervisor/Site Manager. - The transport of construction materials may have the potential to generate dust in dry weather conditions. Roads will be watered down to suppress dust particles in the air as deemed necessary by the Site Supervisor/Manager. - The transport of dry excavated material from the on-site borrow pits, which may have potential to generate dust will be minimised. If necessary, such as in periods of dry weather, excavated material will be dampened prior to transport from the borrow pits. - A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-3). The CEMP includes dust suppression measures.		
EIAR Chapter 11 Climate					
Construction Phase					

MM92	Greenhouse Gas Emissions	EIAR Section 11	- All construction vehicles and plant will be maintained in good operational order while onsite, thereby minimising any emissions that arise.
			- When stationary, delivery and on-site vehicles will be required to turn off engines.
			- Turbines and construction materials will be transported to the site on specified routes only unless otherwise agreed with the Planning Authority.
			- The majority of aggregate materials for the construction of the Proposed Development will be obtained from the borrow pits on site. This will significantly reduce the number of delivery vehicles accessing the site, thereby reducing the amount of emissions associated with vehicle movements.
			- The Construction and Environmental Management Plan (CEMP) (Appendix 4-3) includes a Waste Management Plant (WMP) which outlines the best practice procedures that will occur during the construction phase relating to waste material.
			    ○ Section 4.3.10.7 of Chapter 4 for this EIAR refers to the methodology that will be utilised to manage onsite waste. This waste material will be transferred to a licensed /permitted Materials Recovery Facility (MRF) by a fully licensed waste contractor,
			    ○ The MRF facility will be local to the Proposed Development site to reduce the amount of emissions associated with vehicle movements.
			- Waste associated with the construction of the underground electrical cabling route will be either brought directly to a licensed MRF or brought back to the Primary Construction Compound on-site, whichever is closest to the waste generation location in order to reduce vehicle movements.		

EIAR Chapter 12 Noise					
Pre-Commencement Phase					
MM94	Construction Noise	EIAR Section 12	Local residents will be kept informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern;		
Construction Phase					
MM95	Construction Noise	EIAR Section 12	Good practice during all construction phases will be implemented to minimise noise effects. Section 8 of BS 5228-1:2009+A1:2014 recommends a number of simple control measures as summarised below that will be employed onsite: - Local residents will be kept informed of the proposed working schedule, where appropriate, including the times and duration of any abnormally noisy activity that may cause concern; - Any extraordinary site work occurring outside of the core working hours (for example, crane operations lifting components onto the tower) will be programmed, if required, so that haulage vehicles will not arrive at or leave the site between 19:00 and 07:00, with the exception of abnormal loads that would be scheduled to avoid anticipated periods of high traffic flows; - All vehicles and mechanical plant will be fitted with effective exhaust silencers and be subject to programmed maintenance; - Inherently quiet plant will be selected where appropriate and available - all major compressors will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use; - All ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers; - Machines will be shut down or throttled down to a minimum between work periods (or when not in use). Machinery will be not be left idling unnecessarily; - All equipment used on site will be regularly maintained, including maintenance related to noise emissions; - Vehicles will be loaded carefully to ensure minimal drop heights so as to minimise noise during this operation;		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			• All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance and temporary acoustic screens or enclosures will be provided where practicable; and • Use of a temporary acoustic barrier during construction activities in proximity to CNAL5.		
			EIAR Chapter 13 Cultural Heritage		
			Construction Phase		

MM97	Recorded Monuments along the Grid Connection Route	EIAR Section 13	Archaeological monitoring will be carried out under licence from the National Monuments Service along the grid connection cable route where it extends through the ZoN of the following monuments.
			• MA007-046 Megalithic tomb, MA007-046/001 and 002 Hut Sites at Ballyglass
			  ○ Ringfort MA007-048 at Ballycastle
			  ○ Ringfort MA014-026 at Ballinglen
			• A report on the monitoring will be compiled on completion of the work and submitted to the relevant authorities.
			• Further mitigation such as preservation in situ (avoidance), preservation by record (excavation) may be required depending on the results of the monitoring.		

MM98	Sub Surface Archaeological Potential	EIAR Section 13	• Pre-development archaeological testing of the Proposed Development (e.g. turbine bases, hardstands, proposed roads, compounds, substation site, met mast, etc) will be carried out by a suitably qualified archaeologist under licence from the National Monuments Service. As many of these areas are covered in dense forestry it is proposed that the testing will be carried out once the keyhole clear-felling required for the Proposed Development has taken place, but prior to the commencement of construction works. • Further mitigation such as preservation in situ (avoidance), preservation by record (excavation) or buffer zones may be required depending on the results of the testing. Consultation with the NMS and the Planning Authority may be required to discuss the results of testing and any required mitigation. • A report on the testing will be compiled on completion of the work and submitted to the NMS and the Planning Authority for consideration. • Archaeological monitoring of all groundworks associated with the Proposed Development will be carried out by a suitably qualified archaeologist during the construction stage of the project. • A report on the monitoring will be compiled on completion of the work and submitted to the relevant authorities.		
MM99	Features of Local Cultural Heritage Merit	EIAR Section 13	• A buffer zone (c. 180m in diameter) as depicted on Figure 13-30 around the series of buildings will be established and incorporated into the Construction, Environmental and Management Plan (CEMP). • Ground works as part of the construction phase of the Proposed Development will be monitored by a suitably qualified archaeologist as detailed in Section 13.4.2.7.		
MM100	Derelict House	EIAR Section 13	• A buffer zone (c. 170m in diameter) around the buildings as depicted on Figure 13-31 will be established and has been incorporated into the Construction, Environmental and Management Plan (CEMP). • Ground works as part of the construction phase of the Proposed Development will be monitored by an suitable qualified archaeologist as detailed in Section 13.4.2.7.		
			Chapter 15 Material Assets		
			Pre-Commencement		
MM101	Water Supply	EIAR Section 15	In advance of any construction activity for the grid route, the contractor will undertake pre-commencement surveys of the proposed route to confirm the presence or otherwise of any services such as water supply. If found to be present, the relevant service provider will be consulted with in order to determine the requirement for specific excavation or relocation methods and to schedule a suitable time to carry out works. In the event that water mains are encountered the water supply will be turned off by the utility so work can commence on diverting the service. The section of existing pipe will be removed and will be replaced with a new pipe along the new alignment of the service. The works will be carried out in accordance with the specifications of the relevant utility provider.		
			Construction Phase		
MM102	Electricity	EIAR Chapter 15	• Goal posts will be established under the two overhead lines for the entirety of the construction phase. They will not exceed a height of 4.2 metres, unless specifically agreed with ESB Networks		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			- The suitability of machinery and equipment for use near power lines will be risk assessed. - All staff will be trained on the routes and operating voltages of overhead electricity lines running across the local road in the townland of Lisglennon All staff will be trained to be aware of the risks associated with overhead lines. - Barriers will run parallel to the overhead line at a minimum horizontal distance of 6 metres on plan from the nearest overhead line conductor wire. - Prior to the delivery of turbines to the Proposed Development site, a dry run of the route using vehicles with similar dimensions. Please see Section 15.1 above for details. - When activities must be carried out beneath overhead lines, e.g. component delivery or grid cable laying, a site-specific risk assessment will be undertaken prior to any works. The risk assessment must take into account the maximum potential height that can be reached by the plant or equipment that will be used is undertaken prior to any works. Overhead line proximity detection equipment is fitted to machinery when such works are required. - Information on safe clearances will be provided to all staff and visitors. - Signage indicating locations and health and safety measures regarding overhead lines will be erected in canteens and on site. - All staff will be made aware of and adhere to the Health & Safety Authority's 'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan. - All health and safety measures as detailed in Chapter 5: Population and Human Health will be adhered to during the construction, operation and decommissioning phases.		
			Chapter 15 – Traffic		
			Pre-Commencement		
MM106	Traffic	EIAR Section 15	Prior to the commencement of the construction phase of the Proposed Development a detailed Traffic Management Plan will be prepared by the Contractor in accordance with the measures proposed in the TMP, for agreement with the relevant local authorities and An Garda Síochána . The TMP includes measures which will include the measures below as a minimum requirement, for the following: - Traffic Management Coordinator – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management. - Delivery Programme – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site. - Information to locals – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided. - A Pre and Post Construction Condition Survey – Where required by the local authority, a pre-condition survey of roads associated with the Proposed Development will be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers. - Liaison with the relevant local authority - Liaison with the County Councils and An Garda Síochána, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, (in compliance with the provisions of the CEMP), the Roads section will be informed of the relevant names and contact numbers for the Project Developer/Contractor Site Manager as well as the Site Environmental Manager. - Implementation of temporary alterations to road network at critical locations – at locations highlighted in section 15.1.8. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable. - Identification of delivery routes – These routes will be agreed with the County Councils and adhered to by all contractors. - Delivery times of large turbine components - The management plan includes the commitment to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage. - Travel plan for construction workers – While the assessment above has assumed the worst case in that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site. - Additional measures - Various additional measures will be put in place in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required. These are set out in the CEMP which is contained in Appendix 4.3.		

Ref. No.	Reference Heading	Reference Location	Mitigation Measure	Audit Result	Action Required
			› Re-instatement works - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.		
			Construction Phase		
MM107	Traffic	EIAR Section 15	The construction of this development will require significant coordination and the following comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the proposed wind farm. Delivery of abnormal sized loads › The following are the main measures that will be implemented for these deliveries. These will take place during nighttime hours and will comply with the following process : › The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised. › The deliveries will be made in consultation with the Local Authority and An Garda Síochána. › It is estimated that 198 abnormal sized loads will be delivered to the site, comprising 40 convoys of 5, undertaken over 40 separate nights. › These nights will be spread out over an approximate period of 20 weeks and will be agreed in advance with the relevant authorities › In order to manage each of the travelling convoys, for each convoy there will be two police escort vehicles that will stop traffic at the front and rear of the convoy of 5 vehicles. › There will also be two escort vehicles provided by the haulage company for each convoy.		

7. MONITORING PROPOSALS

All monitoring proposals relating to the pre-commencement, construction and operational phases of the Proposed Development were set out in various sections of the EIAR, NIS and Biodiversity Enhancement Plan prepared as part of the planning permission application to An Board Pleanála.

This section of the Construction and Environment Management Plan groups together all of the monitoring proposals presented in the EIAR. The monitoring proposals are presented in the following pages.

By presenting the monitoring proposals in the below format, it is intended to provide an easy to audit list that can be reviewed and reported on during the future phases of the project. The tabular format in which the below information is presented, can be further expanded upon during the course of future project phases to provide a reporting template for site compliance audits

Table 7-1 Monitoring Measures

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			Pre-Construction Phase			
MX1	Drainage Maintenance	EIAR Section 4 SWMP Section 4	Prior to commencement of works in sub-catchments across the site, main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment by catchment basis prior to the commencement of construction works across the site, as works in all areas will not commence simultaneously.	On going	Monthly	Project Hydrologist
MX2	Forestry Felling Drainage Management	EIAR Section 9 SWMP Section 3	Before the commencement of any felling works, an Environmental Clerk of Works (ECoW) will be appointed to oversee the keyhole and extraction works. The ECoW will be experienced and competent, and will carry out the following measures and operate their record using a Schedule of Works Operation Record (SOWOR), as proposed in the planning application: › Attend the site for the setup period when drainage protection works are being installed, and be present on site during the remainder of the forestry keyhole felling works. › Prior to the commencement of works, review and agree the positioning by the Operator of the required Aquatic Buffer Zones (ABZs), silt traps, silt fencing (see below), water crossings and onsite storage facilities for fuel, oil and chemicals (see further below). › Be responsible for preparing and delivering the Environmental Tool Box Talk (TBT) to all relevant parties involved in site operations, prior to the commencement of the works. › Conduct daily and weekly inspections of all water protection measures and visually assess their integrity and effectiveness in accordance with Section 3.4 (Monitoring and Recording) and Appendix C (Site Monitoring Form (Visual Inspections)) of the Forestry & Freshwater Pearl Mussel Requirements. › Take representative photographs showing the progress of operation onsite, and the integrity and effectiveness of the water protection measures. › Collect water samples for analysis by a 3rd party accredited laboratory, adhering to the following requirements: › Surface water samples will be collected upstream and downstream of the keyhole felling site at suitable sampling locations. › Sampling will be taken from the stream / river bank, with no in-stream access permitted. › The following minimum analytical suite will be used: ○ pH, ○ Electrical Conductivity, ○ Temperature ○ Total Suspended Solids, Biochemical Oxygen Demand, Total Phosphorus, Ortho-Phosphate, Total Nitrogen, and Ammonia. › Review of operator's records for plant inspections, evidence of contamination and leaks, and drainage checks made after extreme weather conditions. › Prepare and maintain a Emergency Response Plan (refer to Section 5 of the Construction and Environmental Management Plan). › Suspend work where potential risk to water from siltation and pollution is identified, or where operational methods and mitigation measures are not specified or agreed. › Prepare and maintain a register of all proposed drainage control/protection measures (Water Protection Measure Register). This document is to be updated weekly by the ECoW.	As Required	Weekly	ECoW
MX3	Drainage Inspection	EIAR Section 9 SWMP Section 4	Drainage performance will form part of the civil works contract requirements. During the construction phase the effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treatment of potentially silt-laden water from the works areas will be monitored periodically (daily, weekly, and event based monitoring, i.e. after heavy rainfall events) by the ECoW and/or the Project Hydrologist. The ECoW will respond to changing weather and drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained. Prior to the commencement of construction an inspection and maintenance plan for the on-site drainage system will be prepared by the ECoW in consultation with the Project Hydrologist. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.	Daily/Weekly/Quarterly	As Required	ECoW/Project Hydrologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			Any excess build-up of silt levels at check dams, the settlement ponds, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. The following periodic inspection regime will be implemented: › Daily general visual inspections at pre-determined locations, as chosen by the Project Hydrologist and by ECoW; › Weekly (existing & new drains) inspections of all drainage measures by the ECoW and/or the site Construction Manager; › Inspection to include all elements of drainage systems and all water quality monitoring. Inspections required to ensure that drainage systems are operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter shall be noted and corrective action shall be implemented. High risk locations such as settlement ponds will be inspected daily by the ECoW. Daily inspections checks will be completed on plant and equipment, and whether materials such as silt fencing or oil absorbent materials need replacement; › Event based inspections by the ECoW as follows: › >10 mm/hr (i.e. high intensity localised rainfall event); › >25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or, › Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week). › Monthly site inspections of the drainage measures by the Project Hydrologist during construction phase; and, › Quarterly site inspections of the drainage measures by the Project Hydrologist after construction for a period of one year following the construction phase. › A written record will be maintained or available on-site of all construction phase monitoring undertaken. The abandonment triggers as set out in the SOWOR will be adopted as part of drainage inspections to ensure that any of the conditions prescribed under any abandonment trigger does not exist at the locations under inspection.			
MX4	Surface Water Monitoring	SWMP Section 4	Water quality field testing and laboratory analysis will be undertaken prior to commencement of felling and construction at the site. The monitoring programme will be subject to agreement with Mayo County Council but will be based on the planning stage programme already outlined in the EIAR and CEMP and presented in this document. It is proposed to begin baseline monitoring three months prior to the commencement of the construction phase. Analysis will be for a range of parameters with relevant regulatory limits along with Environmental Quality Standard's (EQSs) and sampling will be undertaken for each stream that drains from the construction site. Baseline sampling will be completed on at least two occasions and these will coincide with low flow and high flow stream conditions. The high flow sampling event will be undertaken after a period of sustained rainfall, and the low flow event will be undertaken after a dry spell. There is an existing drainage network across the site and runoff drains relatively freely to local watercourses and streams. This existing drainage system will continue to function as it is during the pre-construction phase. However, prior to commencement of works in sub-catchments across the site, main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. These inspections will be done on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.	Twice	As Required	Project Hydrologist
MX5	Invasive Species	EIAR Section 6 CEMP Section 3	From a precautionary perspective, a pre-construction invasive species survey will be undertaken as part of the proposed project. This will provide updated data in advance of any construction given the intervention time period between the original survey work and any future grant of permission/ construction. Previously identified infested areas will be resurveyed prior to the commencement of the treatment procedures. The purpose of this is to identify if the Rhododendron has spread outside of previously mapped areas.	Once	As required	Project Ecologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
MX6	Flora and Fauna - Otter	EIAR Section 6	A pre-commencement confirmatory otter survey will be undertaken in accordance with standard best practice guidance prior to the commencement of site works.	Once	As required	Project Ecologist
MX7	Flora and Fauna - Badger	EIAR Section 6	A pre-construction badger survey will be undertaken at the location of the identified sett by a qualified ecologist prior to the commencement of any works to determine if the setts are in use and to identify any additional sett entrances that may have been excavated in the intervening period. The sett will be monitored for 2 weeks prior to construction using a camera trap to determine if it is in use.	Once	As Required	Project Ecologist
MX8	Birds	Appendix 7-1	During the breeding season (March-August) bird monitoring surveys within the proposed wind farm development site will take place to a distance of up to 1 km from the proposed wind farm development site. The purpose of the surveys is to confirm the locations of breeding territories prior to construction to ensure that mitigation is successfully implemented (see Section 5.2) to avoid disturbance effects on breeding activities as a result of the works. The survey for breeding birds on the adjoining bog to the west and southeast will follow methodology of Brown and Shepherd (1993) and will take place in the April to July period (4 visits) in the season before works, including tree felling, commence. This schedule will provide guidance to the contractor on where restrictive zones are likely to be required. As noted in Section 2.9.4 (Breeding Season Distribution and Abundance Surveys), targeted surveys for breeding raptors were not undertaken within the Proposed Development site or within a 2 km radius of the site. Owing to the high conservation status of merlin, and noting the difficulties associated with survey for breeding merlin (as highlighted by Lusby et al. 2011), particular focus will be placed on locating possible territories within a distance of at least 1 km of the works area. The survey, which will take place in the period April to July, prior to any works on site commencing including tree felling, will comprise a combination of traditional search methods (after Hardey et al. 2009) and vantage point watches focused on suitable habitat within 1 km maximum of the vantage point location (see Lusby et al. 2011). The merlin survey will be undertaken by field workers with experience of surveying birds of prey. Survey limitations were also identified with establishing the status of breeding woodcock on site (see Section 2.9.4.3). A full survey for breeding woodcock, following Gilbert et al. (1998), will be undertaken in the breeding season prior to any works, including tree felling, commencing on site.	Once	As required	Project Ornithologist
			Construction Phase			
MX9	Birds	Appendix 7-1	Any ground clearance of habitat during the period March to August that could support breeding birds will be walked to establish the presence of breeding birds (mainly passerines). This will be done by an ornithologist up to 10 days before the clearance works take place. If 10 days elapse without the clearing commencing, a further survey will take place. The focus will be on the area to be cleared but zones up to 100 m (approximately) around the area will also be included. Should a breeding territory be identified, the surveyor will attempt to establish the phase of building, e.g., nest building, incubating, feeding young, and will advise the contractor accordingly on measures to be followed (see Section 5.2).	As required	As required	Project Ornithologist
MX10	Archaeological Monitoring	EIAR Section 13	Archaeological monitoring will be carried out under licence from the National Monuments Service along the grid connection cable route where it extends through the ZoN of the following monuments. › MA007-046 Megalithic tomb, MA007-046/001 and 002 Hut Sites at Ballyglass › Ringfort MA007-048 at Ballycastle › Ringfort MA014-026 at Ballinglen A report on the monitoring will be compiled on completion of the work and submitted to the relevant authorities. Further mitigation such as preservation in situ (avoidance), preservation by record (excavation) may be required depending on the results of the monitoring.	As Required	As Required	Project Archaeologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
MX11	Archaeological Monitoring	EIAR Section 13	Pre-development archaeological testing of the Proposed Development (e.g. turbine bases, hardstands, proposed roads, compounds, substation site, met mast, etc) will be carried out by a suitably qualified archaeologist under licence from the National Monuments Service. As many of these areas are covered in dense forestry it is proposed that the testing will be carried out once the keyhole clear-felling required for the Proposed Development has taken place, but prior to the commencement of construction works. Further mitigation such as preservation in situ (avoidance), preservation by record (excavation) or buffer zones may be required depending on the results of the testing. Consultation with the NMS and the Planning Authority may be required to discuss the results of testing and any required mitigation. A report on the testing will be compiled on completion of the work and submitted to the NMS and the Planning Authority for consideration. Archaeological monitoring of all groundworks associated with the Proposed Development will be carried out by a suitably qualified archaeologist during the construction stage of the project. A report on the monitoring will be compiled on completion of the work and submitted to the relevant authorities.	As Required	As Required	Project Archaeologist
MX12	Water Quality and Monitoring	SWMP Section 4	Daily visual inspections of the installed drains and outfalls will be performed during the construction period to ensure suspended solids are not entering streams and rivers on site, to identify any obstructions to channels and to allow appropriate maintenance of the drainage regime. Should the suspended solids levels measured during construction, at the daily visual inspection locations, be higher than the baseline levels, the source will be identified, and additional mitigation measures implemented. Inspection sheets and photographic records will be kept on site. Inspection points will include the in-situ field monitoring point locations, the laboratory analysis sampling points and continuous monitoring locations. Inspection points will depend on works being completed within the catchment upstream of the identified monitoring locations. Visual inspections will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period and data including photographs will be collected by visual inspections and independently assessed by the supervising hydrologist who will monitor and advise on the records being received. Daily Visual Inspection locations will be chosen by the Project Hydrologist and ECoW, prior to the commencement of the construction phase, and a Daily Visual Check Sheet Template is included in Appendix C. Daily Visual Inspections are subject to change upon commencement of construction activity and works in progress within the catchment areas. The following periodic inspection regime will be implemented: › Daily general visual inspections of site operations and inspections of all watercourses within the site and in the surrounding area by the ECoW or a suitably qualified and competent person as delegated by the ECoW; › Inspections to include all elements of drainage infrastructure to ensure the system is operating correctly and to identify any maintenance that is required. Any changes, such as discolouration, odour, oily sheen or litter shall be noted and corrective action shall be implemented. High risk locations such as settlement ponds will be inspected daily by the ECoW. Daily inspections checks will be completed on plant and equipment, and whether materials such as straw bales or oil absorbent materials need replacement; › Event based inspections by the Environmental Clerk of Works as follows: ○ 10 mm/hr (i.e. high intensity localised rainfall event); ○ 25 mm in a 24-hour period (heavy frontal rainfall lasting most of the day); or, ○ Rainfall depth greater than monthly average in 7 days (prolonged heavy rainfall over a week). › Monthly site inspections by the Project Hydrologist/ Environmental Clerk of Works of the drainage measures during construction phase; › Quarterly site inspections by the Project Hydrologist/ Environmental Clerk of Works of the drainage measures after construction for a period of one year following the construction phase; and, › A written record will be maintained or available on-site within this Construction Environmental Management Plan (CEMP) which will be maintained on-site during the construction phase.	Daily	Daily	ECoW

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
MX13	Water Quality and Monitoring	CEMP Section 3 SWMP Section 4	During, the construction phase, continuous, in-situ, monitoring equipment will be installed where required at locations surrounding the wind farm site. The monitoring equipment will provide continuous readings for turbidity levels, flow rate and water depth in the watercourse. This equipment will be supplemented by daily visual monitoring at their locations as outlined in the Section 4.1.2.1. The proposed locations for continuous, in-situ monitoring will be determined by the Project Hydrologist.	Continuous	As Necessary	ECoW/Project Hydrologist
MX14	Water Quality and Monitoring	SWMP Section 4	Baseline laboratory analysis, at locations chosen by the Project Hydrologist, of a range of parameters with relevant regulatory limits and EQSs will be undertaken as per water monitoring programme for the overall windfarm development and each primary watercourse along the route. This will not be restricted to just these locations around the immediate wind farm site with further sampling points added as deemed necessary by the ECoW, in consultation with the Project Hydrologist and Site Manager, as the construction phase progresses.	Monthly	Monthly	ECoW Project Hydrologist
MX15	Water Quality and Monitoring	EIAR Section 9 SWMP Section 4	Field chemistry measurements of unstable parameters, (pH, specific electrical conductivity, temperature and turbidity) will be taken at the surface water monitoring locations, as per water monitoring programme for the overall wind farm development and each primary watercourse along the route and also at all installed sonde locations. These analyses will be carried out by either the ECoW or the Project Hydrologist. In-situ field monitoring will be completed on a weekly basis. In-situ field monitoring will also be completed after major rainfall events, i.e. after events of >25mm rainfall in any 24-hour period. The Project Hydrologist will monitor and advise on the readings collected by in-situ field monitoring.	At least weekly	As Necessary	ECoW/Project Hydrologist
MX16	Surface Water Quality	CEMP Section 4 SWMP Section 4	Visual inspection and monthly laboratory analysis results of water quality monitoring shall assist in determining requirements for any necessary improvements in drainage controls and pollution prevention measures implemented on site. It will be the responsibility of the Environmental Clerk of Works to present the ongoing results of water quality and weather monitoring at or in advance of regular site meetings. Reports on water quality will consider all field monitoring and visual inspections, and results of laboratory analysis completed for that period. Reports will describe how the results compare with baseline data as well as previous reports on water quality. The reports will also describe whether any deterioration or improvement in water quality has been observed, whether any effects are attributable to construction activities and what remedial measures or corrective actions have been implemented. Any proposed alteration to sampling frequency will be agreed with Mayo County Council in advance.	As Required	Monthly	ECoW
MX17	Clear felling of Coniferous Plantation	EIAR Section 9	› Checking and maintenance of roads and culverts will be on-going throughout felling activity. › Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines (i.e., hot spot areas). › Inspections of plant and machinery will be conducted prior to any works to assure all are in good condition. › Inspection of drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. The pre-felling inspection will be conducted during rainfall events. › Following tree felling, all main drains will be inspected to ensure that they are functioning.	As Required	As Required	ECoW
MX18	Construction Drainage System	EIAR Section 9	Regular inspections of installed drainage systems will be undertaken, especially after heavy rainfall, to check for damage and blockages, and ensure there is no escape or build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.	As Required	As Required	ECoW
MX19	Plant and Equipment Inspections	EIAR Section 9 CEMP Section 4	The plant used during construction will be regularly inspected for leaks and fitness for purpose	As Required	Monthly	ECoW
MX20	Flora and Fauna	CEMP Section 4	The responsibilities and duties of the Project Ecologist will include the following: › Review and input to the final construction phase CEMP in respect of ecological matters;	As required	As required	Project Ecologist

Ref. No.	Reference Heading	Reference Location	Monitoring Measure	Frequency	Reporting Period	Responsibility
			- In liaison with Environmental Clerk of Works, oversee and provide advice on all relevant ecology mitigation measures set out in the EIAR and planning permission conditions; - Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required; - Carry out ecological monitoring and survey work as may be required by the planning authority. - Carry out ecological monitoring and survey work as may be required by the planning authority.			
MX21	Birds	EIAR Section 7	Any ground clearance of habitat during the period March to August that could support breeding birds will be walked to establish the presence of breeding birds (mainly passerines). This will be done by an ornithologist up to 10 days before the clearance works take place. If 10 days elapse without the clearing commencing, a further survey will take place. The focus will be on the area to be cleared but zones up to 100 m (approximately) around the area will also be included. Should a breeding territory be identified, the surveyor will attempt to establish the phase of building, e.g., nest building, incubating, feeding young, and will advise the contractor accordingly on measures to be followed (see Section 5.2).	As required	As required	Project Ornithologist
MX22	Piped Slope Drains	EIAR Section 4	Piped slope drains will be inspected weekly and following rainfall events. Inlet and outlets will be checked for sediment accumulation and blockages. Stake anchors or fill over the pipe will be checked for settlement, cracking and stability. Any seepage holes where pipe emerges from drain at the top of the pipe will be repaired promptly.	Weekly		ECoW
MX23	Check Dams	EIAR Section 4	Check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.	As required		ECoW
MX24	Stilling Ponds	CEMP Section 3	Inspection and maintenance of all settlement ponds, along with the entire drainage network, will be ongoing through the construction period.			
MX25	Peat Management	CEMP Section 2	The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis (by the Site manager/ECoW/Project Geotechnical Engineer) during the works, particularly before/following trafficking by heavy vehicular loads. Due to the nature of floating road construction, it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2m). These surveys points will be surveyed on a weekly basis, and more frequently when construction activities are ongoing in the area. The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.	As required/weekly		ECoW/Project Geotechnical Engineer
MX26	Peat and Placement Areas	CEMP Section 2	Movement monitoring instrumentation will be placed around the areas where peat has been placed. The locations where monitoring is required will be identified by the Project Geotechnical Engineer on site. Supervision by the Project Geotechnical Engineer will be carried out for the works.	As required		Project Geotechnical Engineer

8. PROGRAM OF WORKS

8.1 Construction Schedule

The construction phase will take approximately 18-24 months to complete from starting on site to the commissioning of the electrical system and export of electricity from site.

The EIAR stipulated that in the interest of breeding birds, construction would not commence during the breeding bird season, which runs from March to August. The EIAR also stipulated that the removal of conifers (forestry) by felling will take place between the 1st of September and the end of February, thus avoiding the period from the 1st of March to the 31st of August inclusive, as prescribed in the Wildlife Acts.

Works during the construction phase of the development, including delivery of construction materials will generally take place between 7 a.m. and 7 p.m. daily Monday to Friday and 7 a.m. to 2 p.m. on Saturdays, with large concrete pours requiring an earlier start when deemed necessary. Delivery of abnormal loads such as turbine tower sections and blades will take place at night outside of peak traffic hours.

The phasing and scheduling of the main construction task items are outlined in Figure 8-1 below, where 1st January has been selected as an arbitrary start date for construction activities.

ID	Task Name	Task Description	Q1 2028	Q2 2028	Q3 2028	Q4 2028	Q1 2029	Q2 2029	Q3 2029
1	Site Health and Safty								
2	Site Compounds	Site Compounds, site access, fencing, gates							
3	Site Roads	Construction/upgrade of roads, construct underpasses install drainage measures, install water protection measures							
4	Turbine Hardstands	Excavate/pile for turbine bases where required							
5	Turbine Foundations	Fix reinforcing steel and anchorage system, erect shuttering, concrete pour							
6	Substation Construction and Electrical Works	Construct substation, underground cabling, grid connection							
7	Backfilling and Landscaping								
8	Turbine Delivery and Erection								
9	Substation Commissioning								
10	Turbine Commisioning								

Figure 8-1 Indicative Construction Schedule

9. COMPLIANCE AND REVIEW

9.1 Site Inspections and Environmental Monitoring

Routine inspections of construction activities will be carried out on a daily and weekly basis by the ECoW and the Site Supervisor/Construction Manager to ensure all controls to prevent environmental impacts, relevant to the construction activities taking place at the time, are in place.

Environmental inspections will ensure that the works are undertaken in compliance with this CEMP and all other planning application documents. Only suitably trained staff will undertake environmental site inspections.

9.2 Auditing

The Contractor will be responsible for implementing the mitigation and monitoring measures specified throughout the EIAR and compiled in Sections 6 and 7 of this CEMP. The Contractor will also be responsible for ensuring that all construction staff understand the importance of implementing the mitigation measures. The implementation of the mitigation measures will be overseen by the environmental clerk of works or supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation.

Environmental audits will be carried out during the construction phase of the project. In contrast to monitoring and inspection activities, audits are designed to highlight the underlying causes of non-compliance, and not merely detect the non-compliance itself. In addition, audits are the main means by which system and performance improvement opportunities may be identified. Environmental audits will be carried out by contractor staff or alternatively by external personnel acting on their behalf. It is important that an impartial and objective approach is adopted. Environmental audits will be conducted at planned intervals to determine whether the CEMP is being properly implemented and maintained. The results of environmental audits will be provided to project management personnel.

9.3 Environmental Compliance

The following definitions will apply in relation to the classification of Environmental Occurrences during construction of the proposed renewable energy development:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the EMP.

9.4 Corrective Action Procedure

A corrective action is implemented to rectify an environmental problem on-site. Corrective actions will be implemented by the Site Supervisor/Construction Manager, as advised by the Site Environmental Clerk of Works. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions.

If an environmental problem occurs on site that requires immediate attention direct communications between the Site supervisor/Construction Manager and the ECoW will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

9.5 Construction Phase Review

This CEMP will be updated and reviewed prior to commencement of construction, and also every six months thereafter during the construction phase of the project.

APPENDIX 2

CHAPTER 9: HYDROLOGY AND HYDROGEOLOGY

(NOTE: ALL FURTHER APPENDICES REFERRED TO IN THIS APPENDIX ARE INCLUDED IN EIAR VOLUME 3B)

9. HYDROLOGY AND HYDROGEOLOGY

9.1 Introduction

CDM Smith Ireland Ltd was engaged by MKO Ireland (MKO), on behalf of Glenora Wind Farm DAC, to assess the potential likely and significant hydrological and hydrogeological effects of the Proposed Development on the receiving water environment (surface water and groundwater).

The Proposed Development was described in detail in Chapter 4 of this EIAR, and location and layout maps were presented in **Figure 4-1a** and **Figure 4-1b**.

The assessment of likely significant effects is based on:

- Requirements for preparation of this Chapter 9, per relevant legislation and guidance referred to in Section 9.1.4.
- Publicly available data and information relevant to baseline hydrological and hydrogeological conditions.
- Site-specific baseline data generated from site investigations and site walkover surveys described in Section 9.2.2.

The assessment is guided by the source-pathway-receptor model of environmental risk assessment that underpins water protection initiatives in Ireland.

In this Chapter 9:

- The term 'Proposed Development' refers to the project in its entirety, including the grid connection route.
- The terms 'Wind Farm Site' or 'Site' refers to the Proposed Development, <u>excluding</u> the grid connection. Hence, it refers to the Proposed Development within Glenora Forest which will accommodate the new wind farm infrastructure.
- The terms 'EIAR redline boundary' and 'EIAR boundary' defines the geographic extent of the Proposed Development, as presented in Chapter 2.
- The term 'development footprint' refers to the land that will be subject to the proposed infrastructure within the Wind Farm Site.

9.1.1 Statement of Authority

This Chapter 9 was prepared by Henning Moe of CDM Smith Ireland Ltd. He is a registered professional geologist (P. Geo.) with the Institute of Geologists of Ireland and has more than 30 years of practical experience. He has worked on several projects for EPA related to the implementation of the European Union Water Framework Directive (WFD). This included working with EPA's Catchment Science and Management Unit to prepare guidance on Investigative Assessments of rural catchments involving a wide range of environmental pressures and mitigation measures, including those associated with peat- and forestry-related activity. Henning has also worked with both the National Parks and Wildlife Service (NPWS) and the Pesticide Control and Forestry Services of the Department of Agriculture, Food and Marine (DAFM). For MKO, he prepared the Hydrology and Hydrogeology chapter for a proposed 21 turbine wind farm at Sheskin, Co. Mayo. With MKO, he assisted with the review of potential impacts of planned improvement works along the Kiltiernan-Ballinderreen Flood Mitigation Scheme on Natura 2000 sites. For Kerry County Council, he reviewed flood risk downstream of a proposed major quarry development based on a discharge of 25,000 m^3/d. For Uisce Éireann, Henning peer-reviewed the hydrology and hydrogeology chapters of the EIAR for the Shannon Pipeline project which traverses more than 25 km of peatland. For Bord na Móna, he led the preparation of the Soils, Geology and Hydrogeology, and Water chapters for a proposed expanded landfill development within Timahoe Bog in Co. Kildare.

Henning was supported by Dr Jon Hunt who contributed technically to the planning stage drainage plan. Jon has 20 years of experience which has included mapping upland and peat terrains through his geological research (e.g., mapping 34 km^2 at 1:10,560 scale in upland areas of the west of Ireland), and managing flood risk assessments of housing developments using modelling techniques and mitigation measures to alleviate potential downstream risks and impacts.

Technical review was provided by Ruairi O'Carroll BE MEng Sc CEng MIEI, a chartered engineer with over 20 years of experience in the management and delivery of environmental and engineering projects. Ruairi has prepared feasibility studies, preliminary reports and assessment studies for a range of water and environmental projects, and has extensive expertise in the preparation of tender documents, procurement and contract management.

9.1.2 Objectives

The objectives of this Chapter 9 are to:

- Present the methodology that was applied to assess potential and likely significant effects of the Proposed Development.
- Describe baseline conditions of the Wind Farm Site in terms of its hydrology and hydrogeology.
- Identify likely significant effects of the Proposed Development on surface water and groundwater resources, and related water-dependent habitats, during construction, operational and decommissioning phases.
- Identify and describe suitable and proposed mitigation measures that will be implemented to avoid, reduce or offset any likely significant negative effects.
- Assess likely significant residual effects.
- Assess cumulative effects of the Proposed Development after mitigation measures are implemented, in association with other relevant projects that are outlined in Chapter 2.

9.1.3 Scope and Consultation

As described in Chapter 2 of this EIAR, scoping was undertaken during the preparation of this EIAR. Scoping responses are included in **Appendix 2-1**. Inputs from consultees have informed the preparation of content in this Chapter 9. Key matters that were raised in respect of hydrology and hydrogeology are summarised in **Table 9-1**.

Table 9-1 Summary of Hydrological and Hydrogeological Matters Raised by Consultees

Consultee	Matters Raised	Addressed in Chapter Section
Mayo County Council	Provide information on slopes, soil types, bedrock, depth to bedrock, depth to groundwater, depth of peat.	Section 9.3.8
	Show and discuss the existing drainage on site relative to proposed development including roads, access tracks, turbines hard stand areas and grid connections. This shall include drainage associated with forestry and turf cutting.	Chapter 2, Chapter 4, Appendix 4-4
	Provide details of site management relative to watercourses in the area. This should have regard to the requirements of the Water Framework Directive, and any relevant River Basin Management Plan This should include	Appendix 4-1, Appendix 4-4, Section 9.4.2, Section 9.4.3

Consultee	Matters Raised	Addressed in Chapter Section
	impact of downstream water body status. The development should have regard to any Priority Areas for Action and High-Status Objective water bodies in the area.	
	The hydrological context for the overall site should be set out, together with a delineation of individual subcatchments within the Proposed Development associated with each turbine, including slope, drainage and proximity to same. This should include the location and flow direction of all drains and streams on site. Pathways to watercourses and drains should be clearly identified, mapped.	Section 9.3, Appendix 4-4
	Access track and road any associated water crossing and details of how these will be designed and constructed to reduce impacts on the receiving environment.	Appendix 4-1, Appendix 4-4, Sections 9.3.13, 9.4.2
	Grid connection and any associated water crossing and details of how these will be designed and constructed to reduce impact on the receiving environment.	Chapter 4
	Establish baseline water quality condition prior to works commencing on site.	Section 9.3.7
Inland Fisheries Ireland (IFI)	In summary, and with regard to this Chapter 9, the IFI request the following to be addressed: › Water quality › Surface water hydrology › Sediment transport	Sections 9.3.3, 9.3.4., 9.3.5, 9.3.7, 9.4.2
	The EIS should assess the potential impacts the proposed development may have including, damage to the aquatic and associated riparian habitat, pollution of water, introduction of non-native species, site hydrology and interference with upstream and downstream movement of aquatic life. The assessment should include all aspects of the development, forestry, roads, borrow pits, silt ponds, grid connection etc.	Chapter 6, Section 9.4.2
	A construction and operational phase water quality and habitat monitoring programme must be put in place.	Section 9.3.14, Chapter 6
	A site survey must be carried out identify all watercourses including drains/minor watercourses. IFI recommends a minimum width of 15metres from a drains/minor watercourse to low risk parts of the construction site with larger buffer zones required for more sensitive habitats and higher risk operations.	Appendix 4-4, Sections 9.3.13, 9.4.2
	Assessment of the impacts on the hydrology of the site must be carried out particularly where excavations including excavations for road construction are being proposed. It is important	Appendix 4-4, Appendix 9-2, Sections 9.4.2, 9.4.3

Consultee	Matters Raised	Addressed in Chapter Section
	that natural flow paths are not interrupted or diverted in such a manner as to give rise to erosion. The proposed site crosses three catchments there must be no diversion of waters from one catchment into another.	
	The impact of site drainage must be assessed including the pumping of waters from excavations such as turbine excavations. Settlement ponds and other silt treatment/mitigation measures must be engineered to ensure sufficient retention times are provided for sediment settlement. The silt traps should be designed to minimise the movement of silt especially during intense precipitation events where silt traps may be hydraulically overloaded. It is essential that they are located with good access to facilitate monitoring, sampling and maintenance. A license to discharge to waters may be required from the local authority.	Appendix 4-1, Appendix 4-4, Section 9.4.2, Appendix 9-2
	The impact of site offices and the services should form part of the EIA. Details should be provided in relation to the management of construction phase pollutants including cement waste, such as cement truck wash out, hydrocarbons and any other toxic materials.	Section 9.4.2.8, 9.4.2.10, 9.4.3.1
	Should works be approved a detailed method statement addressing the issues outlined above, including all mitigations measures, precautions and environmental incident procedures must be forwarded to Inland Fisheries Ireland before works commence. The IFI publication: Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites should be followed. https://www.fisheriesireland.ie/documents/624-guidelines-on-protection-of-fisheries-during-construction-works-in-and-adjacent-to-waters/file.html	Section 9.1.4, noting that the later 2016 IFI publication "Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters" has also been referenced.
Geological Survey Ireland (GSI)	GSI provided a list of publicly available datasets to be considered.	Chapters 8 and 9 throughout make use of GSI reference materials and publicly available maps.
Development Applications Unit (DAU) of the Department of Tourism, Culture, Arts, Gaeltacht, Sport, and Media	Observations to assist identify potential impacts on European sites, other nature conservation sites, and biodiversity and environmental protection in general. Topics to be covered by assessment of effects: › Drainage › Extraction/quarrying › Tree felling › Surface waters › Wetlands › Flood plains › Natura 2000 sites	Section 9.3.13, Sections 9.4.2, 9.4.3, Appendix 9-1, Appendix 9-3, Appendix 4-4

Consultee	Matters Raised	Addressed in Chapter Section
	- Other designated sites - Positions, locations and sizes of construction infrastructure and mitigation such as settlement ponds, disposal sites and construction compounds.	
	Construction work should not be allowed to impact on water quality and measures should be detailed in the EIAR to prevent sediment and/or fuel runoff from getting into watercourses which could adversely impact on aquatic species.	Sections 9.4.2, 9.4.3, Appendix 4-3 (CEMP)
	Assessment and monitoring results from nearby windfarms should be considered. Cumulative impact from all windfarms in the area needs to be assessed and the data from surrounding sites needs to be considered in the assessment of impacts.	Section 9.4.5
Environmental Health Service (EHS) (Mayo)	All drinking water sources, both surface and groundwater (including private wells) shall be identified. Any potential impacts to these drinking water sources shall be assessed. Details of bedrock, overburden, vulnerability, groundwater flow and gradients, inner and outer zones of protection and catchment areas should all be considered when assessing potential impacts and possible mitigation measures. The EHS would recommend that all information is gathered by means of a site survey as desktop studies do not always accurately reflect the current use of water resources.	Sections 9.3.8, 9.3.9, 9.4.2.12

9.1.4 Relevant Legislation and Guidance

This Chapter 9 was prepared in accordance with the legislation itemised in Chapter 1 (Introduction) and the following guidance documents:

- Environmental Protection Agency (2022). Guidelines on the Information to be Contained in Environmental Impact Assessment Report
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements.
- National Roads Authority (2009): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters.
- Eastern Regional Fisheries Board (2003): Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites.
- Scottish Natural Heritage (2010): Good Practice During Wind Farm Construction.
- LAWPRO/EPA (2022). An Overview of Catchment Science and Management. A Guidance Handbook, Volumes 2 and 3. Local Authority Waters Programme and Catchment Science and Management Unit, Environmental Protection Agency.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note).
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note).
- CIRIA (Construction Industry Research and Information Association) (2006): Guidance on ‘Control of Water Pollution from Linear Construction Projects’ (CIRIA Report No. C648, 2006).

- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors (CIRIA C532, 2006).

9.2 Assessment Methodology

9.2.1 Desk Study

A desk study of the Wind Farm Site and potential receiving environment was completed which involved collecting relevant data and information from publicly available sources, namely:

- OPW Flood Risk Information, including the CFRAM Flood Risk Assessment mapping (www.floodinfo.ie).
- Environmental Protection Agency (EPA) 'Water' web viewer and databases related to implementation of the Water Framework Directive (WFD) - https://gis-stg.epa.ie/EPAMaps/Water and www.catchments.ie
- EPA and Office of Public Works (NPWS) stream gauging station data.
- Geological Survey of Ireland (GSI) map coverages available on their web viewer.
- EPA and Teagasc soils maps.
- Historical aerial imagery and mid-19th century 6-inch and 25-inch sheets from Ordnance Survey Ireland.
- National Parks and Wildlife Services Public Map Viewer (www.npws.ie).
- Met Eireann rainfall and evapotranspiration data and maps.

Publicly available reports (e.g. from GSI) and journal (research) articles were also used, and are referenced throughout this Chapter 9.

9.2.2 Baseline Monitoring and Site Investigations

Data and findings from past site investigations were also used to help prepare the description of baseline conditions in this Chapter 9, specifically:

- Groundwater level monitoring data from 24 no. piezometers installed across the Proposed Development area, covering the period June 2020 and May 2021, as presented in the site investigation report by Fehiley and Timoney Co. (FT, 2021).
- Peat depth data obtained from a high-level peat probing campaign which was conducted in tandem with the groundwater monitoring (FT, 2021).
- Surface water quality data derived from sampling at five select locations within the Proposed Development Site in September 2020, November 2020, January 2021, March 2021, and May 2021 (FT, 2021).

Site walkover surveys were also conducted by CDM Smith (Jon Hunt, Henning Moe – see Section 9.1.1) in July 2021 and June 2023 during rainfall events, with a focus on the existing site drainage. This supplemented site walkover surveys reported by FT in February and May 2020 (FT, 2021).

Related data and findings are presented in subsequent sections.

9.2.3 Assessment Attributes and Terminology

Using the information from the desk study and site investigations, the assessment of likely significant effects of the Proposed Development considers:

- The importance and environmental sensitivity of the receiving environment, per **Table 9-2** (hydrology) and **Table 9-3** (hydrogeology).

- The effects classification terminology of EPA (2022), per **Table 9-4**, noting that descriptors of effects include quality (negative, positive or neutral), significance, probability/likelihood, duration and/or frequency, and type.
- The proximity and probability of effects, per **Table 9-5**.

Table 9-2 Estimation of Importance of Hydrology Attributes (NRA, 2009)

Importance	Criteria	Examples
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2,500 homes. Quality Class A (Biotic Index Q4, Q5). Flood plain protecting more than 50 residential or commercial properties from flooding. Nationally important amenity site for wide range of leisure activities.
High	Attribute has a high quality or value on a local scale	Salmon fishery. Locally important potable water source supplying >1000 homes. Quality Class B (Biotic Index Q3-4). Flood plain protecting between 5 and 50 residential or commercial properties from flooding. Locally important amenity site for wide range of leisure activities.
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery. Local potable water source supplying >50 homes. Quality Class C (Biotic Index Q3, Q2-3). Flood plain protecting between 1 and 5 residential or commercial properties from flooding.
Low	Attribute has a low quality or value on a local scale	Locally important amenity site for small range of leisure activities. Local potable water source supplying <50 homes. Quality Class D (Biotic Index Q2, Q1). Flood plain protecting 1 residential or commercial property from flooding. Amenity site used by small numbers of local people.

Table 9-3 Estimation of Importance of Hydrogeological Attributes (NRA, 2009)

Importance	Criteria	Examples
Extremely High	Attribute has a high quality or value on an international scale	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. SAC or SPA status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple wellfields.

		Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a local scale	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer. Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes.

Table 9-4 Effect Classification Terminology (EPA, 2022)

Impact Characteristic	Term	Description
Quality	Positive	A change which improves the quality of the environment
	Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
	Negative	A change which reduces the quality of the environment.
Significance	Imperceptible	An effect capable of measurement but without significant consequences.
	Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate	An effect that alters the character of the environment in a manner consistent with existing and emerging baseline trends
	Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
	Profound	An effect which obliterates sensitive characteristics
Extent and Context	Extent	Describe the size of the area, number of sites and the proportion of a population affected by an effect

	Context	Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions
Probability	Likely	Effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented
	Unlikely	Effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Duration and Frequency	Momentary	Effects lasting from seconds to minutes
	Brief	Effects lasting less than one day
	Temporary	Effects lasting less than one year
	Short-term	Effects lasting 1-7 years
	Medium-term	Effects lasting 7-15 years
	Long-term	Effects lasting 15-60 years
	Permanent	Effects lasting over 60 years
	Reversible	Effects that can be undone, for example through remediation or restoration
	Frequency	Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Types	Indirect	Effect on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway
	Cumulative	The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects.
	'Do Nothing'	The environment as it would be in the future should the subject project not be carried out
	'Worst Case'	The effects arising from a project in the case where mitigation measures substantially fail
	Indeterminable	When the full consequences of a change in the environment cannot be described.
	Irreversible	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost
	Residual	The degree of environmental change that will occur after the proposed mitigation measures have taken effect
	Synergistic	Where the resultant effect is of greater significance than the sum of its constituents

Table 9-5 Additional Impact Characteristics Considered

Impact Characteristic	Degree/Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

9.3 Existing Environment

9.3.1 Physiographic Setting, Topography and Land Use

The Wind Farm Site is situated within Glenora Forest in an upland blanket bog setting on the south facing slopes of Maumakeogh (elevation 379 metres above Ordnance Datum (mOD)). The topography within the Wind Farm Site (**Figure 14-8**) ranges from approximately 330 mOD along the northern EIAR redline boundary to approximately 120 mOD on the southern EIAR redline boundary by the Altderg and Keerglen Rivers. The grid connection route follows existing roadways to the grid connection location at Tawnaghmore, which is sited at an elevation of approximately 75 mOD.

Topographic slope within the Wind Farm Site (**Figure 9-1**) generally ranges from <2 to approximately 15 degrees, but steeper slopes exist locally, including certain sections of streams where erosion has cut into subsoils. Detailed descriptions of slope at planned infrastructure locations are provided in **Appendix 8-1**.

Land use within the Wind Farm Site is predominantly commercial forestry, operated by Coillte. Both mature and young plantations, as well as open peatland, are present across the Site.

9.3.2 Regional and Local Drainage

At the regional scale, the Wind Farm Site occupies headwater subcatchments of the Owenmore and Ballinglen Rivers. As shown in **Figure 9-2**, the Owenmore River drains to Tullaghan Bay, approximately 27 km straight-line distance to the southwest of the Site. The Ballinglen River drains to Bunatrahir Bay, approximately 8 km straight-line distance to the northeast of the Site. The Owenmore River catchment[1] encompasses a total area of approximately 300 km^2 and the Ballinglen River catchment[2] encompasses a total area of approximately 44 km^2.

The grid connection route from the Wind Farm Site follows existing roads that pass through subcatchments of the Glencullin, Ballinglen, and Cloonaghmore Rivers (**Figure 9-2**). The Glencullin River discharges to Bunatrahir Bay while the Cloonaghmore and Moyne Rivers discharges to Killala Bay.

The headwaters of the Owenmore and Ballinglen Rivers within the Wind Farm Site are (**Figure 9-3**):

- The Altderg River, which incorporates the drainages of the Glenora River from the east and Fiddaunfrankagh Stream from the north. The Altderg River flows south and merges with Inagh River to become the Oweninny River which continues south to become the Owenmore River after its merger with Sheskin River.
- The Keerglen River, which flows east to Ballinglen River. The Keerglen River is fed by several small, unnamed streams which flow south from within the eastern part of Glenora Forest.

The headwaters of the Glencullin River, which includes the Sralagagh River, also originate within Glenora Forest but are outside the Wind Farm Site (**Figure 9-3**).

[1] Defined by EPA's Water Framework Directive (WFD) subcatchments Owenmore(Mayo)_SC_010, Owenmore(Mayo)_SC_020 and Owenmore(Mayo)_SC_030
[2] Part of WFD subcatchment Glencullin[NorthMayo]_SC_010, specifically incorporating WFD river sub-basins Ballinglen_010, Ballinglen_020, and Keerglen_010.

All of the named headwater streams in Glenora Forest originate as a series of bog seeps and springs at higher elevation. The seeps and springs are clearly marked as ‘rises’ on the 6-inch sheets from OSI which show the original, natural drainage pattern in the area in the mid-19th Century.

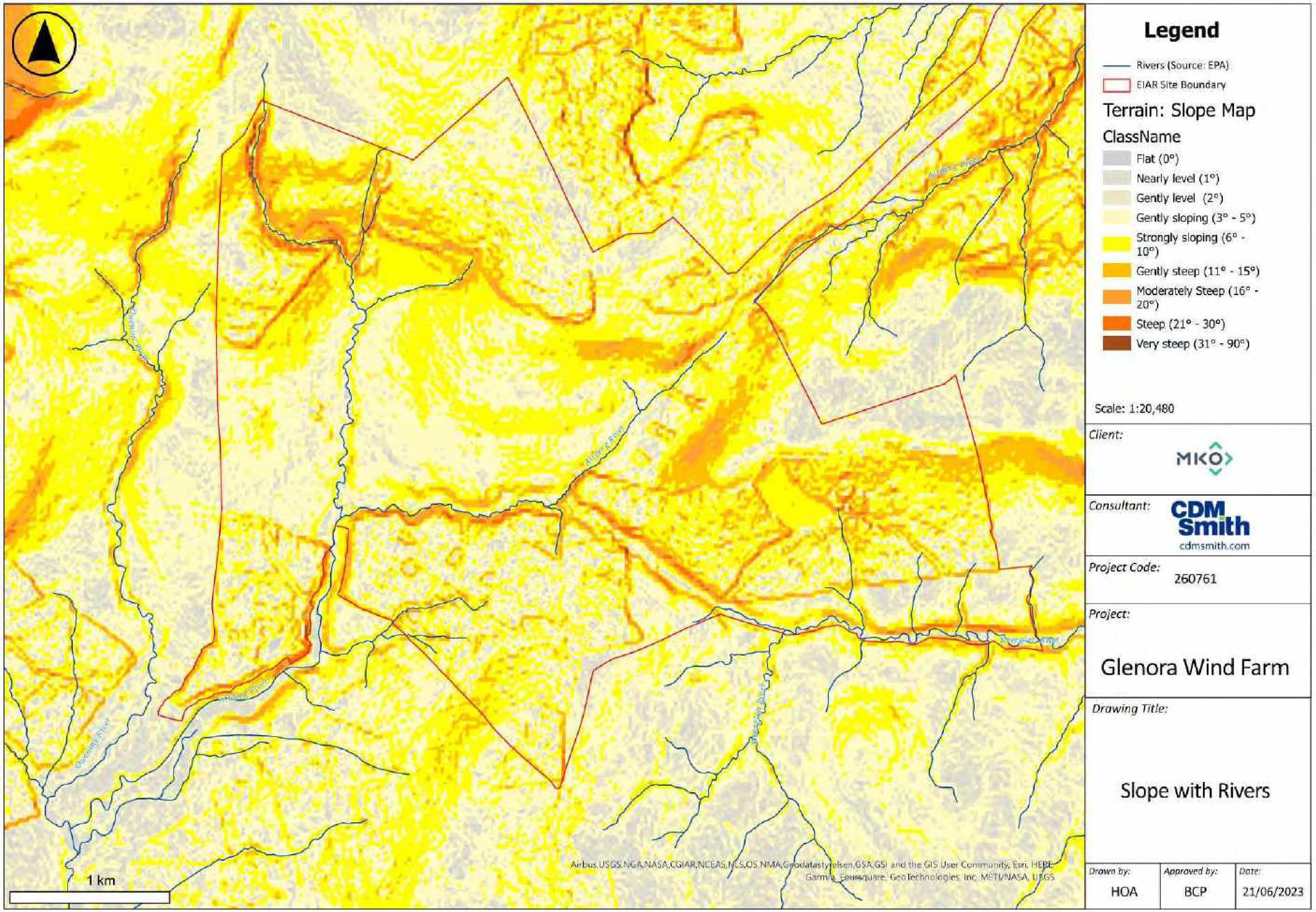

Figure 9-1 Topographic Slope Across the Wind Farm Site

Figure 9-2 Regional Drainage and WFD Subcatchments Linked to the Proposed Development

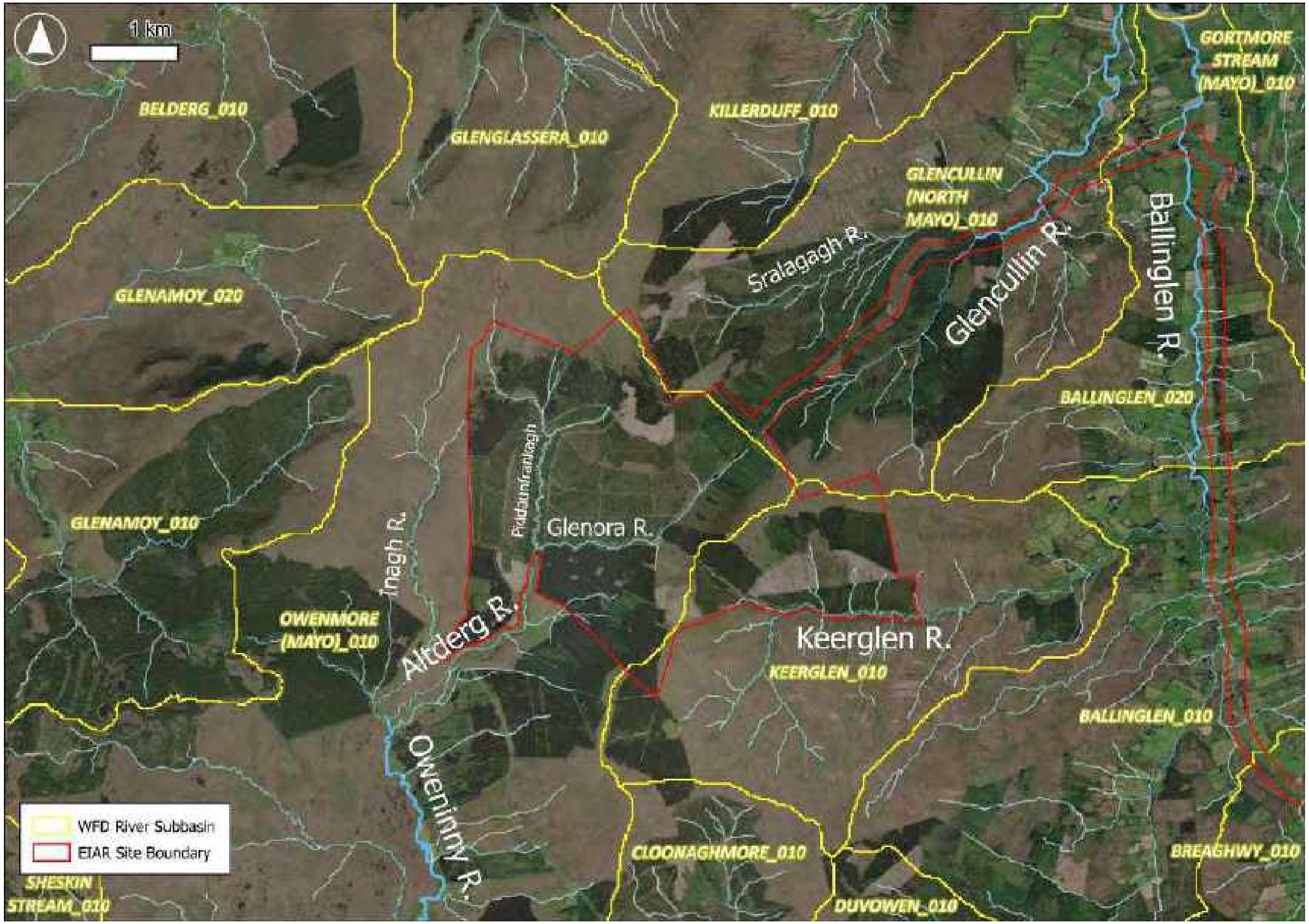

Figure 9-3 Local Streams Associated Within and Near the Wind Farm Site

9.3.3 Site Drainage

The Wind Farm Site is drained as part of ongoing forestry management. Drainage ditches serve to lead greenfield and road runoff to local watercourses. Within forestry plantations, furrows between rows of plantations (**Photo1**) and fire breaks (**Photo 2**) serve to direct greenfield runoff to drains, watercourses directly, and also to bog areas in topographic depressions on lower grounds.

Drainage ditches are principally dug channels which run both parallel to access roads and at angles to plantations. The water that flows in such ditches is directed across roadways via pipe culverts (**Photo 3**). Pipes are made of HDPE or concrete and range between 300 mm and 600 mm in diameter. The water that is conveyed across roads is led to streams or is dispersed across low-lying grounds downslope of culvert locations. Where drainage ditches are absent, excess runoff may flow across roads, where it subsequently disperses naturally across lands downslope of the roads.

Some of the drainage ditches are heavily vegetated, depending on slope and position within the landscape. In all cases, ditches are observed to readily transmit flow. In higher slope areas, where the energy of water flow is greater, streambanks show signs of erosion (**Photo 4**). The erosion is both of the peat and the subsoils, and is likely caused by quickly rising water levels during storm events.

While most ditches are shallow (<1 m deep), they can also cut through the peat into the underlying subsoils (**Photo 5**).

The existing roads within Glenora Forest are constructed from crushed stone, partly to allow water to infiltrate (**Photo 6**). Nevertheless, road runoff is generated and transmitted into drainage ditches during significant, high-intensity rainstorms (**Photo 7**).

The streams within the Wind Farm Site are small, generally less than 3 m wide (and mostly less than 1 m wide) and up to 2 m deep (below ground surface). Stream substrates can often be observed to be coarse, incorporating gravel, boulders and cobble, owing to higher-energy flow events, particularly in headwater positions. Streams are bordered by forestry, heath and/or wet grassland vegetation which helps to trap suspended sediments carried by greenfield runoff. Suspended sediment loads in streams appear mainly to be mobilised by streambank erosion and road runoff.

Finally, in the southwestern corner of Glenora Forest especially, there are quaking bog areas and the 'Altderg Lough' which occupy subtle topographic depressions (see Chapter 6 of this EIAR). These features are a natural part of the blanket bog system and have their own small runoff catchments, mainly from the west. No infrastructure is proposed in the subcatchments of these features.

9.3.4 Potential Receptor Identification

Potential river water bodies that could be affected by the Proposed Development are listed in **Table 9-6** and shown in **Figure 9-4.** With regard to the Owenmore River catchment, the sections of rivers that are considered particularly relevant to this EIAR are the headwaters which originate in Glenora Forest and which extend to the Oweninny and Keerglen Rivers.

Potential groundwater bodies (**Figure 9-5**) that could be affected by the Proposed Development are:

- Bangor (code IE_WE_G_0052)
- Belmullet (code IE_WE_G_0057)
- Bellacorick-Killala (code (code IE_WE_G_0041)

Photo 1: Signs of Drainage Along Furrows Within Plantations (Source: CDM Smith)

Photo 2: Drainage Along Firebreaks (Source: MKO)

Photo 3: Examples of Pipe Culverts (Source, FT)

Photo 4: Eroded Streambanks and Exposed Subsoils

Photo 5: Drainage Ditch With Exposed Subsoil Beneath Peat (Source: FT)

Photo 6: Crushed Aggregate Road, Pipe Culvert Across Road, and Drainage Ditches on Both Sides of Road

Photo 7: Suspended Sediments in Road Runoff Entering Drainage Ditch, 18 June 2023

Table 9-6 Potential Surface Water Receptors

<table>
<tr><th>Watercourse</th><th>WFD River Water Body</th><th>WFD Subcatchment</th><th>Comment</th></tr>
<tr><td colspan="4">Wind Farm Site</td></tr>
<tr><td>Fiddaunfrankagh R.</td><td rowspan="4">Owenmore(Mayo)_010
(IE_WE_33O040050)</td><td rowspan="5">Owenmore[Mayo]_SC_010</td><td></td></tr>
<tr><td>Glenora R.</td><td></td></tr>
<tr><td>Altderg R.</td><td>From confluence of Fiddaunfrankagh R. and Glenora R.</td></tr>
<tr><td>Oweninny R.</td><td>From confluence of Altderg R. and Inagh R.</td></tr>
<tr><td>Owenmore R.</td><td>Owenmore(Mayo)_020
(IE_WE_33O040200)</td><td>Continuation of Oweninny R. downstream of the confluence between Oweninny R. and Sheskin R. Ultimately discharges to Tullaghan Bay</td></tr>
<tr><td>Unnamed streams</td><td rowspan="2">Keerglen_010
(IE_WE_33K010200)</td><td rowspan="3">Glencullin[NorthMayo]_SC_010</td><td>Headwater streams flowing south from eastern part of Glenora Forest to Keerglen R.</td></tr>
<tr><td>Keerglen R.</td><td>Flows into Ballinglen R.</td></tr>
<tr><td>Ballinglen R.</td><td>Ballinglen_010
(IE_WE_33B010100</td><td>Downstream of Keerglen R. Flows into Bunatrahir Bay</td></tr>
<tr><td colspan="4">Grid Connection Route</td></tr>
<tr><td>Sralagagh R.</td><td rowspan="2">Glencullin (North Mayo)_010
(IE_WE_33G020200)</td><td rowspan="4">Glencullin[NorthMayo]_SC_010</td><td>Merges with Glencullin R. downstream</td></tr>
<tr><td>Glencullin R.</td><td>Flows into Bunatrahir Bay</td></tr>
<tr><td rowspan="2">Ballinglen R.</td><td>Ballinglen_020
(IE_WE_33B010200)</td><td>Flows into Bunatrahir Bay</td></tr>
<tr><td>Ballinglen_010
(IE_WE_33B010100)</td><td></td></tr>
<tr><td>Rathroe R.</td><td>Breaghwy_010
(IE_WE_34B060600)</td><td rowspan="3">Cloonaghmore_SC_010</td><td>Merges with Cloonaghmore R. downstream</td></tr>
<tr><td rowspan="2">Cloonaghmore R.</td><td>Cloonaghmore_040
(IE_WE_34C030200)</td><td></td></tr>
<tr><td>Cloonaghmore_050
(IE_WE_34C030270)</td><td>Flows into Cloonaghmore estuary, which is part of the larger Killala Bay</td></tr>
<tr><td>Moyne R.</td><td>Moyne_010
(IE_WE_34M190890)</td><td>Abbeytown_SC_010</td><td>Flows into Killala Bay</td></tr>
</table>

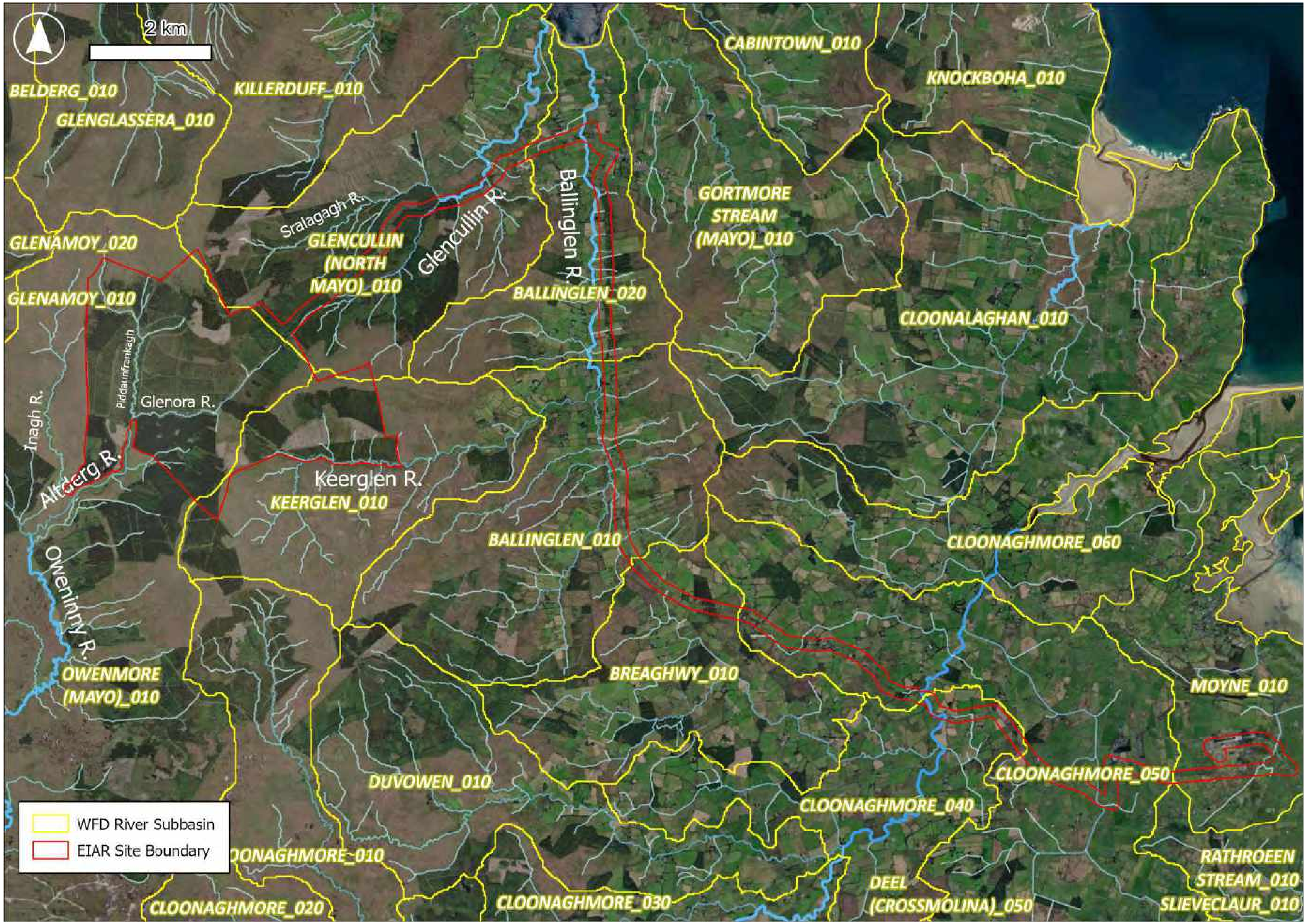

Figure 9-4 Potential River Water Body Receptors

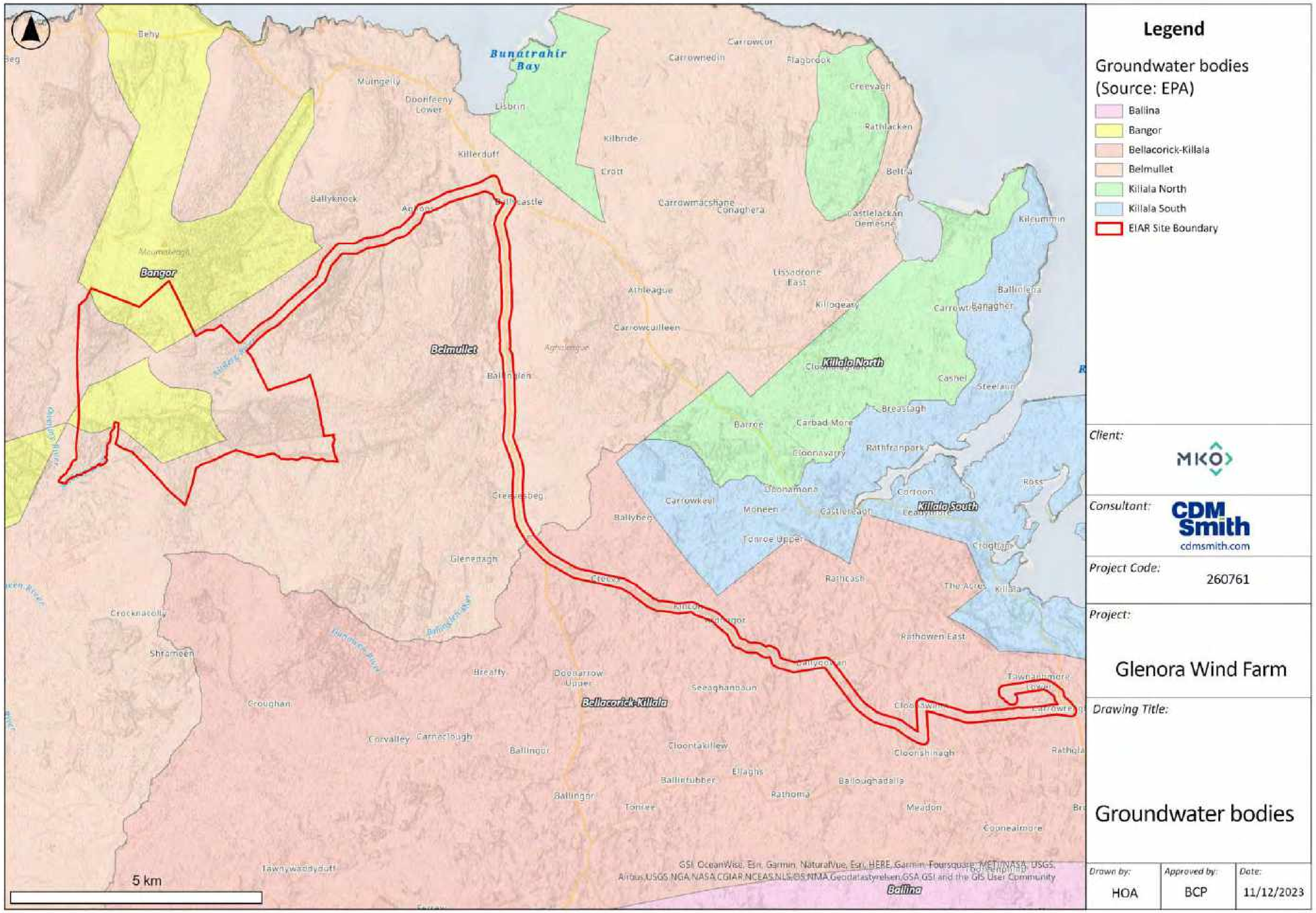

Figure 9-5 Groundwater Bodies (Source: GSI)

9.3.5 Water Balance Components

Natural drainage and streamflows are influenced by rainfall, runoff and recharge. Runoff, which is influenced by rainfall events and the physical attributes of subcatchments, influences the drainage design of the Proposed Development. To estimate runoff, both long-term annual average and return period characteristics must be defined.

9.3.5.1 Long Term Annual Average Rainfall, Runoff and Recharge

The nearest synoptic weather station (to the Wind Farm Site) with long-term rainfall and evaporation data is Belmullet. This station is near sea level and approximately 37 km west-southwest of the Site. The mean annual rainfall for the 30-year period 1981-2010 is 1,248 mm, and as presented in **Table 9-7**, the wettest month historically is October.

Table 9-7 Mean Monthly Rainfall, Belmullet Synoptic Weather Station, 1981-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean monthly total	134.0	97.1	99.2	72.0	70.4	72.1	79.0	101.9	101.8	145.9	134.0	137.4
Greatest daily total	44.7	31.3	25.6	25.9	42.2	38.9	33.2	49.5	62.6	79.6	43.0	41.7
Mean no. days with >= 5.0mm	10.0	7.0	7.0	4.0	4.0	4.0	5.0	6.0	6.0	10.0	10.0	9.0

The Wind Farm Site is situated at a higher elevation than the synoptic weather station at Belmullet, at a mean elevation of approximately 250 mOD. This means that rainfall at the Proposed Development Site will be slightly higher than at Belmullet. Following a rule of thumb of 100 mm of rainfall per 100 m increase elevation, the mean annual rainfall in the Wind Farm Site is expected to approach 1,500 mm.

Based on EPA's Qube model of river flows in ungauged catchments in Ireland (available from EPA's 'Water' web viewer[3], the long-term annual average rainfall (AAR) at the southern end of the Proposed Development Site is approximately 1850 mm/year, at an elevation of approximately 150 mOD. Potential evapotranspiration (PET) is approximately 400 mm/year. Using these figures, effective rainfall (ER), which represents the rainwater that is available for runoff and groundwater recharge, is approximately:

ER = AAR – PET = 1,850 – 400 = 1,450 mm/year

Based on the national groundwater recharge map prepared by GSI, 10% or less of ER is recharged to the bedrock aquifer. For an ER of 1,450 mm/year and a recharge coefficient of 10%, groundwater recharge would be 145 mm/year. This value exceeds the recharge 'cap' of 100 mm/year which GSI assigns to 'poorly productive bedrock aquifer' and which underlies the site (Section 9.3.8). Poorly productive bedrock may not have the physical characteristics and capacity to accept all of the available, infiltrating water. Hence, excess recharge is 'rejected', which enhances flow via shallow pathways, including runoff.

Accordingly, it is inferred that long term average groundwater recharge to bedrock is approximately 100 mm/year at the Wind Farm Site, and the remainder of water, ca. 1,350 mm/yr, is available as runoff and shallow flow through peat and subsoils. This implies that the runoff potential exceeds 90% of long-term effective rainfall. The hydrology of the Wind Farm Site is, therefore, characterised by high runoff rates and low groundwater recharge. Waterlogged peat will enhance lateral runoff of rainwater to streams.

[3] https://gis-stg.epa.ie/EPAMaps/Water

Climate change projections for Ireland are provided by Regional Climate Models (RCM's) downscaled from larger Global Climate Models (GCM). Projections for the period 2041-2060 (mid-century) are available from Met Eireann (Gleeson et al, 2013). The data indicates a projected overall annual decrease in rainfall of approximately 4% (compared to the 30-year average, 1981-2010) but with an increase in the frequency of heavy precipitation events and a winter season increase in rainfall of up to 8%, subject to qualifiers about levels of uncertainty and confidence in projections.

9.3.5.2 Baseline Assessment of Runoff

Long-term average runoff volumes were calculated further for the Wind Farm Site by considering:

- The estimated long-term (30-year) average annual rainfall at the Site (ca. 1,850 mm/yr).
- Applying an escalation factor of 1.1 to account for higher rainfall due to climate change.
- Evapotranspiration, to estimate the effective rainfall.
- Applying a 90% runoff coefficient to the effective rainfall value.
- Multiplying the resulting depth of water to the Wind Farm Site to obtain an average runoff volume.

The calculation is presented in **Table 9-8** below.

Table 9-8 Estimated Long-term Average Annual Runoff

Item	Value	Comment
Long-term average annual rainfall	1,850 mm/yr	Sourced from EPA's Qube model
Escalated rainfall	2,035 mm/yr	Accounts for climate change in future, with a net increase in rainfall totals
Mean annual evapotranspiration	400 mm/yr	From Met Eireann national map of Potential evapotranspiration
Effective rainfall	2,035 - 400 mm/yr = 1,635 mm/yr	Effective rainfall = available recharge
Runoff coefficient	90%	10% is groundwater recharge
Baseline runoff depth	1,635 mm/yr × 90% = 1,472 mm/yr	Rounded
Wind Farm Site	12.90 km^2	Excluding the grid connection route[1]
Long-term average annual runoff	12.90 km^2 × 1,472 m/yr = 18,982,350 m^3/yr, or 52,000 m^3/d, or 0.60 m^3/s.	

Note:
[1] The grid connection route covers a narrow linear path which is on lower elevation and slope, and does not materially affect the overall estimation of runoff.

9.3.5.3 Streamflow

Runoff contributes to streamflow. Estimates of streamflow were obtained from EPA's Qube model for naturalized streamflow in ungauged catchments.[4] The Wind Farm Site, indicated by the redline boundary in **Figure 9-6**, is covered by the two Qube model catchments, shown as the shaded light green areas across Glenora Forest (deep green), as extracted from EPA's 'Water' web viewer.

The Qube model catchment on the top of **Figure 9-6** (node 33_2632) represents the area that contributes runoff and flow to the Altderg River. The Qube model catchment on the bottom (node 33_1811) represents the area that contributes runoff and flow to Keerglen River. It is noted that only about 25% of the catchment of node 33_1811 is within the Wind Farm Site. Within the Wind Farm Site, the two Qube model catchments cover areas of approximately 11.46 and 3.3 km^2, respectively, for a total combined area of 14.76 km^2.

[4] https://www.epa.ie/our-services/monitoring--assessment/freshwater--marine/rivers/water-level-and-flow-data/

The model-derived flow percentiles for the two Qube model catchments are presented in **Figure 9-7**. Flood flow conditions are represented towards the left side of the graph while low flow conditions are represented towards the right. As an example, a flow percentile of 10 in **Figure 9-7** represents the flow that is exceeded 10% of the time (at Qube model nodes 'CD 33_2632' and 'CD 33_1811', indicated by the red crosses in **Figure 9-6**).

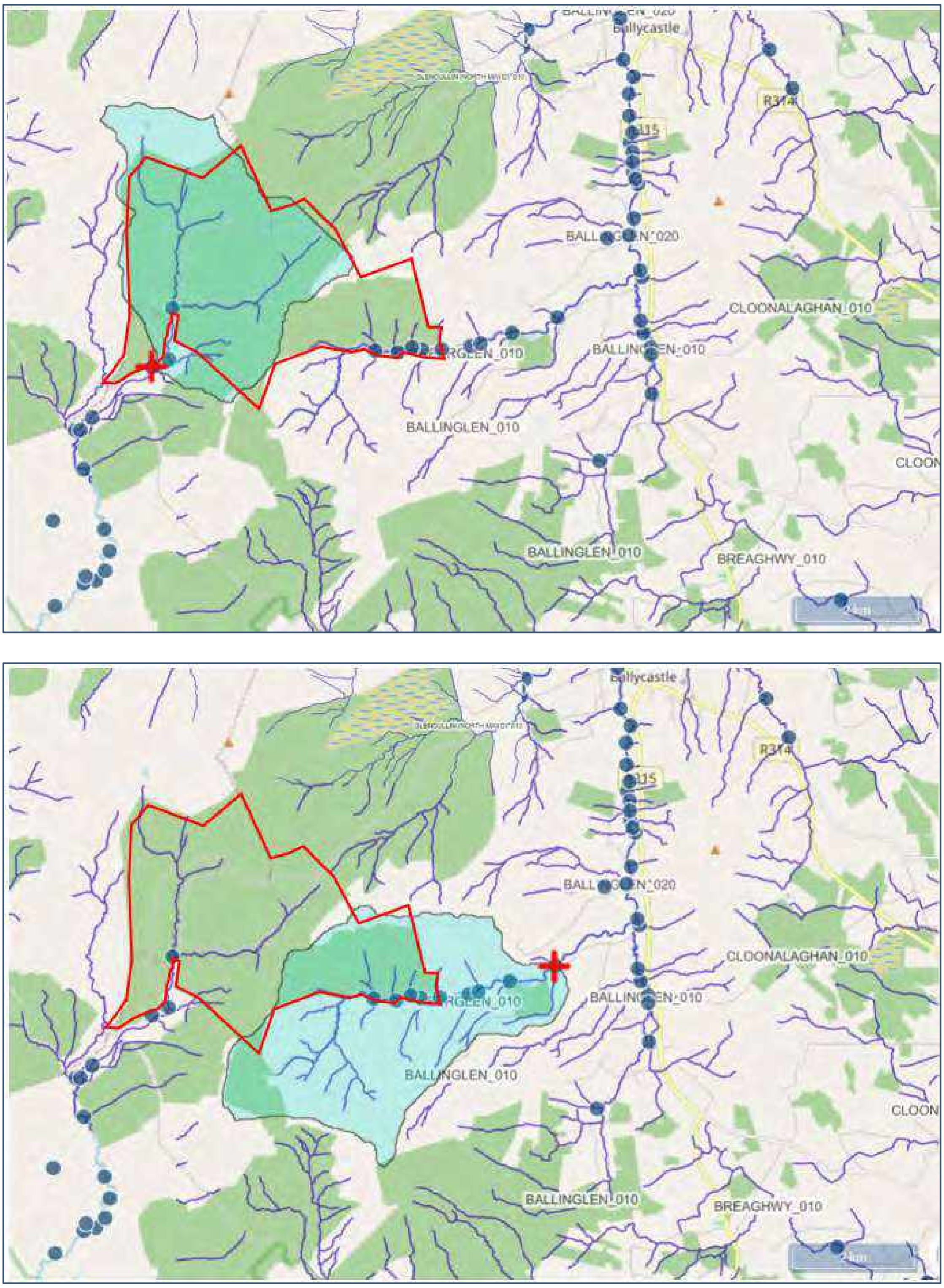

Figure 9-6 Locations and Catchments of Qube Model Nodes 33_2632 (red cross, top) and 33_1811 (red cross, bottom)

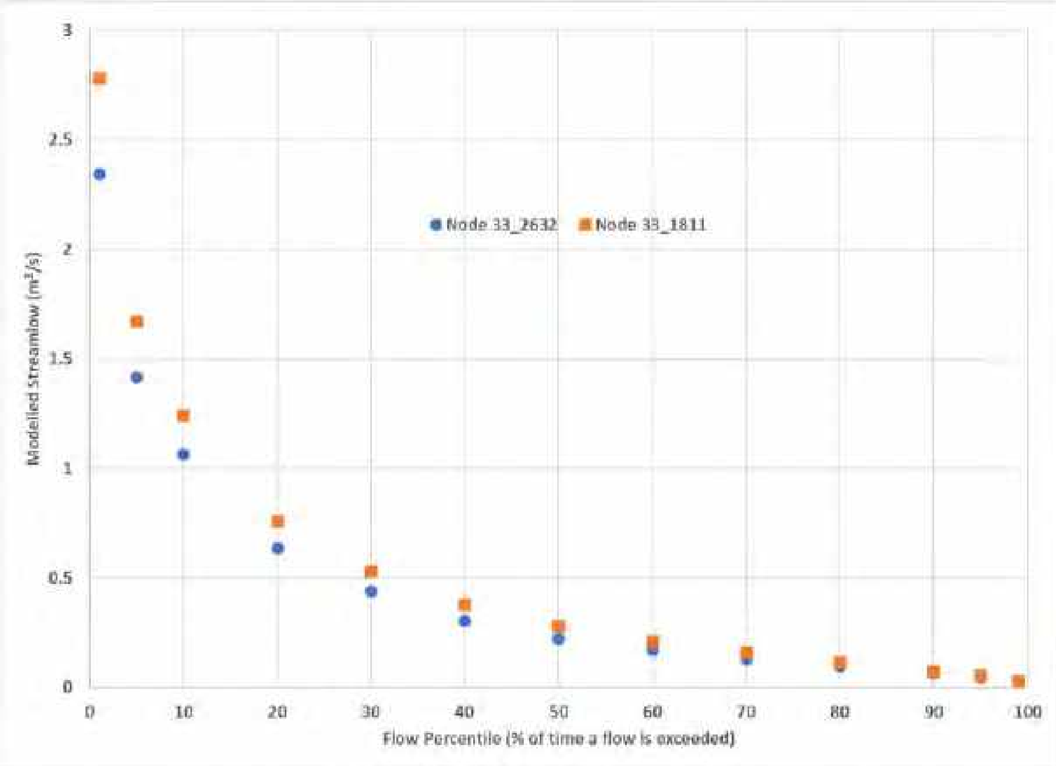

Figure 9-7 Model-Estimated Flow Percentiles for Streams That Drain the Wind Farm Site

Based on **Figure 9-7**:

- Modelled peak streamflows, represented by the 1-percentile flow, are 2.35 and 2.78 m^3/s, respectively in the two catchments.
- Mean estimated streamflows, which is approximated by the 30-percentile flow (LAWPRO/EPA, 2022), are 0.44 and 0.53 m^3/s, respectively.

Low-flow conditions, which are generally defined by the estimated 95-percentile flows, are approximately 0.05 m^3/s in both cases. The mean streamflow values are considerably higher than the estimated long-term average annual runoff, which means that long-term annual average runoff is not a useful metric, requiring further consideration of rainfall characteristics, notably storm-based rainfall (intensity-duration-frequency).

The wide range of estimated streamflow in **Figure 9-7** is characteristic of 'flashy' catchments in which both runoff and streamflow respond quickly to rainfall events. In such catchments, both individual storm events and antecedent (particularly wet) hydrological conditions can significantly influence runoff rates.

Because approximately 25% of the catchment area of Qube model node 33_1811 is within the Wind Farm Site, the area-proportional flow from the tributaries that flow south to Keerglen River within the Site are approximately 25% of the modelled flow at node 33_1811. Hence, the total mean streamflow that exits the Wind Farm Site is estimated to be, approximately:

$$0.44\ m^3/s + (0.53\ m^3/s \times 25\%) = 0.57\ m^3/s$$

For the runoff coefficient of 90%, an estimated 0.51 m^3/s (i.e., 90% of the 0.57 m^3/s total mean flow) represents mean annual runoff from the Wind Farm Site. The remaining 10% is contributed by groundwater baseflow. Adjusted for the total combined runoff contributing area of 14.76 km^2, the mean specific runoff associated with the Wind Farm Site is (0.51 m^3/s divided by 14.76 km^2) = 0.035 $m^3/s/km^2$.

The Qube-modeled mean monthly flows are depicted in **Figure 9-8** for the two model catchments, showing significantly higher mean monthly flows in winter compared to summer, reflecting the higher rainfall conditions in the winter season.

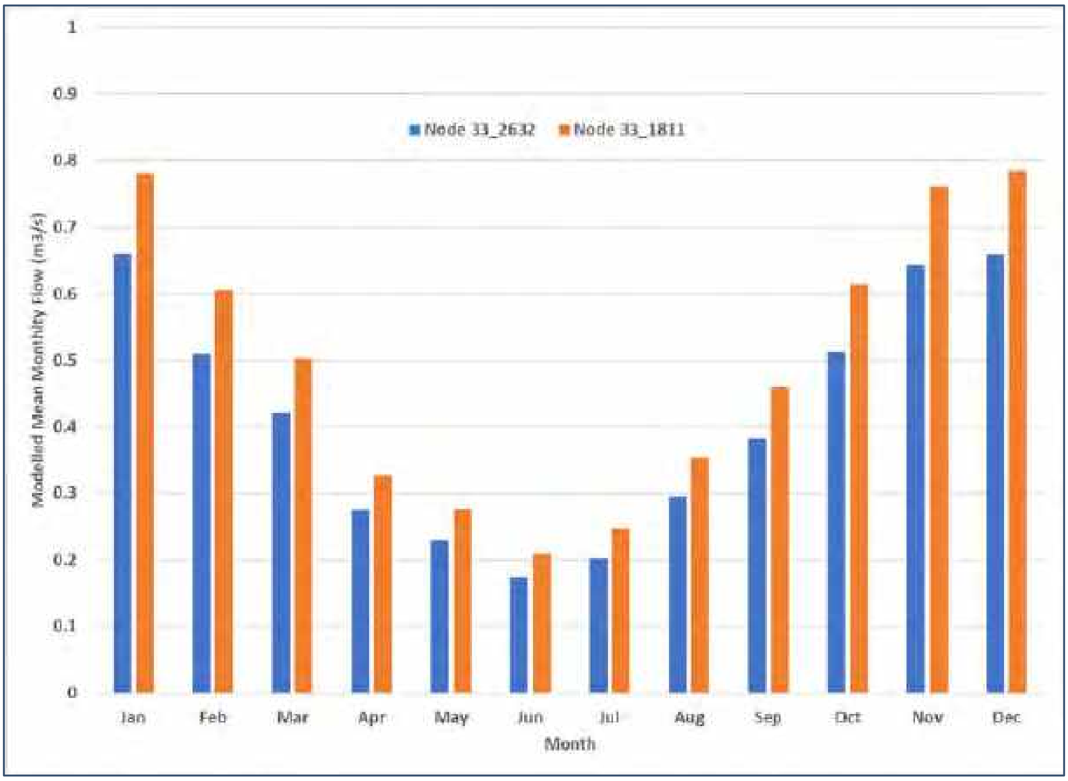

Figure 9-8 Model-Estimated Mean Monthly Flows in the Two Streams That Drain the Proposed Development Area

9.3.5.4 Rainfall Return Periods

Table 9-9 below presents return period rainfall depths for the Wind Farm Site, specifically at Irish Grid coordinate 103510E/335644N near the centre of the Site. The data were sourced from Met Eireann and provide rainfall depths for a range of storm durations and return periods. These values were sourced to compute design runoff rates (see Section 9.3.13).

9.3.6 Summary of Flood Risk Assessment

A preliminary flood risk assessment (FRA) of the Proposed Development is presented in **Appendix 9-1**. The FRA sources information from i) preliminary flood risk maps prepared by the Office of Public Works (OPW), ii) groundwater flood maps prepared by Geological Survey Ireland (GSI), and iii) historical 6-inch sheets and 25-inch basemaps that are available from Ordnance Survey Ireland (OSI).

9.3.6.1 Wind Farm Site

The area covered by the Wind Farm Site was not considered in OPW's Catchment Flood Risk Assessment and Management (CFRAM) Programme. However, as shown in **Figure 9-9**, OPW's National Indicative Fluvial flood risk maps show coincident "*medium probability*" and "*low probability*" flood extents along sections of the Altderg and Keerglen Rivers. The section along Altderg River extends to the southern boundary of the Wind Farm Site. The section on Keerglen River follows the southeastern boundary but does not extend into the Wind Farm Site.

Table 9-9 Rainfall (mm) Return Periods for Irish Grid Location 103510E, 335664N (Source: Met Eireann)

Duration		Years															
		0.5	1	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5	mins	3.0	4.2	4.9	5.9	6.6	7.1	8.9	10.9	12.2	14.1	15.7	17.0	19.0	20.6	21.8	N/A
10	mins	4.2	5.9	6.8	8.2	9.2	9.9	12.4	15.2	17.0	19.6	21.9	23.7	26.5	28.6	30.4	N/A
15	mins	4.9	6.9	8.0	9.7	10.8	11.7	14.6	17.8	20.0	23.1	25.8	27.9	31.2	33.7	35.8	N/A
30	mins	6.5	9.1	10.4	12.5	13.9	15.0	18.5	22.4	25.1	28.7	32.0	34.5	38.4	41.4	43.9	N/A
1	hours	8.6	11.8	13.5	16.1	17.8	19.1	23.4	28.2	31.4	35.8	39.7	42.6	47.2	50.8	53.7	N/A
2	hours	11.3	15.4	17.5	20.7	22.8	24.4	29.7	35.5	39.3	44.5	49.2	52.7	58.1	62.3	65.8	N/A
3	hours	13.3	18.0	20.4	24.0	26.4	28.2	34.1	40.6	44.8	50.7	55.8	59.7	65.7	70.3	74.0	N/A
4	hours	14.9	20.1	22.7	26.7	29.3	31.3	37.6	44.7	49.2	55.5	61.0	65.2	71.6	76.5	80.5	N/A
6	hours	17.6	23.5	26.5	30.9	33.8	36.1	43.2	51.1	56.1	63.1	69.2	73.8	80.8	86.2	90.7	N/A
9	hours	20.7	27.4	30.8	35.8	39.1	41.6	49.7	58.4	64.0	71.7	78.4	83.5	91.3	97.2	102.1	N/A
12	hours	23.3	30.6	34.3	39.8	43.4	46.1	54.8	64.2	70.3	78.6	85.8	91.2	99.5	105.8	111.0	N/A
18	hours	27.4	35.7	40.0	46.1	50.2	53.2	62.9	73.5	80.2	89.3	97.3	103.3	112.4	119.3	125.0	N/A
24	hours	30.7	39.9	44.5	51.2	55.6	58.9	69.5	80.8	88.0	97.8	106.4	112.8	122.5	129.9	135.9	156.5
2	days	41.2	52.0	57.4	65.1	70.1	73.9	85.6	98.0	105.8	116.3	125.4	132.2	142.3	150.0	156.2	177.2
3	days	50.3	62.6	68.6	77.1	82.6	86.7	99.5	112.9	121.3	132.5	142.1	149.3	160.0	168.0	174.5	196.2
4	days	58.7	72.2	78.8	88.1	94.0	98.5	112.2	126.5	135.4	147.2	157.3	164.8	176.0	184.4	191.2	213.7
6	days	74.4	90.1	97.7	108.3	115.0	120.0	135.3	151.2	160.9	174.0	184.9	193.1	205.2	214.2	221.4	245.5
8	days	89.2	106.8	115.2	126.9	134.3	139.8	156.6	173.8	184.4	198.4	210.1	218.9	231.7	241.3	248.9	274.3
10	days	103.4	122.7	131.9	144.6	152.6	158.6	176.6	195.1	206.4	221.3	233.7	243.0	256.5	266.6	274.7	301.3
12	days	117.2	138.1	148.0	161.7	170.3	176.6	195.9	215.4	227.4	243.1	256.2	265.9	280.1	290.6	299.1	326.8
16	days	144.1	167.9	179.2	194.5	204.1	211.2	232.6	254.2	267.3	284.5	298.8	309.3	324.7	336.0	345.1	374.8
20	days	170.4	196.9	209.3	226.2	236.7	244.5	267.8	291.1	305.3	323.8	339.1	350.3	366.8	378.8	388.5	420.0
25	days	202.9	232.4	246.1	264.8	276.3	284.8	310.2	335.6	350.9	370.9	387.3	399.4	417.0	429.9	440.2	473.6

Figure 9-9 Recorded Flood Events and Modelled Extent of "Medium" and "Low" Probability" Fluvial Flood Risk (Source: OPW)

OPW defines "*medium probability*" flooding as a *"modelled extent of land that might be flooded by rivers (fluvial flooding) during a theoretical or 'design' flood event with an estimated probability of occurrence, rather than information for actual floods that have occurred in the past*." In this instance, the probability of occurrence is 100:1, which is a 100-year return period event, noting that this does not account for possible effects of climate change. The "*low probability*" flood risk extent is defined by a 1,000:1 probability of occurrence, or a 1000-year return period event.

There are no records of historical flooding or recurring flood incidents with the Wind Farm Site. The nearest recorded flooding on a river that is hydrologically linked with the Wind Farm Site is on the Owenmore River, between Bellacorick and Bangor Erris, more than 20 km downstream of the Wind Farm Site.

GSI's mapping does not show any groundwater flooding in vicinity of the Wind Farm Site. Historical OSI 6- or 25-inch sheets for the Wind Farm Site do not identify any lands that are "liable to flood".

With the exception of roads and road crossings on lower ground, all infrastructure within the Wind Farm Site is located outside and above the OPW-modelled 1,000- and 100-year return period flood levels. As such, all planned infrastructure is located in Flood Zone C (Low Risk).

Roads that cross streams within the Wind Farm Site incorporate pipe culverts and an existing single-span bridge (on Altderg River). Flood risk at culvert crossings will be accommodated by designing conservatively for 1 in 100 year storm flow events (**Appendix 9-2**).

9.3.6.2 Grid Connection Route

The area that is traversed by the grid connection route is also not considered in OPW's Catchment Flood Risk Assessment and Management (CFRAM) Programme. However, OPW's National Indicative Fluvial flood risk maps show coincident "*medium probability*" and "*low probability*" flood extents along the Glencullin, Ballinglen, and Cloonaghmore Rivers, as reproduced in **Figure 9-9**. The grid connection route follows existing roadways which are at higher elevations than the rivers, and outside the indicative flood extents, which means that the grid cable will remain above the OPW-modelled 1,000- and 100-year return period flood levels. At locations where the grid cable crosses rivers with identified flood risk, cable crossings will be accommodated by existing bridges or horizontal direction drilling beneath streambeds. Neither creates or involves flood risk.

The recurring flood events on the Cloonaghmore River (**Figure 9-9**) is upstream of where the grid connection route crosses the river.

9.3.7 Surface Water Quality

Surface water samples were collected at 5 locations within the Wind Farm Site in September 2020, November 2020, January 2021, March 2021, and May 2021 (FT, 2023). The sample locations are shown in **Figure 9-10**, and the reported results are presented in **Table 9-10**.

Nutrient concentrations (ammonia, nitrate and orthophosphate) are generally low to non-detected in nearly all samples. For example, total ammonia concentrations were below the limit of detection (LOD, <0.01 mg/L as N) in 22 of the 25 samples that were collected. The three detections ranged from 0.017 mg/L at Location 2 to 0.025 mg/L at Location 5. The data overall do not indicate any specific water quality issue, and taken together, the sample results are consistent with water bodies that meet the default WFD 'Good' chemical status objective, whereby all results comply with environmental quality standards (EQSs) for at least 'Good' chemical status (per the European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2022, S.I. No. 288/2022).

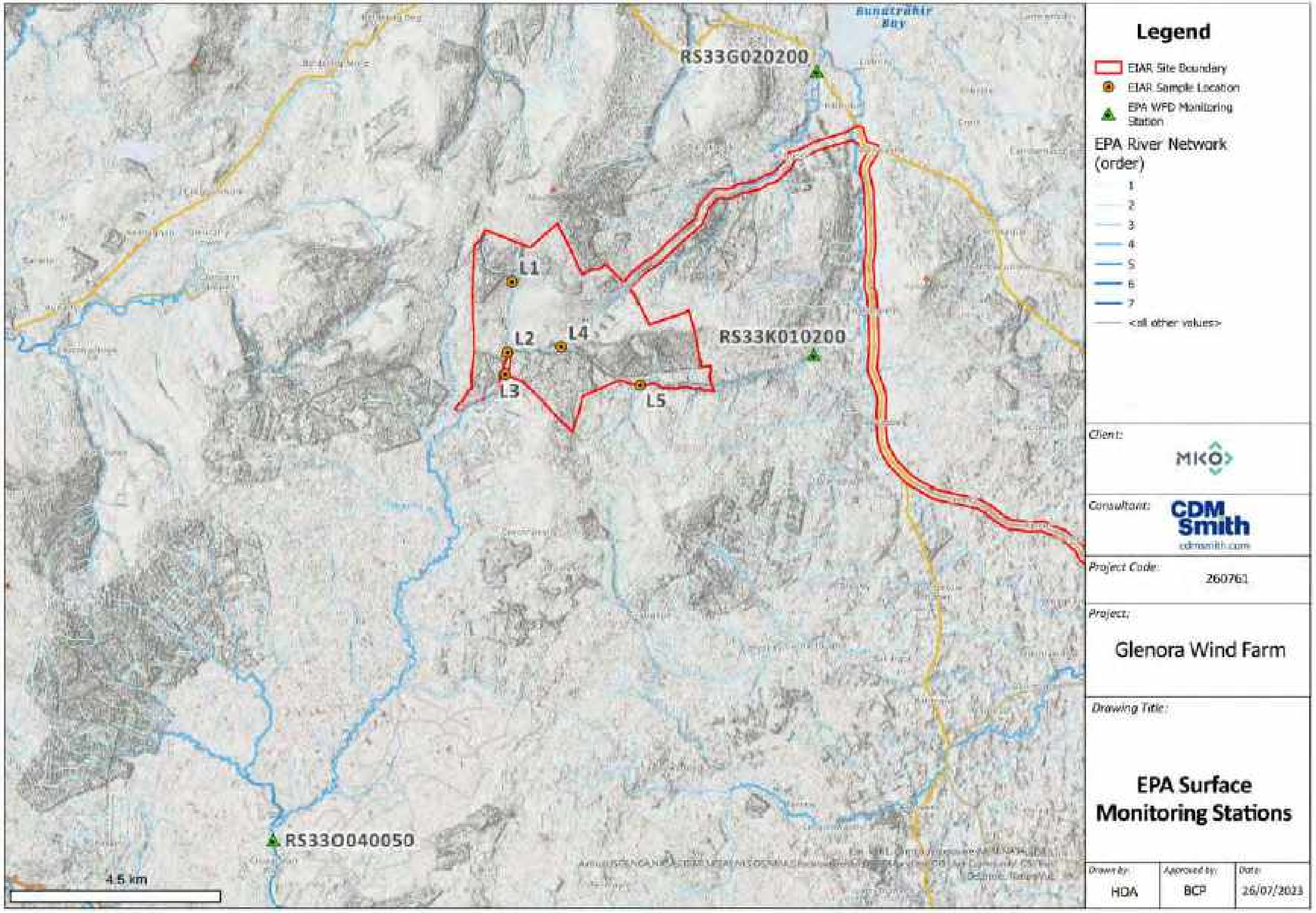

Figure 9-10 Surface Water Sample Locations

Table 9-10 Surface Water Quality at 5 Locations In the Wind Farm Site, 2020-2021 (Source: FT, 2022)

Parameter	Unit	Location 1					Location 2					Location 3				
		29-Sep-20	26-Nov-20	27-Jan-21	31-Mar-21	27-May-21	29-Sep-20	26-Nov-20	27-Jan-21	31-Mar-21	27-May-21	29-Sep-20	26-Nov-20	27-Jan-21	31-Mar-21	27-May-21
Aluminium (dissolved)	mg/L	0.058	0.079	0.063	0.091	0.045	0.09	0.085	0.066	0.098	0.046	0.074	0.096	0.071	0.092	0.046
Alkalinity (as $CaCO_3$)	mg/L	32.7	<30	<30	<30	43.9	38.6	<30	<30	<30	54.1	48.7	<30	<30	<30	66.4
Ammonia as N	mg/L	<0.01	<0.01	0.018	<0.01	<0.01	<0.01	<0.01	0.017	<0.01	0.014	<0.01	<0.01	<0.01	<0.01	<0.01
BOD_5	mg/L	<2	--	<2	<2	<2	<2	--	<2	<2	<2	<2	--	<2	<2	<2
Chloride	mg/L	16.9	14.7	10.9	17.7	19.4	18.7	15.5	11.4	18.9	20.7	19.6	16.6	15.3	19.3	21.7
COD	mg/L	18	--	14	28	10	33	--	21	35	15	43	--	31	38	25
Conductivity @ 20°C	µS/cm	144	--	<132	432	136	142	--	<132	<132	151	165	--	<132	<132	303
Dissolved Oxygen	mg/L	9.44	--	10.89	10.14	10.48	9.41	--	10.9	10.22	10.42	9.13	--	10.87	10.49	10.66
Iron (dissolved)	mg/L	0.269	0.216	0.157	0.201	0.271	0.624	0.32	0.23	0.291	0.493	0.947	0.48	0.323	0.339	0.717
Total Nitrogen	mg/L	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Nitrite as N	mg/L	<0.005	<0.005	0.079	0.079	0.079	<0.005	<0.005	0.065	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrate as N	mg/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Orthophosphate as P	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.042	<0.025
pH	mg/L	7.68	--	7.42	7.02	7.55	7.55	--	7.24	6.99	7.65	7.7	--	7.17	6.97	7.83
Phosphorus, Total as P	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TON as N	mg/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Suspended Solids	mg/L	<2	<2	<2	<2	2	<2	<2	<2	<2	<2	<2	2	<2	<2	2
Turbidity	NTU	0.38	--	0.88	1.49	0.96	0.38	--	0.91	1.24	0.74	0.85	--	1.17	1.24	0.84

Parameter	Unit	Location 4					Location 5				
		29-Sep-20	26-Nov-20	27-Jan-21	31-Mar-21	27-May-21	29-Sep-20	26-Nov-20	27-Jan-21	31-Mar-21	27-May-21
Aluminium (dissolved)	mg/L	0.711	0.091	0.071	0.147	0.051	0.067	0.091	0.068	0.089	0.049
Alkalinity (as $CaCO_3$)	mg/L	81.5	<30	<30	<30	102	62.6	<30	<30	<30	76.3
Ammonia as N	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.025	<0.01	<0.01	<0.01
BOD_5	mg/L	<2	--	<2	<2	<2	<2	--	<2	<2	<2
Chloride	mg/L	20.3	17.6	16.2	18.9	22.2	19.5	16.4	15.4	18.4	20.9
COD	mg/L	43	--	30	42	24	35	--	25	37	18
Conductivity @ 20°C	µS/cm	230	--	<132	<132	222	198	--	<132	158	181
Dissolved Oxygen	mg/L	9.49	--	10.78	10.06	10.69	9.52	--	10.72	10.03	10.73
Iron (dissolved)	mg/L	0.957	0.538	0.385	0.378	0.676	0.781	0.422	0.275	0.295	0.532
Total Nitrogen	mg/L	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Nitrite as N	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrate as N	mg/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Orthophosphate as P	mg/L	<0.025	<0.025	<0.025	0.042	<0.025	<0.025	<0.025	<0.025	0.049	<0.025
pH	mg/L	7.75	--	7.41	7.11	7.9	7.75	--	7.33	7.02	7.87
Phosphorus, Total as P	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TON as N	mg/L	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Suspended Solids	mg/L	<2	5	5	4	2	4	<2	5	4	3
Turbidity	NTU	1.24	--	1.38	1.32	0.98	1.01	--	1.02	1.67	0.96

Publicly available surface water quality data from EPA were also reviewed, notably from three monitoring stations that are part of EPA's national WFD monitoring programme, as follows:

- Station ID RS33O040050 on the Owenmore River (**Figure 9-10**). This station is situated c. 12 km south-southwest of the Wind Farm Site, downstream of the Altderg River which exits Glenora Forest to the south. EPA's records cover the period 2007 to present.
- Station ID RS33K010200 on the Keerglen River (**Figure 9-10**). This station is situated c.5.5 km east and downstream of the Wind Farm Site. EPA's records cover the period 2016 to present.
- Station ID RS33G020200 on the Glencullin River (**Figure 9-10**). This station is situated c.7.5 km northeast of the Wind Farm Site. EPA's records cover the period 2007 to present. This station is not hydrologically downstream of infrastructure within the Wind Farm Site, but the data nevertheless reflects a subcatchment which originates within Glenora Forest. For this reason, it was included in the baseline description for purposes of comparison with the Owenmore and Keerglen Rivers.

The EPA data are summarised in **Table 9-11**. In short, the data show:

- Low nutrient concentrations
- Well oxygenated and low biological oxygen demand conditions
- Variable and wide-ranging true colour concentrations
- Variable alkalinity concentrations, although average alkalinity values are <100 mg/l (as $CaCO_3$), *i.e.* low, at each location.

Additionally, average concentrations for total ammonia, orthophosphate (ORP), BOD_5 are below annual average (AA) EQSs for WFD "Good" chemical status. Results for individual water quality parameters are presented below. The WFD status classification of river water bodies and groundwater bodies linked to the Proposed Development is presented in **Appendix 9-3**.

9.3.7.1 Total Ammonia

Total ammonia concentrations are shown in **Figure 9-11**. Sample results are generally below limits of detection (LOD, which is either 0.02 or 0.03 mg/L as N, depending on the sample). The vast majority of data, hence also annual averages, are below the AA-EQS of 0.065 mg/L as N for WFD "Good" chemical status. The maximum recorded value in the datasets is 0.78 mg/l in 2020, which is considered a single outlier detection (thus not shown in **Figure 9-11**).

9.3.7.2 Orthophosphate

Orthophosphate concentrations are shown in **Figure 9-12**. Sample results are generally below limits of detection (LOD, mostly at 0.01 mg/L as P). The vast majority of data, hence also annual averages, are below the AA-EQS of 0.035 mg/L as N for WFD "Good" chemical status. The maximum recorded value in the datasets is 0.096 mg/l in 2008.

9.3.7.3 SEC

SEC values are shown in **Figure 9-13**. Recorded values range from <100 to approximately 500 µS/cm and tend to show summer maxima and winter minima, likely reflecting higher rainfall and flow in winter. SEC is generally lower at the Owenmore River station compared to the other two stations, owing to a greater surface water influence in a much larger subcatchment at this location.

Table 9-11 Summary of EPA Water Quality Data, WFD Monitoring Stations

			Subcatchment: Owenmore (Mayo)_010 River: Owenmore EPA Station ID: RS33O040050 EPA Station name: Br SE Srahnakilly					Subcatchment: Keerglen_010 River: Keerglen EPA Station ID: RS33K010200 EPA Station name: Bridge N.E. of Doondragon					Subcatchment: Glencullin (North Mayo)_010 River: Glencullin EPA Station ID: RS33G020200 EPA Station name: Killerduff Bridge					
Parameter	**Unit**	**LOD[1]**	**Min**	**Max**	**Average[2]**	**n[3]**	**n>LOD**	**Min**	**Max**	**Average**	**n**	**n>LOD**	**Min**	**Max**	**Average**	**n**	**n>LOD**	**AA-EQS[4]**
Total Alkalinity (as $CaCO_3$)	mg/l	8-10	<8	92.00	30.84	73	64	11.00	266.00	90.90	39	39	<8	193.00	68.84	76	76	
Total Hardness (as $CaCO_3$)	mg/l	10	14.00	102.00	42.25	73	63	19.00	269.00	102.51	39	39	30.00	214.00	85.53	76	76	
Biological Oxygen Demand (5-day)	mg/l	1	<1	4.10	0.84	71	30	<1	3.60	0.90	37	16	<1	1.90	0.78	74	28	≤1.5
Chloride	mg/l	2	9.82	46.00	22.36	73	73	7.98	39.00	20.29	39	39	8.71	42.80	24.32	76	76	
Electrical Conductivity @ 25°C	µS/cm	15	29.00	266.00	140.86	72	72	78.00	565.00	249.16	38	38	95.00	461.00	221.57	75	75	
Total Ammonia (NH_3 as N)	mg/l	0.02	<0.02	0.085	0.015	73	10	<0.02	0.032	--	39	4	<0.02	0.770	0.023	76	6	≤0.065
Nitrate (as N)	mg/l	0.2	<0.2	1.50	--	36	1	<0.2	0.570	0.142	36	8	<0.2	0.210	--	36	1	
Nitrite (as N)	mg/l	0.004	<0.004	0.014	--	71	1	<0.004	0.016	--	37	1	<0.004	0.013	--	71	1	
Total Oxidisable Nitrogen (as N)	mg/l	0.2	<0.2	1.500	--	73	1	<0.2	0.560	0.138	39	8	<0.2	0.200	--	76	1	
Ortho-Phosphorus (as P)	mg/l	0.01	<0.01	0.019	0.006	73	8	<0.01	0.015	0.007	39	12	<0.01	0.098	0.013	76	40	≤0.035
pH	pH units	2	6.10	8.10	7.18	72	72	7.00	8.10	7.63	38	38	6.70	8.50	7.68	75	75	
True Colour	mg/l Pt Co	5	32.00	402.00	166.58	73	73	22.00	293.00	139.97	39	39	12.00	412.00	159.21	76	76	
Dissolved Oxygen	% Sat	1	89.00	116.00	99.41	70	70	48.00	120.00	97.47	36	36	50.00	125.00	100.23	73	73	>80<120
Dissolved Oxygen	mg/l	0.1	8.20	12.70	10.83	33	33	5.00	13.00	10.69	35	35	5.50	13.00	10.92	35	35	

Notes:
1 LOD = limit of detection
2 Averages not calculated if number of detections (n>LOD) is ≤4. Averages calculated using half the LOD where results are <LOD.
3 n – number of samples
4 Annual Average Environmental Quality Standard for WFD Good Status classification of river water bodies, per the European Communities Environmental Objectives (Surface Waters) (Amendment) Regulations 2022, S.I. No. 288/2022 as amended.

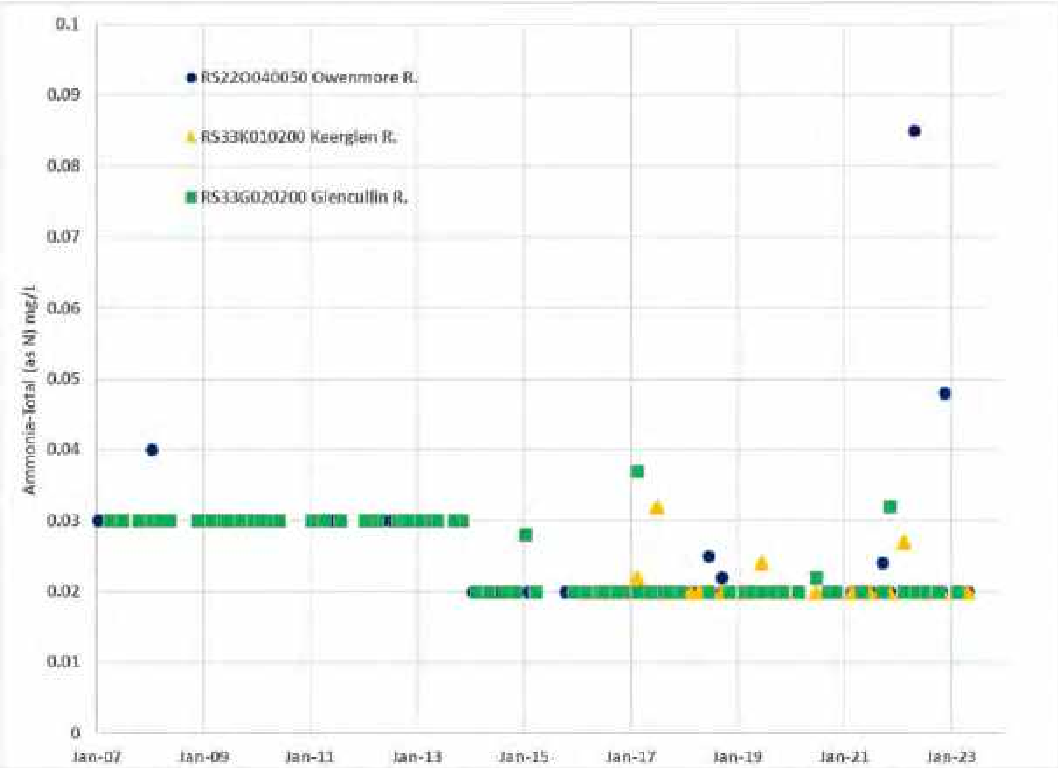

Figure 9-11 Total Ammonia, 2007-2023, EPA Data

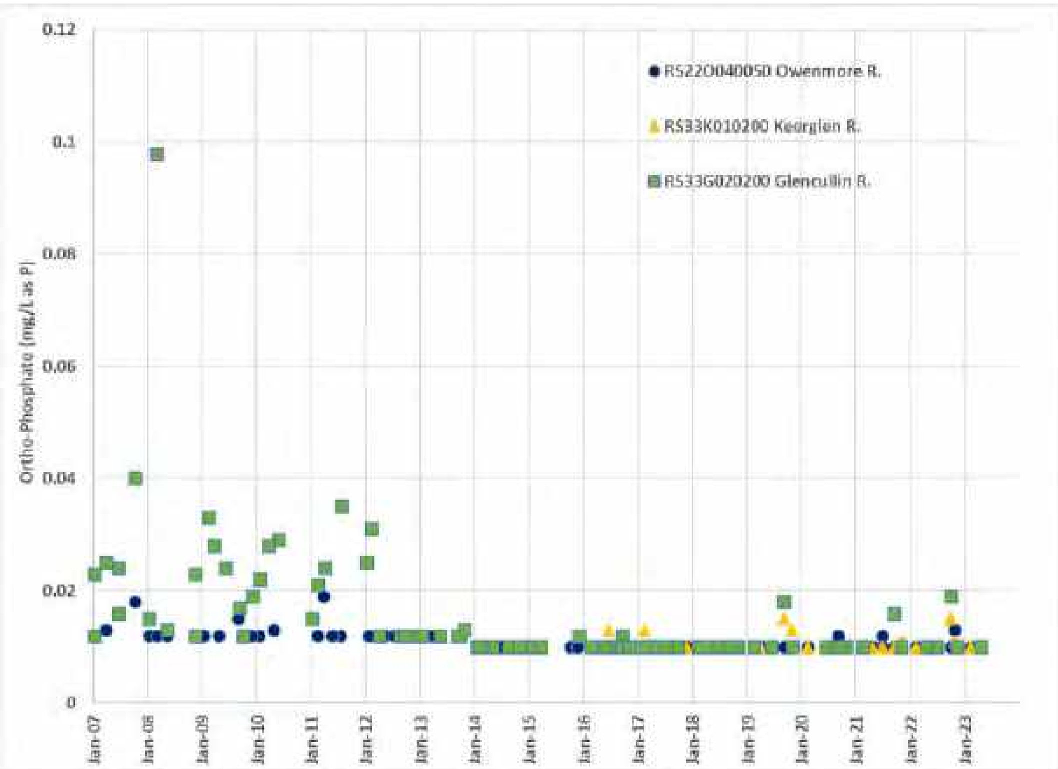

Figure 9-12 Orthophosphate, 2007-2022, EPA Data

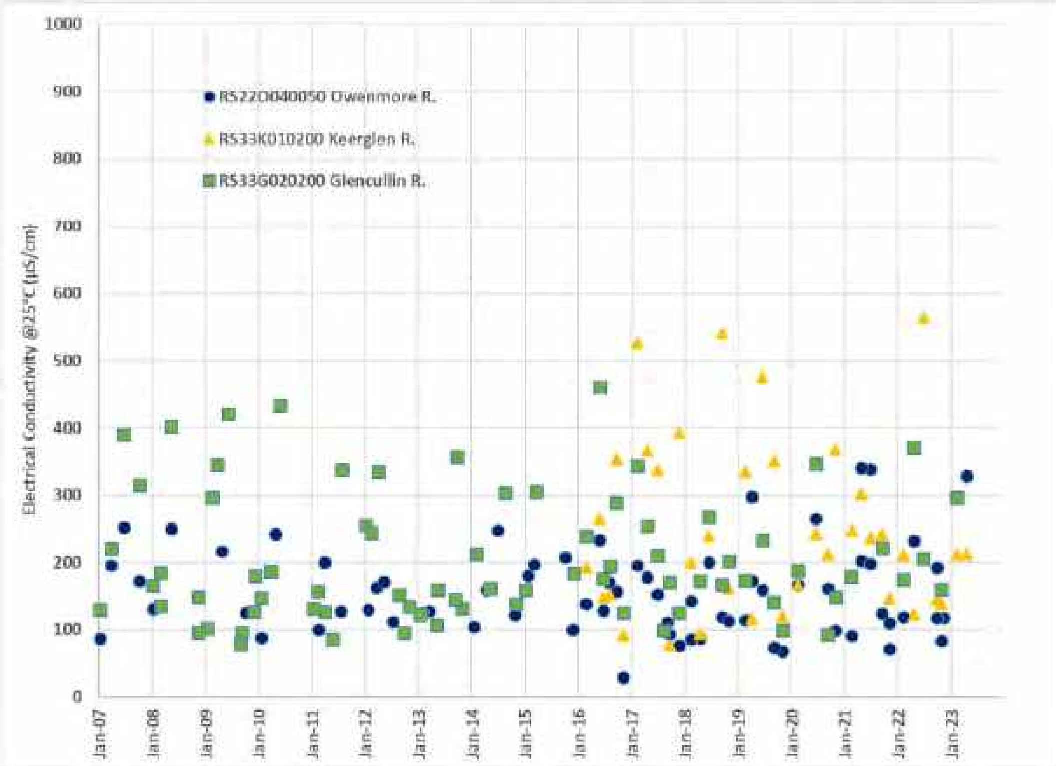

Figure 9-13 Electrical Conductivity, 2007-2023, EPA Data

9.3.7.4 Total Alkalinity

Total alkalinity concentrations are shown in **Figure 9-14**. Concentrations show seasonal changes, generally with summer maxima. Average concentrations are <100 mg/L (as $CaCO_3$) at each station, but concentrations are noticeably lower at the Owenmore River station compared to the other two stations, for the same reasons described above.

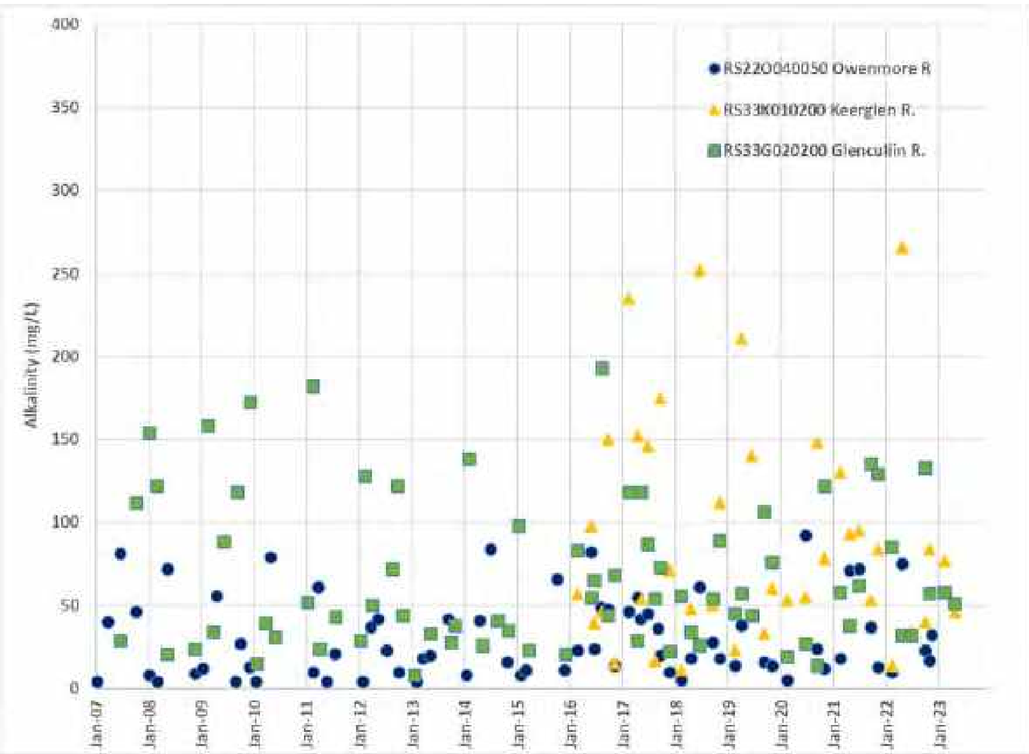

Figure 9-14 Total Alkalinity, 2007-2023, EPA Data

9.3.7.5 pH

As shown in **Figure 9-15**, pH values range from 6 to 8.5, generally with summer maxima. pH values are also generally lower at the Owenmore River station.

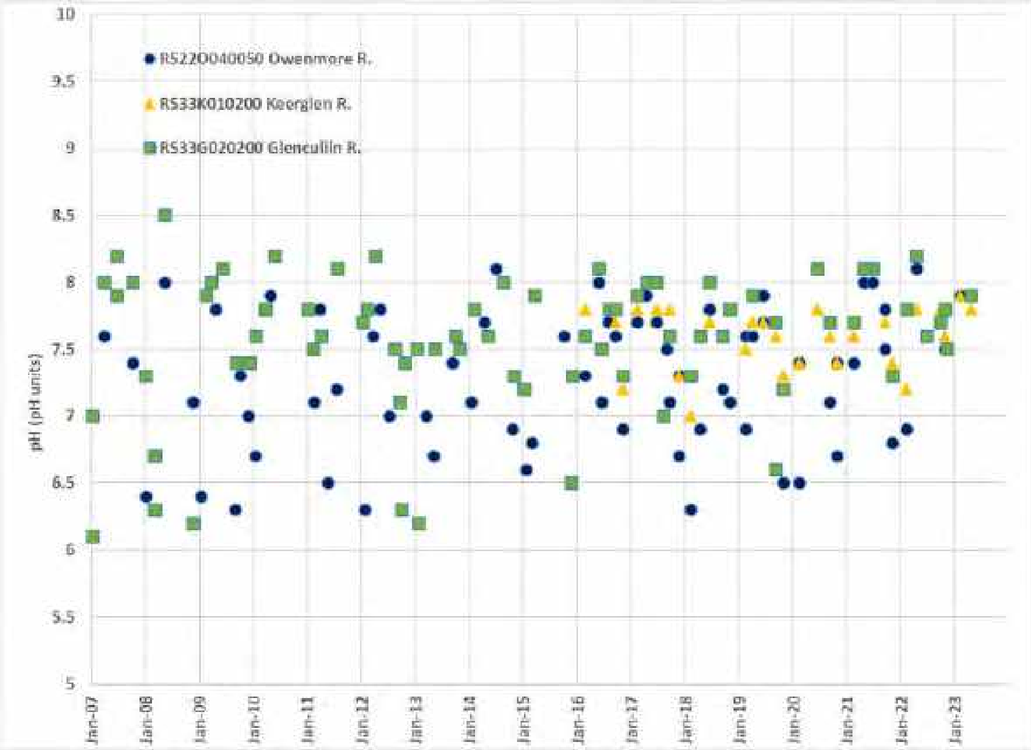

Figure 9-15 pH, 2007-2022, EPA Data

9.3.7.6 True Colour

As shown in **Figure 9-16**, true colour concentrations ranged between 12 and 402 mg/l in the three rivers over the period of record. Water leaving bogs has natural colour, principally from dissolved organic (humic) matter in the peat (**Photo 8**). The recorded variations reflect runoff and drainage of peat during storm events. The higher true colour values result from the mobilisation and export of organic matter during rainstorm events.

9.3.7.7 Suspended Solids

Based on **Table 9-10**, concentrations of suspended solids in the five locations sampled within Glenora Forest were low at the time of sampling (generally <2 mg/L, max 5 mg/L). This is supported by low turbidity values in the same samples. Unfortunately, the longer-term EPA datasets do not contain suspended solids or turbidity data.

Likely, the sampling events did not capture conditions during significant storm events. During site walkover surveys conducted on 17 and 18 June 2023, observations were made of sediment mobilisation to drainage ditches as depicted in **Photo 9**, taken on 18 June 2023. On this day, several short (<15 min) duration and intense rain showers occurred across the Wind Farm Site within a short time period (estimated c. 2 hours). Although far away, the nature of the rainfall is exemplified by the available hourly rainfall data from the Belmullet synoptic weather station (**Figure 9-17**), where 5.8 mm of rainfall was recorded over a 4-hour period.

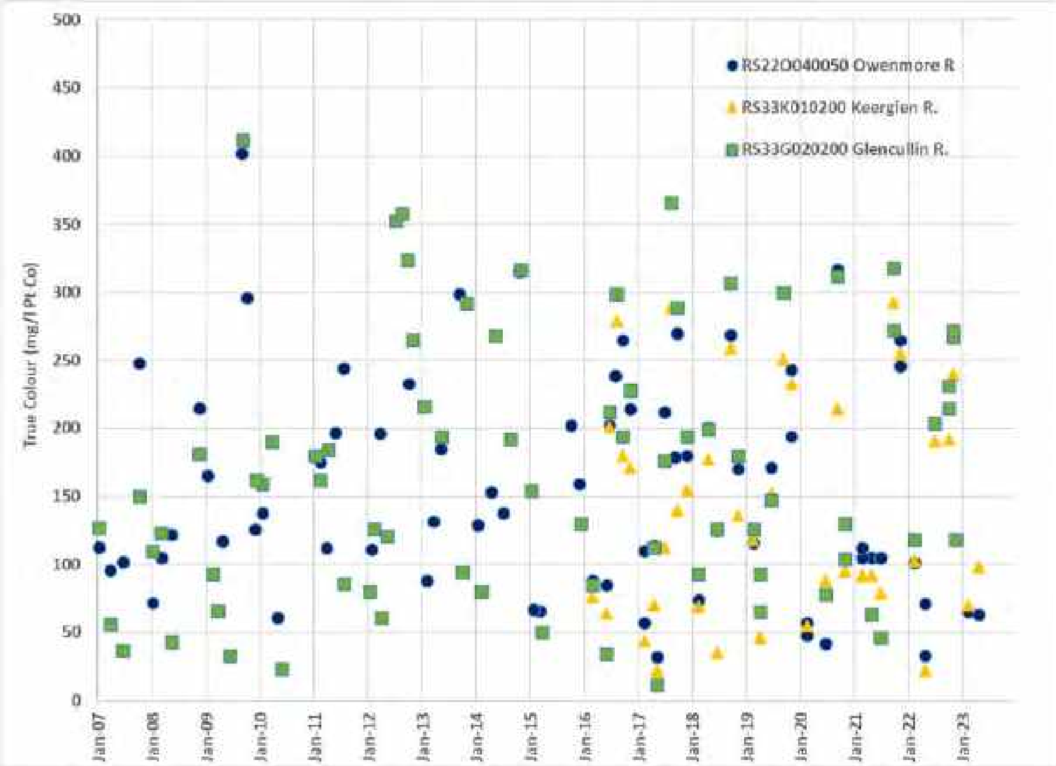

Figure 9-16 True Colour, EPA Data, 2007-2022

Photo 8: Natural Orange/Brown (Humic) Water Colour in Drainage Ditches

Photo 9: Suspended Sediments in Drainage Water, 18 June 2023

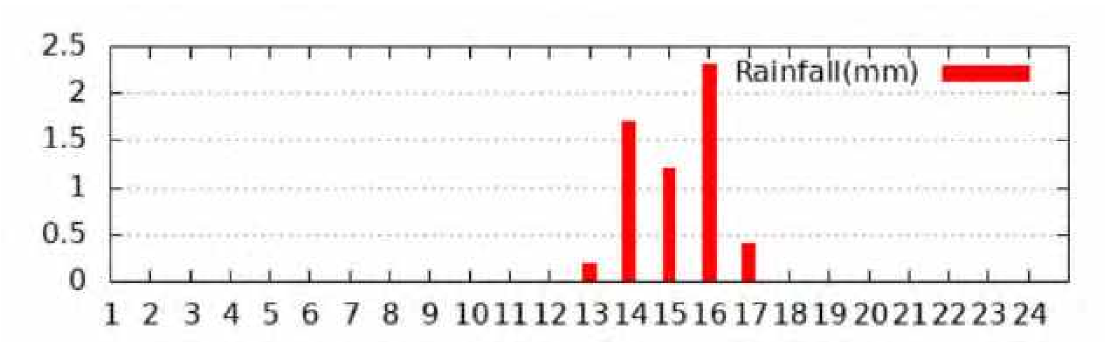

Figure 9-17 Hourly Rainfall (mm), Belmullet, 18 June 2023 (Source: Met Éireann)

9.3.7.8 EPA Q Values

In addition to the WFD water quality monitoring, EPA conducts biological monitoring through macroinvertebrate 'kick-sampling' at the same fixed water quality sampling locations on the same named rivers. Most recent data from EPA[5] shows that resulting 'Q rating' values are:

- For station ID RS33O040050 on the Owenmore River, 4 to 5 in 2021, indicating High Q status (invertebrate) conditions.
- For station ID RS33K010200 on the Keerglen River, 4 to 5 in 2020, indicating High Q status (invertebrate) conditions.
- For station ID RS33G020200 on the Glencullin River, 4 to 5 in 2021, indicating High Q status (invertebrate) conditions. A second station on the Glencullin River closer to Glenora Forest, station ID RS33G020100, indicated a Q value of 4 (Good Q status) in 2011 (latest available value at that location).

9.3.8 Hydrogeology

9.3.8.1 Bedrock Aquifer Classification

Based on GSI's 1:100,000 scale bedrock mapping (**Figure 9-18**), the Wind Farm Site in Glenora Forest is principally underlain by sandstones, siltstones and mudstones of the Downpatrick, Minnaun Sandstone Formations. The southwestern extent comprises the Glencullin River Formation and the northwesternmost corner of the Wind Farm Site is underlain by the Pollacappul Formation which incorporates metamorphic rock types, notably quartzite, schist and marble.

In the northwestern part of the Wind Farm Site, rock formations are faulted, and mapped faults trend northeast-southwest and north-south (see **Figure 9-18**). Drainage may be influenced by such structures, noting that the Altderg and Ballinglen Rivers tend to align with mapped faults.

The grid connection route is mainly underlain by the Downpatrick Formation (including the Moyny Point Limestone Member along the Ballinglen River) and the Ballina Limestone Formation (Lower)[6] further east.

From a hydrogeological perspective, the geological formations named above are classified by GSI as:

- 'Pl' bedrock aquifers: Downpatrick Formation, Pollacappul Formation.
- 'Ll' bedrock aquifer: Glencullin River Formation
- 'Lm' bedrock aquifer: Minnaun Sandstone Formation
- 'Lk' bedrock aquifer: Moyny Point Limestone Member of the Downpatrick Formation, present along the Ballinglen River

[5] As presented on the EPA Water web viewer at https://gis-stg.epa.ie/EPAMaps/Water
[6] As described by MacDermot *et al* (1996).

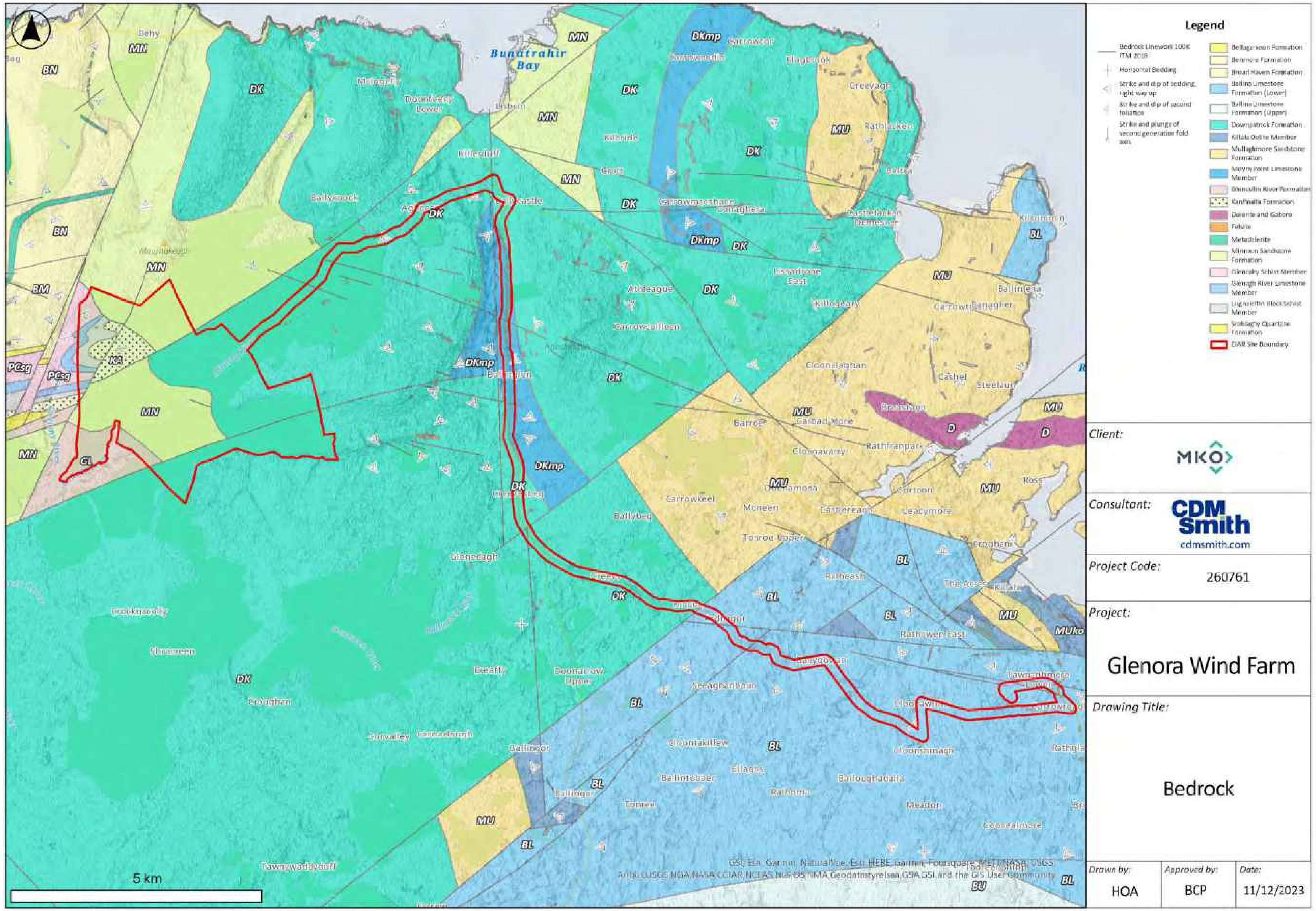

Figure 9-18 Bedrock Map, 1:100,000 Scale (Source: GSI)

GSI's bedrock aquifer classification map is presented in **Figure 9-19**. GSI' classification scheme (DELG/EPA/GSI 1999) considers the relative importance of bedrock as a groundwater resource, whereby:

- 'Pl' and 'Ll' bedrock aquifers are defined as "*poorly productive bedrock aquifers which are generally unproductive except for local zones*", where the term 'local zones' usually refers to geological faults.
- 'Lm' bedrock aquifers are "*locally important*" and "*generally moderately productive*". 'Lk' bedrock aquifers are "*locally important*" and "*karstified*". The latter term means that bedrock is prone to dissolution processes, whereby groundwater can move preferentially through solutionally enlarged conduits. It is noted that GSI's database of karst features (which is available from GSI's website) does not contain any karst features in the mapped area of the Moyny Point Limestone Member. This does not, however, mean that karst features are necessarily absent, as GSI's karst database reflects the current status of GSI's national mapping and is regularly updated (based on GSI's field work).

The predominance of 'Pl' and 'Ll' (poorly productive) and 'Lm' bedrock aquifers in the areas of interest means that groundwater will, conceptually, provide limited baseflow to streams/rivers, but may yet be important in providing the environmental supporting conditions for blanket bog.

9.3.8.2 Peat and Subsoil Characteristics

The bedrock is overlain by subsoils and peat. Based on 550 no. peat probes conducted along roadways and at infrastructure locations, recorded peat depths range from 0.1 to 4.6 m, with an average peat depth of 1.8 m (FT, 2023). Sixty-three percent (%) of the probes recorded peat depths of less than 2.0 m, and 99% of probes recorded peat depths of less than 3.0 m. a small number of recorded peat depths ranged from 3.0 to 4.6m (FT, 2023).

The subsoils beneath the peat consist of glacial till. Based on trial pit excavations, the till comprises soft to stiff, sandy, gravelly, SILT and CLAY with variable pebble and cobble content (FT, 2022). Grey to orange and brown, silty, SAND and GRAVEL deposits are also recorded locally (FT, 2022). Based on particle size distribution curves of 9 no. till samples (FT, 2022), the sediments can be described as poorly sorted, with percentages passing SILT grade ranging from 25 to 98%.

The glacial till is exposed on steep slopes and along streams that cut through the peat. Small areas of alluvial sediments have also been mapped by GSI along the lower section of the Altderg and Keerglen Rivers (**Figure 9-20**).

The grid connection route is underlain by glacial till of different types which are derived from the underlying bedrock.

In the hydrogeological context, the GSI has mapped and considers the subsoils across the Wind Farm Site to have 'Moderate' and 'Low' permeability characteristics (**Figure 9-21**). In such scenarios, groundwater fluxes through subsoils will be limited.

9.3.8.3 Groundwater Vulnerability

Groundwater vulnerability within the Wind Farm Site is mapped by GSI as 'Extreme' to 'Low' (**Figure 9-22**). GSI's vulnerability mapping is based on the combination of estimates of depths to bedrock and subsoil permeability (DELG/EPA/GSI, 1999). GSI's 'Extreme' vulnerability areas have been mapped on higher ground where subsoils are thinner and/or bedrock is exposed. Areas of 'Low' vulnerability coincide with lower elevation grounds along the Altderg River. The site specific data presented in FT's site investigations report (FT, 2022) broadly confirm GSI's mapped interpretation of vulnerability, even if localised differences apply. Peat is thinner on higher ground and generally thicker and deeper on lower ground.

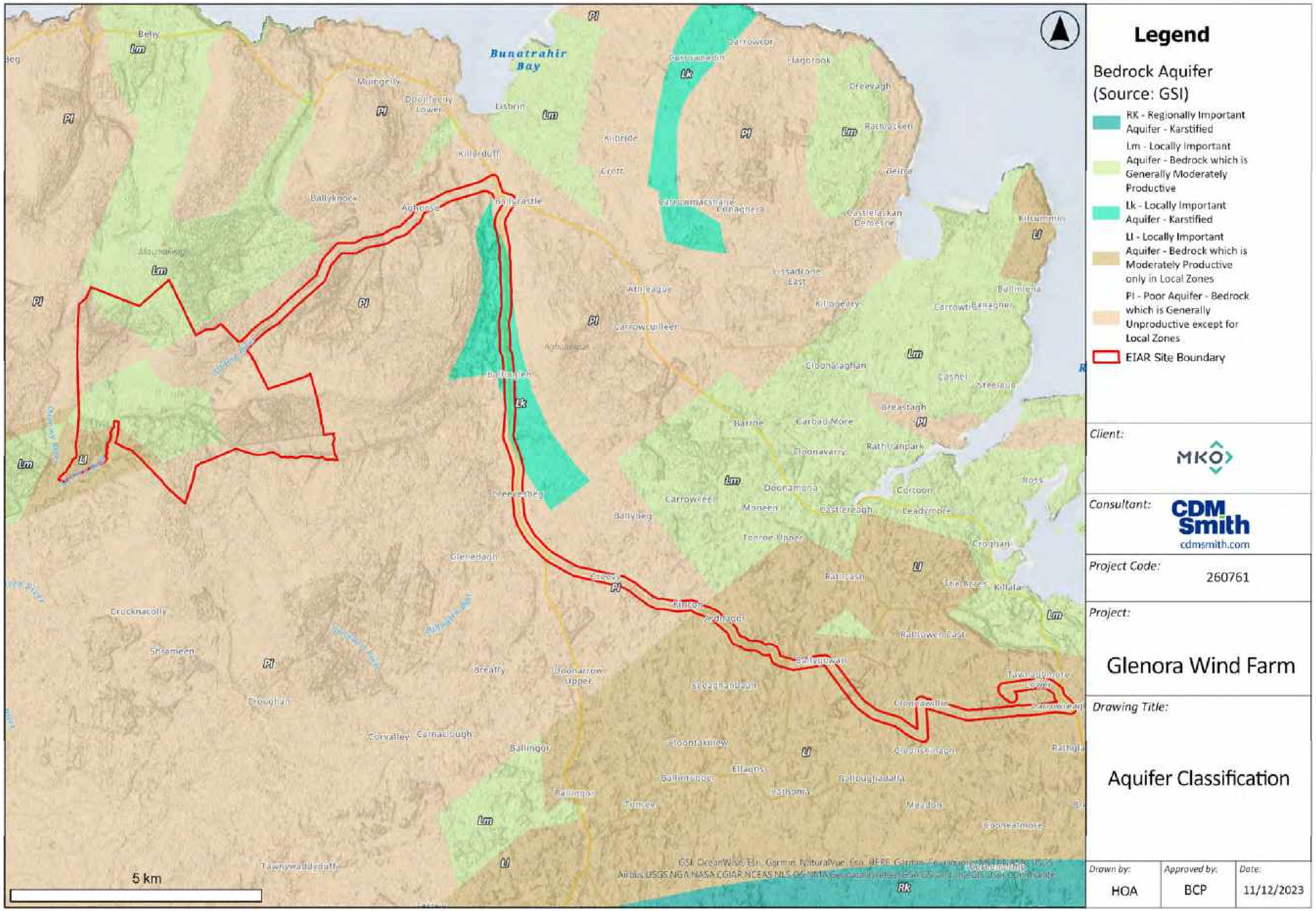

Figure 9-19 Bedrock Aquifer Classification (Source: GSI)

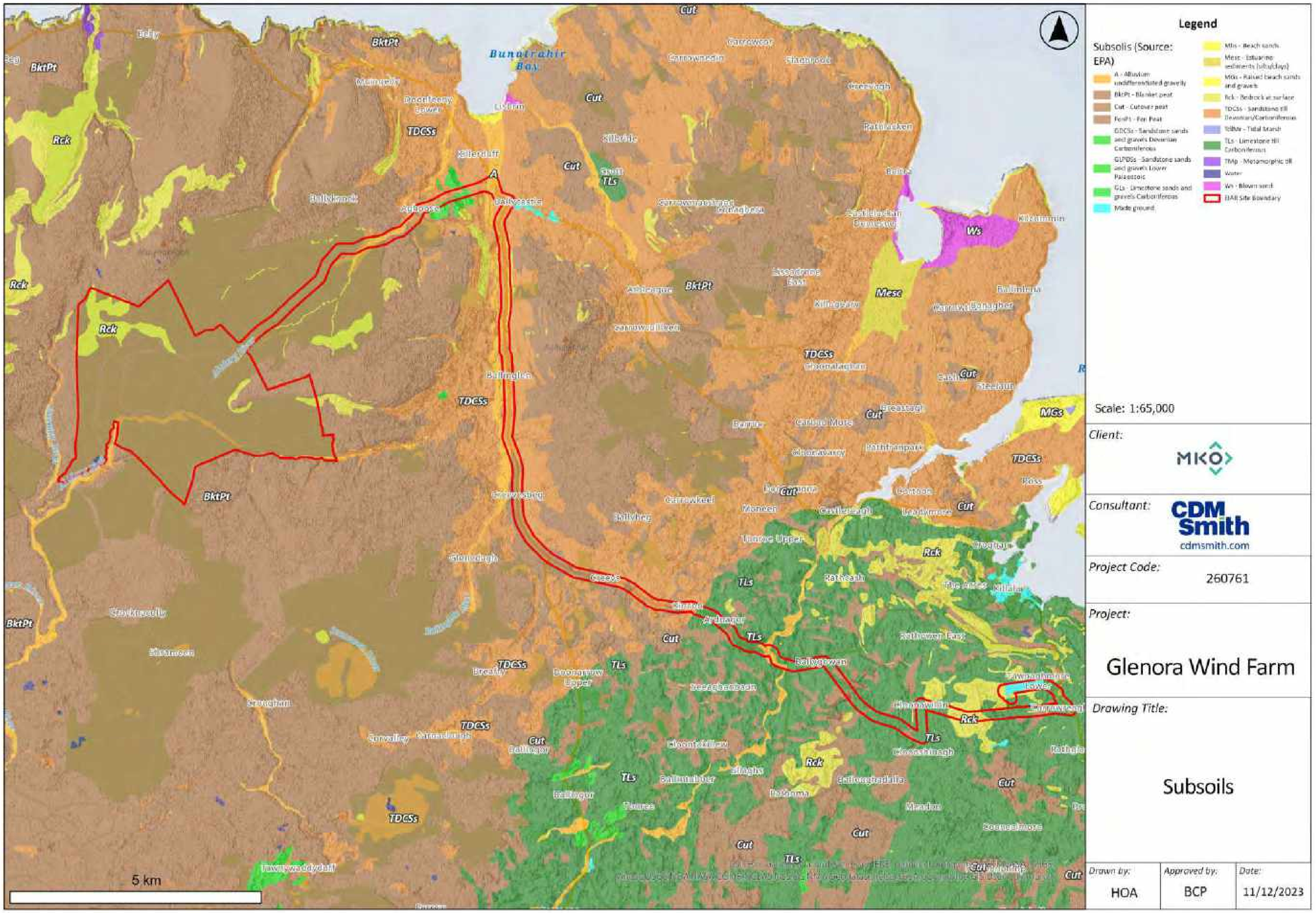

Figure 9-20 Subsoil Map (Source: GSI)

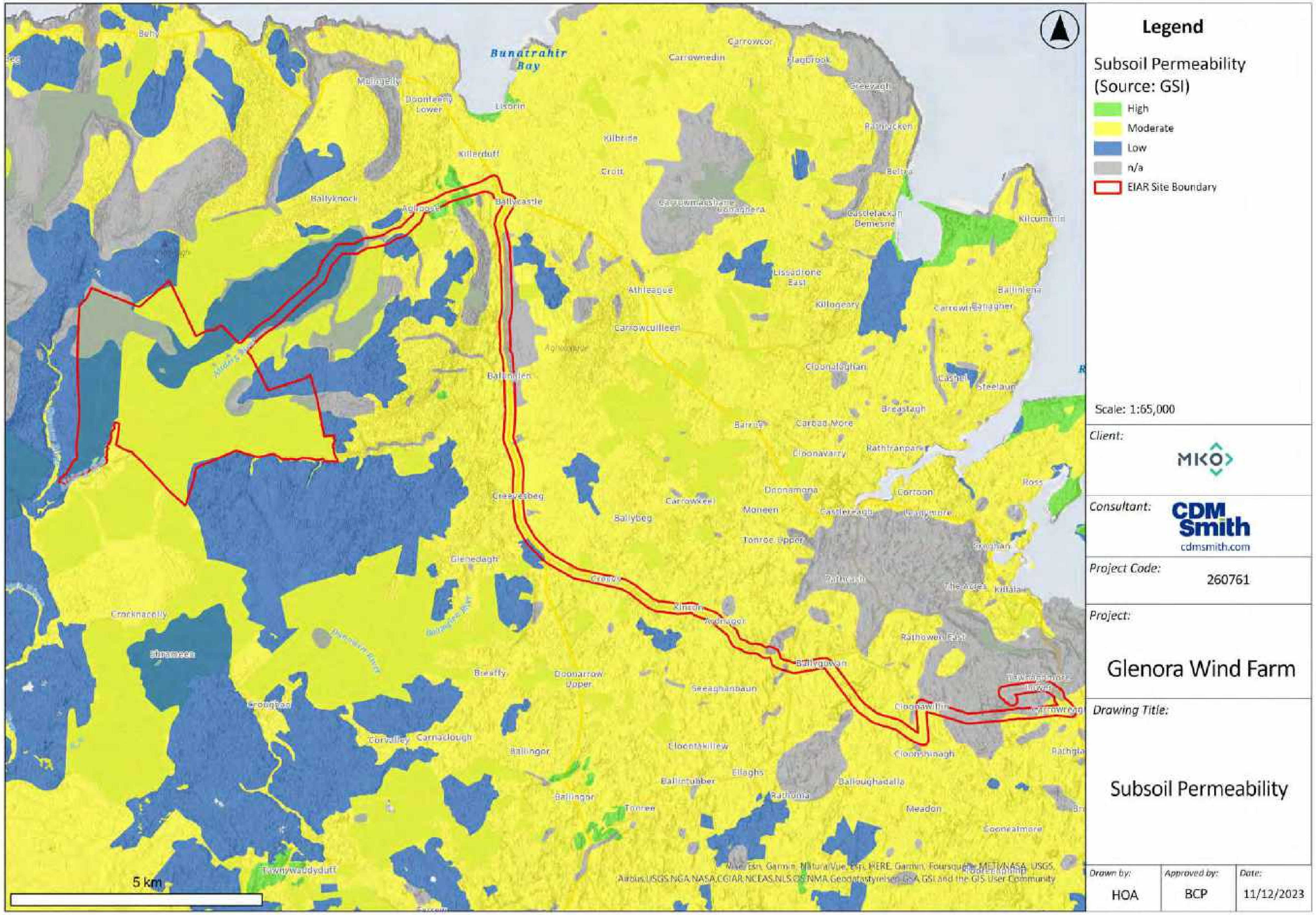

Figure 9-21 Subsoil Permeability (Source: GSI)

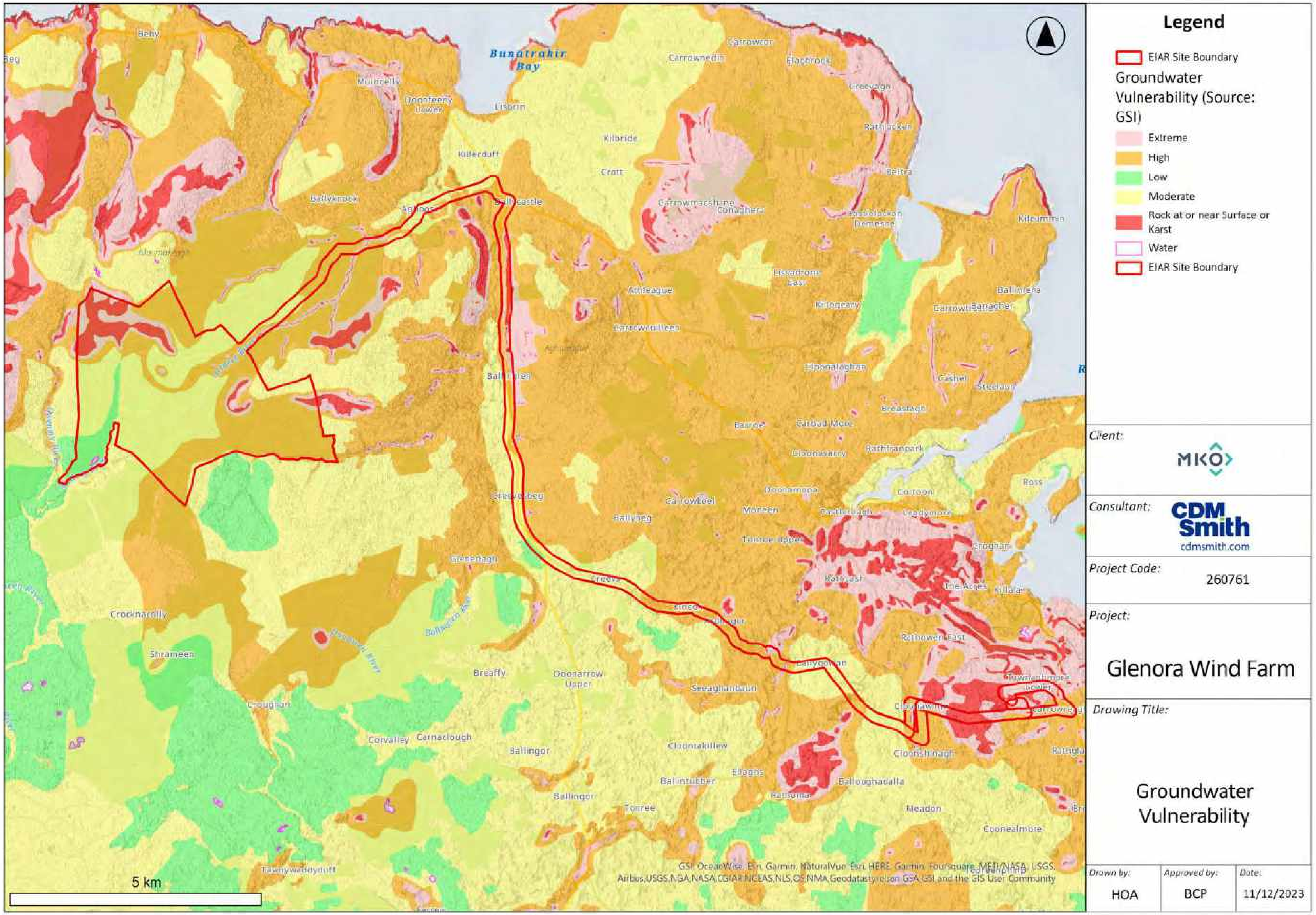

Figure 9-22 Groundwater Vulnerability (Source: GSI)

Along tributaries of the Glencullin River and along a section of the Keerglen River, groundwater vulnerability is mapped as 'Extreme' where peat and till have been cut through by the rivers and bedrock is close to surface or exposed along the streambed.

9.3.8.4 Groundwater Levels and Flow

During the excavation of 13 no. trial pits (to max. depths of 4.5 m) across the Wind Farm Site, groundwater seepages were recorded in most trial pits at depths between 1.0 and 3.2 mbgl (FT, 2022). Some trial pits were also reported as being dry (*i.e.,* seepages were not observed).

A total of 24 no. piezometers were installed across the Wind Farm Site for groundwater level monitoring purposes (FT, 2022). The piezometers were mainly installed to monitor water levels in peat but some of the piezometers also extend into subsoils. The piezometer locations are shown in **Figure 9-23**.

Water level measurements were taken manually in each piezometer at monthly intervals across one year, from May 2020 to May 2021 (FT, 2022). Automatic data loggers were also installed in Piezometers 6, 15 and 23 for continuous recording of water levels in the period September 2020 through May 2021.

Monthly measurements of depth to groundwater in the piezometers are shown in **Figure 9-24,** reproduced from FT, 2022. Automatically recorded water levels (mOD) in Piezometer 6 are shown in **Figure 9-25,** also reproduced from FT, 2022. Piezometer 6 was selected for presentation as the piezometer is far removed from any stream and, therefore, depicts the seasonal change in water level within the bog at this location, and which is free of any influence of streams on water levels in the bog. In both **Figure 9-24** and **Figure 9-25**, water levels are plotted along daily rainfall for rainfall measurement stations in Co. Mayo.

Key observations from the available data can be summarised as follows:

- Water levels in the peat fluctuated by less than 0.5 m over the period of record.
- The observed water level responses across the Wind Farm Site are consistent for the period of record.
- The seasonally high water levels generally occurred in January 2021 (with few exceptions) and the seasonally low water levels occurred in July/August 2020).
- Water levels in certain piezometres may be affected by drainage already, noting that several piezometers (e.g. Piezo 10) record water tables deeper than 50 cm.
- Water levels respond quickly to individual rainfall events.

As documented by FT (2022), groundwater flow directions in the peat/subsoils tend to mimic topography, flowing towards the local streams/rivers. As such, it is inferred that shallow groundwater in the peat and subsoil provides *some* baseflow to local streams/rivers.

Within the bedrock, groundwater flows through fissures and fractures. Like peat and subsoils, groundwater flow directions will be influenced by topography and shallow groundwater in bedrock is expected to discharge towards the Altderg and Keerglen Rivers. Groundwater flow patterns may also be locally influenced by faults, whereby enhanced fracture permeability along faults can act as groundwater drains. In poorly productive bedrock settings, groundwater flow cells tend to be localised, with flow paths that are on a scale of a few hundred metres only. Conceptually, the shallow groundwater in bedrock may also be hydraulically connected with groundwater in subsoils, potentially via a 'transition zone' at the top of rock (Moe *et al.*, 2010).

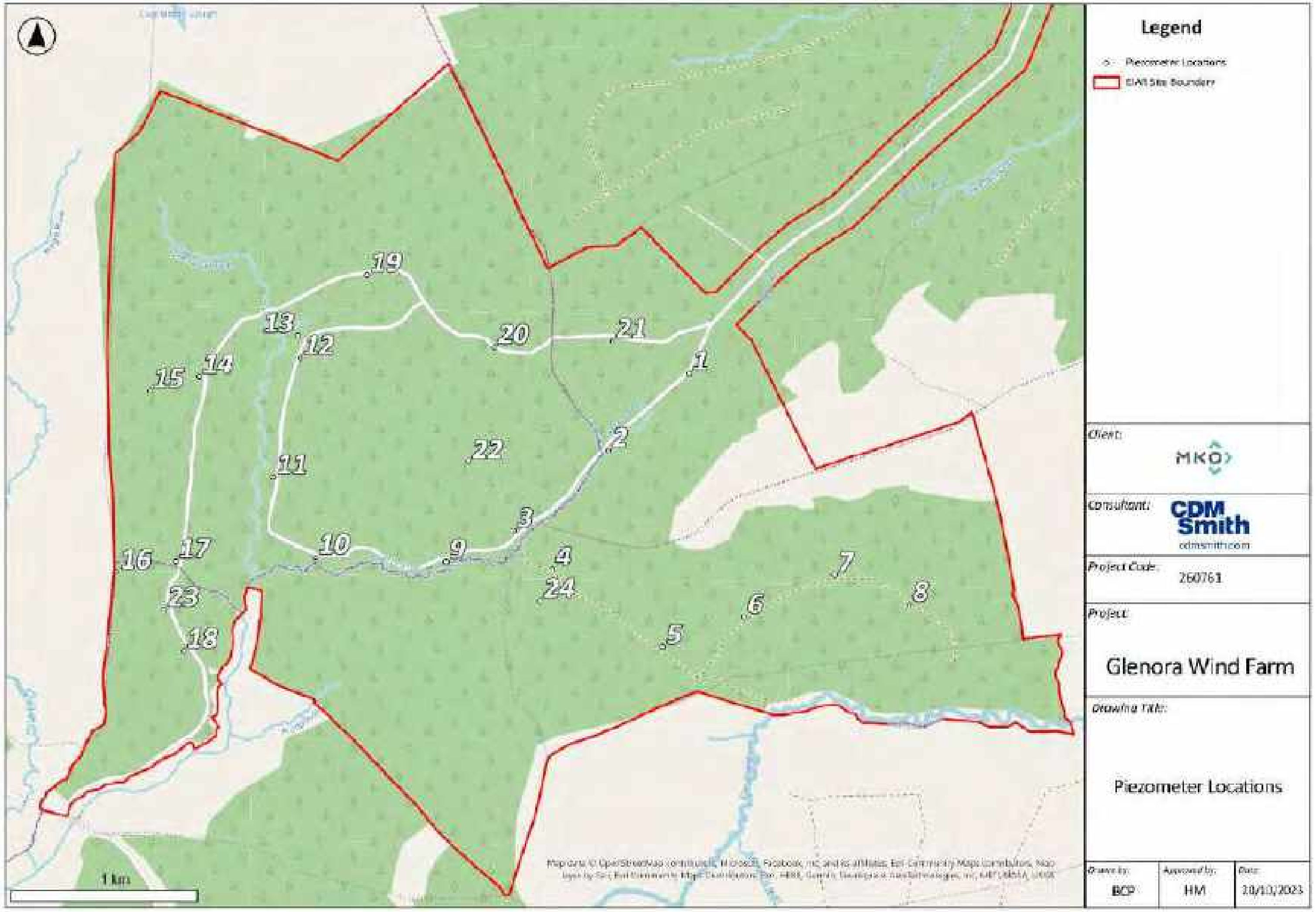

Figure 9-23 Piezometer Locations (Source of Coordinates: FT, 20

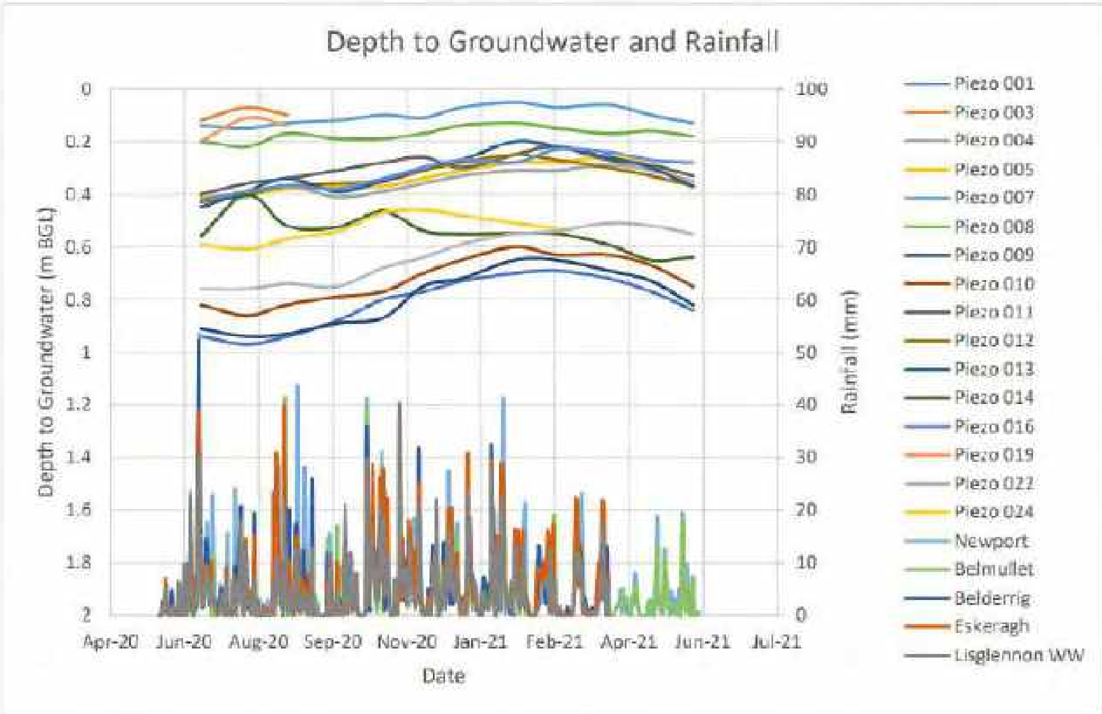

Figure 9-24 Groundwater Levels, All Piezometers, May 2020 - May 2021 (Source: FT, 2022)

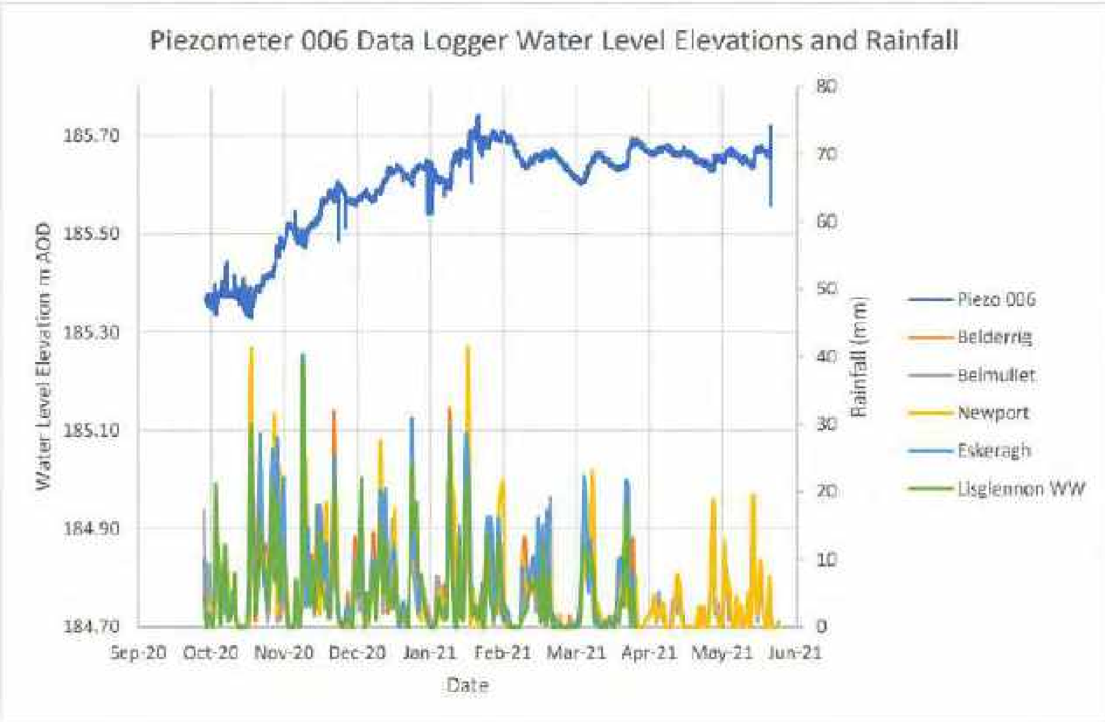

Figure 9-25 Groundwater Level Fluctuations in Piezometer 6, Sept. 2020 – May 2021 (Source: FT, 2022)

As indicated in Section 9.3.5, groundwater discharges to streams for a small component of the water balance across the Wind Farm Site. Surface runoff and water flow through the peat are expected to be the dominant pathways to surface watercourses. This is consistent with existing descriptions of the Belmullet and Bangor groundwater bodies by the GSI.[7]

9.3.9 Public and Private Water Supply

There are no surface water or groundwater abstractions used for public water supply purposes within or downslope/downgradient of the Wind Farm Site. The nearest source of public water supply is at Belderrig, c. 6 km to the northwest of Glenora Forest, outside subcatchments that are linked with the Proposed Development. It is noted that the nearest town, Ballycastle, receives water supply from the Ballina distribution network which is sourced from Lough Conn.

With regard to private water supplies, the nearest dwellings and/or farms that may abstract groundwater from private wells are located in the townland of Gurrankill to the east of the Wind Farm Site. Although the area is served by public water, it is conservatively assumed, but not confirmed, that dwellings/farms in this area use private wells. The townland of Gurrankill is sidegradient of groundwater flow directions within the Wind Farm Site and private wells are, therefore, not at risk of potential pollution from the Proposed Development activity.

9.3.10 WFD Water Body Status and Risk Assessment

A WFD compliance assessment is presented in **Appendix 9-3**. A summary of the latest WFD status classification (period 2016-2021) and WFD risk assessment for the third cycle of WFD implementation in Ireland (2022-2027) is presented in **Table 9-12**. In short:

- The Keerglen River, specifically the Keerglen_010 river water body, has been assigned a WFD 'High' ecological status objective by the EPA. Protection of 'High' ecological status water bodies is a priority in the latest available river basin management plan for Ireland (DEHLG, 2022).
- The Keerglen River did not meet its WFD 'High' status objective in the period 2016-2021. Based on information available from EPA's website www.catchments.ie, the water body is classified at 'Moderate' ecological status, due to "*Moderate biological conditions*", specifically "*Moderate fish status or potential*". The specific cause of this is not given, and it is noted that EPA's water quality test criteria were met (hence, the classification is not caused by water quality).
- The downstream Ballinglen_010 and Ballinglen_020 river water bodies also do not meet their WFD 'Good' status objectives. EPA cites unsatisfactory fish and invertebrate status, respectively. For Ballinglen_010, EPA (2021) notes "*a decline in both salmon and trout number. The pressure is unknown, but siltation is expected to be an issue.*" The Ballinglen_010 river water body is also flagged by EPA as having a water quality issue with chromium. Both of the Ballinglen river water bodies are 'Areas for Action', and both rivers are presently subjects of investigative assessments by the Local Authorities Waters Programme (EPA, 2021).
- The Moyne_010 river water body is of 'Moderate' status, which is based on modelling, noting that a) EPA has assigned 'low confidence' to this case; and b) there are no monitoring data available for the Moyne River.

[7] Available from: https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/Pages/Groundwater-bodies.aspx

Table 9-12 Summary of WFD Status (2016-2021) and Risk (2022-2027)

WFD River Water Body	WFD Status Objective	WFD Ecological Status Classification 2016-2021	WFD 3rd Cycle Risk Assessment	Comments
Wind Farm Site				
Owenmore(Mayo)_010 (IE_WE_33O040050)	At Least Good	High	Not at Risk	WFD status exceeds its WFD status objective
Owenmore(Mayo)_020 (IE_WE_33O040200)	At Least Good	High	Not at Risk	WFD status exceeds its WFD status objective
Keerglen_010 (IE_WE_33K010200)	High	Moderate	Not at Risk	Failed to meet its WFD High status objective based on 'moderate biological status or potential' (specifically, 'moderate fish status or potential'. Water quality conditions passed EPA's test criteria. Details at https://stg.catchments.ie/data/#/waterbody/IE_WE_33K010200?_k=rc11va
Ballinglen_010 (IE_WE_33B010100	At Least Good	Poor	At Risk	Failed to meet its Good status objective based on 'poor biological status or potential' (specifically, 'poor fish status or potential'. Water quality conditions are 'moderate', based on chromium exceedances. Details at https://stg.catchments.ie/data/#/waterbody/IE_WE_33B010100?_k=65940q
Ballinglen_020 (IE_WE_33B010200)	At Least Good	Poor	Under 'Review'	Failed to meet its WFD Good status objective based on 'moderate biological status or potential' (specifically, 'moderate invertebrate status or potential'. Water quality conditions passed EPA's test criteria. Details at https://stg.catchments.ie/data/#/waterbody/IE_WE_33B010200?_k=hbtcwc
Grid Connection Route				
Glencullin (North Mayo)_010 (IE_WE_33G020200)	At Least Good	Good	Not at Risk	WFD status objective is met.
Ballinglen_010 (IE_WE_33B010100	At Least Good	Poor	At Risk	See above. Risks are related anthropogenic pressures which are yet to be determined by EPA.
Ballinglen_020 (IE_WE_33B010200)	At Least Good	Moderate	Under 'Review'	See above. EPA is currently undertaking investigate assessments in the subcatchment.
Breaghwy_010 (IE_WE_34B060600)	At Least Good	Good	Not at Risk	WFD status objective is met.

WFD River Water Body	WFD Status Objective	WFD Ecological Status Classification 2016-2021	WFD 3rd Cycle Risk Assessment	Comments
Cloonaghmore_040 (IE_WE_34C030200)	At Least Good	Good	Not at Risk	WFD status objective is met.
Cloonaghmore_050 (IE_WE_34C030270	At Least Good	Good	Not at Risk	WFD status objective is met.
Moyne_010	At Least Good	Moderate	Under 'Review'	The water body is subject to investigative assessment work by LAWPRO/EPA.

All other water bodies linked with the Proposed Development met or exceeded their WFD ecological status objective. From the information above, it is apparent that current practices within Glenora Forest are presently not identified or confirmed as a cause of water quality deterioration to the extent that it negatively influences WFD ecological status in the period 2016-2021.

With regard to the WFD risk assessment, only the Ballinglen river water bodies are classified as being at risk of failing to achieve WFD objectives in year 2027. As stated previously, The Ballinglen river water bodies are subjects of ongoing investigative assessments by the Local Authority Waters Programme (LAWPRO), owing to anthropogenic pressures to be determined. An earlier catchment assessment report prepared by EPA (2019) for the second cycle of WFD implementation in Ireland (to year 2021, lists environmental pressures in respective subcatchments as hydromorphology (channelisation), urban wastewater discharges (Ballycastle agglomeration), and agriculture.

With regard to the three groundwater bodies that underlie the Proposed Development, these were all at 'Good' status in the period 2016-2021 and classified as 'Not at Risk' of failing to achieve 'Good' status objectives in year 2027.

9.3.11 Designated Sites and Protected Areas

The potential for the Proposed Development to impact on designated sites and protected areas considered the mapping and listing by NPWS of:

- Special Areas of Conservation (SACs) and Special Protection Areas for Birds (SPAs), which are designated under the EU Habitats Directive and EU Birds Directive, respectively. SACs and SPAs are collectively referred to as 'Natura 2000' or 'European Sites'.
- Natural Heritage Areas (NHAs), which are designated under Section 18 the Wildlife (Amendment) Act 2000.
- Proposed Natural Heritage Areas (pNHAs), which are designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated.
- Candidate SACs and SPAs listed (but not designated) under the terms of the EU Habitats Directive.

The source-pathway-receptor model of environmental risk assessment served to guide the determination about which sites might be affected. Mainly, the designated sites have to be potentially hydrologically or hydrogeologically connected with the Proposed Development via surface water or groundwater pathways. As well, the designated sites and protected areas must have qualifying interest (designation features) which are water-dependent. The latter was checked from 'site synopsis' reports and web-based resources made publicly available by the National Parks and Wildlife Service (NPWS), as presented on their website (www.npws.ie).

With reference to the presentation of designated sites and protected areas in Chapter 6 of this EIAR, those that are potentially connected with the Proposed Development (i.e., within the 'Likely Zone of Influence' of the Proposed Development) are listed in **Table 9-13.**

None of the rivers or designated sites named previously are designated bathing waters, drinking water protected areas, or designated freshwater pearl, salmonid or nutrient sensitive waters. However, EPA notes that the Ballinglen River is an "*important non-designated salmonid area*". As described in Chapter 6 of this EIAR, salmonid species were recorded in the Owenmore, Keerglen and Ballinglen Rivers. Sites on the Owenmore River and Keerglen River provided the best overall salmonid nursery habitat.

Table 9-13 Designated Sites and Protected Areas – Assessment of Likely Zone of Influence

Designated Site/Protected Area	Nearest Distance From Proposed Development	Assessment of Likely Zone of Influence
Special Areas of Conservation (SAC)		
Glenamoy Bog Complex SAC [000500]	0.2 km from Site (upslope)	The SAC boundary is approximately 200 m from the EIAR redline boundary, but 750 m away from the nearest proposed works, in the upslope direction. Hence, there will be no direct effects as the development footprint is outside the designated site and there are no pathways or surface water linkages in a downstream direction. From a hydrogeological perspectives, indirect effects of peat drainage could translate to the SAC. However, the 750 m distance to the SAC boundary the likelihood of effects occurring is low to negligible. Hence, **further assessment is not required.**
Bellacorick Bog Complex SAC [001922]	c. 2.5 km from Site (downslope)	The SAC boundary, which is marked by the Oweninny River, is approximately 2.5 km from the Wind Farm Site boundary in the downslope direction. There will be no direct effects as the development footprint is located entirely outside the SAC. Although there is potential for water pollution of the Oweninny River, there are no pathways or connectivity to the habitats within the SAC, and there will be no effects of the Proposed Development on the SAC. There are other wind farms in existence near the SAC. For these reasons, **further assessment is required** as part of the potential cumulative effects.
Broadhaven Bay SAC [000472]	>30 km flow distance from Site (downslope)	The SAC is more than 30 km downstream of the Wind Farm Site. There will be no direct effects as the footprint of the Proposed Development is outside the designated site. There is only indirect and remote hydrological connectivity Wind Farm Site via the Owenmore River and Tullaghan Bay (an estuary), thus potential effects are considered negligible. Hence, **further assessment is not required.**
Killala Bay/Moy Estuary SAC [000458]	1.1 km from grid connection	There will be no direct effects as the development footprint is located outside the designated site. Downstream surface connectivity with the SAC has been identified via the watercourses that cross the proposed grid connection route. Hence, there is (remote) potential for deterioration of water quality during the construction phase of the grid connection, and **further assessment is required.**
Owenduff/Nephin Complex SAC [000534]	13.3 km from Site (downslope)	The SAC boundary is approximately 13.3 km downslope of the Wind Farm Site boundary. The SAC boundary runs along the bank of the Owenmore River. There will be no direct effects as the development footprint is located entirely outside the SAC. Although there is potential for water pollution of the Owenmore River, there are no pathways or connectivity to the habitats within this SAC, and there will be no effects of the Proposed Development on the SAC. Hence, **further assessment is not required.**
Special Protection Area (SPA)		
Blacksod Bay/ Broadhaven SPA [004037]	>30 km flow distance from Site (downslope)	There will be no direct effects as the footprint of the Proposed Development is outside the designated site. The designated site is indirectly hydrologically linked in the downstream direction, but because of the distance involved (more than 30 km), there is an unlikely potential for effects to occur. Any pollutants will be diluted to such an extent that impact will not be perceptible. For this reason, **further assessment is not required.**
Killala Bay/Moy Estuary SPA [004036]	1.9 km from grid connection	There will be no direct effects as the grid connection footprint is located outside the designated site. Downstream hydrological connectivity with the SAC is identified via the watercourses that cross the proposed grid connection route. There is (remote) potential for deterioration of water quality during the construction phase of the grid connection and for this reason **further assessment is required.**

Designated Site/Protected Area	Nearest Distance From Proposed Development	Assessment of Likely Zone of Influence
Owenduff/Nephin Complex SPA [004098]	13.3km from Site (downslope	There will be no direct effects as the development footprint is located entirely outside the designated site. The SPA boundary is approximately 20 km (flow distance) of the Wind Farm Site boundary in the downslope direction, and the SPA boundary runs along the bank of the Owenmore River. Although there is potential for water pollution of the Owenmore River, there are no pathways or connectivity to the habitats of this SPA and there will be no effects of the Proposed Development on the SPA. Hence, **further assessment is not required.**
National Heritage Area (NHA)		
Inagh Bog NHA [002391	0 km. Adjacent.	Works will be conducted close to the boundary of this NHA, which borders the Wind Farm Site. There will be no direct effects but there can be indirect effects, e.g. dust transmission, hydrological changes from peat/subsoil drainage. The Wind Farm Site adjoins the NHA, in a sidegradient and downgradient direction. As stated in the site synopsis report for the NHA (NPWS, 2004), the site is of "*considerable conservation value*" and "*The main threats are from grazing, burning, drainage, further afforestation and potentially renewable energy development, in particular wind power installations and associated infrastructure*". For this reason, **further assessment is required.**
Ummerantarry Bog NHA [00157]	<0.1 km, opposite Keerglen River	There will be no direct effects as the NHA is south of, and on the opposite side of, Keerglen River, from the Proposed Development Site. Although there is potential for water pollution of the Keerglen River, there are no pathways or connectivity to the habitats of this NHA, and there will be no effects of the Proposed Development on the NHA. For this reason, **further assessment is not required.**
Proposed National Heritage Area (pNHA)		
Glenamoy Bog Complex [000500]	0.2 km from Site (upslope)	See SAC description above. **Further assessment is not required.**
Bellacorick Bog Complex [001922]	c. 2.5 km from Site (downslope)	See SAC description above. **Further assessment is required.**
Killala Bay/Moy Estuary [000458]	1.1 km from grid connection	See SAC description above. **Further assessment is required.**
Owenduff/Nephin Complex [000534]	13.3 km from Site (downslope)m Site (downslope)	See SAC description above. **Further assessment is required.**

9.3.12 Receptor Importance/ Sensitivity

Based on the baseline characterisation, the principal environmental receptors associated with the Wind Farm Site are the surface watercourses (streams) that drain to the Altderg and Keerglen Rivers, plus those two named rivers. The many watercourses that are crossed by the grid connection route are also potential receptors.

None of the referenced watercourses are designated salmonid rivers, nutrient sensitive water bodies, or within a freshwater pearl mussel catchment. They are also not used for drinking water supply and are not upstream of a designated drinking water protected area.

The Keerglen River and its tributaries within the Wind Farm Site are, however, designated WFD 'High Status' objective water bodies, and are Quality Class A water bodies (with Biotic Index Q4, Q5). Based on **Table 9-2**, the importance and sensitivity of this receptor surface water environment is considered to be "Very High" (from **Table 9-2**).

The Altderg River and its tributaries within the Wind Farm Site are not designated WFD 'High' status objective water bodies. However, the Altderg River adjoins two bog NHAs and includes Quality Class A water bodies (with Biotic Index Q4, Q5). The Western Way which passes through the Wind Farm Site, and the Altderg River subcatchment specifically, is also an important amenity site. For these reasons, and based on **Table 9-2**, the importance and sensitivity of the related watercourses are considered to be "Very High".

For the grid connection route, related watercourses incorporate important amenity sites, including the Western Way, and Quality Class A water bodies (with Biotic Index Q4, Q5). As such, the related watercourses are also assigned a "Very High" significance and importance as a receptor surface water environment.

Groundwater provides minor baseflow to streams and is a minor water balance component overall. However, groundwater is part of the environmental supporting conditions of the peat within the Wind Farm Site. For this reason, the importance of the groundwater receiving environment is considered to be "Medium" (from **Table 9-3**).

9.3.13 Drainage Planning

Modification of surface runoff patterns will occur within the Wind Farm Site as a result of the construction of new infrastructure. Mainly, drainage management will influence how runoff moves through the Wind Farm Site to local streams. If roads and associated drainage is poorly designed, constructed or maintained, then runoff could travel through a subcatchment much faster than if it were to travel as diffuse overland flow. This could result in an increase in peak flows and influence response times during storm events.

To accommodate the Wind Farm Site, the integration of existing drains into the drainage planning reduces the magnitude of changes to the existing drainage regime. To serve as a basis for the assessment of likely significant effects, the drainage system that will need to be constructed within the Wind Farm Site was planned as presented below, described in **Appendix 4-1,** and shown in **Appendix A of Appendix 4-4**. In short:

- Existing and new interceptor drains will capture greenfield runoff from areas that are upslope of new and existing infrastructure. This greenfield runoff will be discharged in a controlled manner from multiple locations at greenfield runoff rates to flow diffusely across ground before entering streams. Buffered outfalls will promote percolation of discharge waters across vegetation. The interceptor drains will be integrated with existing drains that currently exist

as part of forestry operations. In-line check dams in interceptor dams will be used to break the energy of drain water during high flow, storm events.
- Swales will be established downslope of proposed infrastructure components and access roads to capture 'dirty water' during construction activity. The swale water will be directed to settlement ponds before being discharged diffusively across ground before entering streams to the maximum extent possible. The swales will remain in place during all subsequent phases of the Proposed Development and will capture runoff from access roads and hardstanding.

The proposed drainage system layout is presented in **Appendix A of Appendix 4-4**. Calculations of runoff rates and pond area requirements are presented in **Appendix 9-2**. Layout and locations of drains, swales, and ponds are dictated by the combined consideration of:

- Topography, making sure the drainage network always transmits water in the downslope direction, even across shallow gradient areas.
- Physical space, between existing or planned features.
- Avoidance of situations where discharges from one drain or pond is entrained by another in the downslope direction. It is noted that there will be certain situations where this occurs, specifically where access roads are constructed parallel to one another, at different elevations within the Wind Farm Site.

Topography in some areas is also subtle, and it is anticipated that some engineering judgement of final placement/alignment of culverts, swales and settlement ponds will be necessary during construction based on detailed surveying. The proposed drainage layout will require the:

- Construction of 2 no. new watercourse crossings.
- Potential upgrade of 4 no. existing culverted watercourse crossings.
- Provision of an estimated 66 no. culverts, which includes upgrades to existing piped culverts and which are not related to natural watercourse crossings.
- Construction of interceptor drains upstream and swales with settlement ponds downslope of proposed infrastructure elements.

Along the grid connection route, drainage management will not be needed as cables will be housed in trenches along existing roadways, span existing bridges and only in a few cases cross streams with drilled, horizontal boreholes.

To estimate greenfield runoff rates, the Wind Farm Site was divided into subcatchments that drain to roads and infrastructure components. Subcatchments were drawn from development layouts and detailed Lidar survey data (0.5-m contour intervals). Roads were divided into logical segments guided by their orientations relative to topographic contours and natural streams. The delineated subcatchments are presented in **Figure 9-26**. Calculations are presented in **Appendix 9-2**.

The proposed drainage management approach is detailed in **Appendix 4-4**. Infrastructure, including swales, drains and settlement ponds, will be constructed at least 50 m away from streams, where possible, in order to minimize the potential for effects (e.g., sedimentation and morphological changes) to streams. The layout of the planned infrastructure (swales, drains, settling ponds, etc.), watercourses and 50 m buffer are shown on the planning-level drawings in **Appendix A of Appendix 4-4**. One of the borrow pits will by design need to extend into the 50 m buffer of a local watercourse. A swale will be built between the borrow pit and an access road which parallels the water course in question as a protective measure. The captured swale water will subsequently be directed to a settlement pond.

In no circumstance will direct discharges to watercourses take place. There are, however, locations constrained by physical space where some discharges will have to be within a few metres of watercourses. In such instances, additional attenuation ponds and double or triple silt fencing will be applied as additional measures, the details of which will be judged practically in the field. Where existing drains are utilised, there will be no direct discharge to streams. During construction, new drains will be integrated with existing drains as much as possible to reduce the scale of earthworks and maintain current runoff patterns in Glenora Forest.

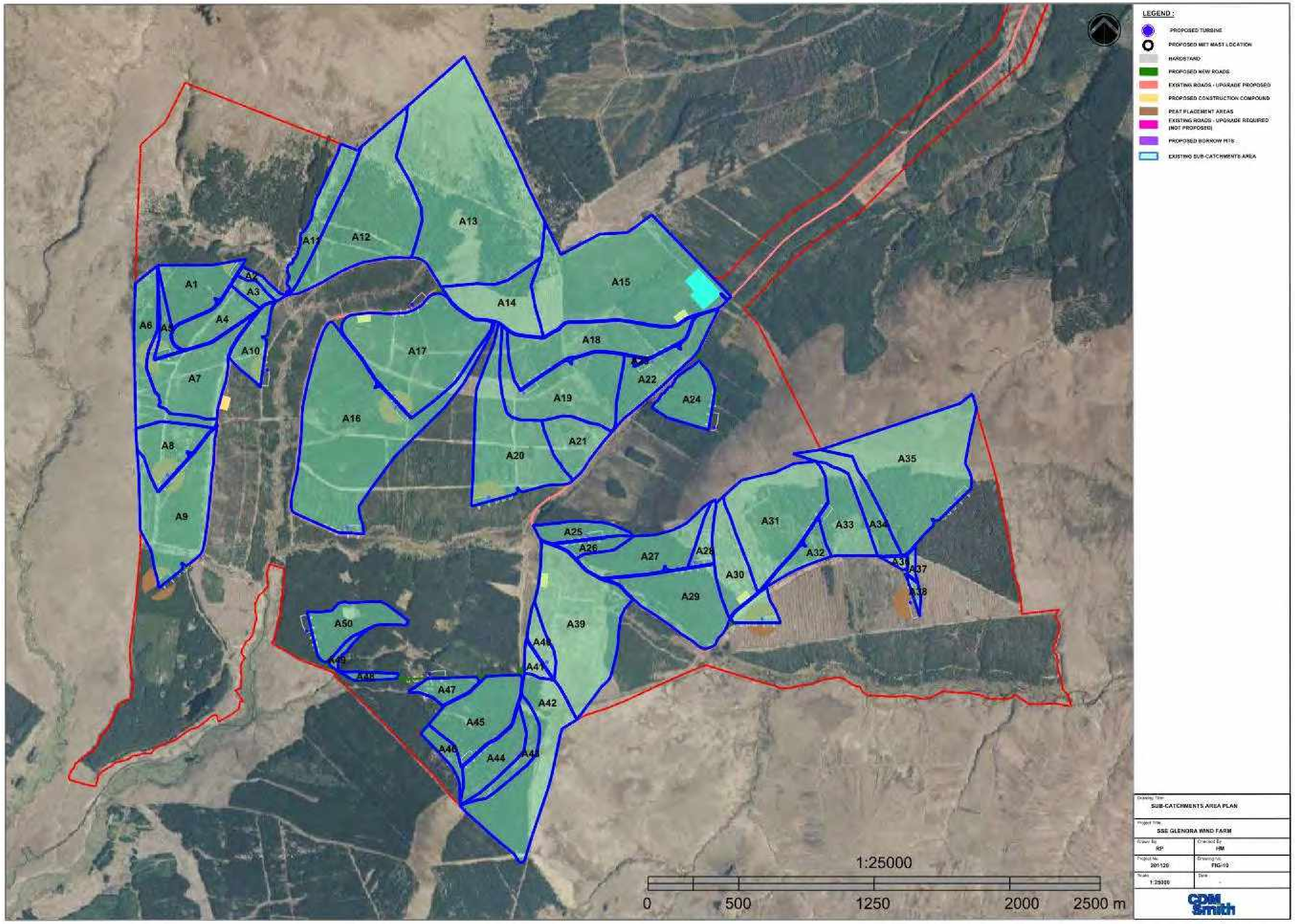

Figure 9-26 Subcatchments Used To Calculate Greenfield Runoff

Check dams will be incorporated along interceptor drains and swales to attenuate the flow and energy associated with storm events, thereby reducing scour and erosion and promoting the settling of sediments. Depending on slope, check dams will be incorporated every 50 m or less.

The proposed Construction and Environmental Management Plan (CEMP) in **Appendix 4-3** incorporates all measures related to drainage management. Runoff management is furthermore detailed in the Surface Water Management Plan in **Appendix 4-4**.

9.3.14 Proposed Monitoring

During the construction phase, a field monitoring campaign will be undertaken in related streams. Stream monitoring involves a) visual checks of drains, swales, settlement ponds and streams, and b) measurements of field parameters temperature, pH, specific electrical conductivity (SEC), alkalinity and turbidity. The field measurements will be taken at locations upstream and downstream of the construction activity. Frequency of measurement will be judged in the field by the resident/supervising engineer, but will be done at least on a weekly basis (potentially more frequently during storm events).

The field measurement campaign will begin two weeks prior to the proposed commencement of works, and will cease up to four weeks after the proposed works are completed, unless observations dictate that measurements should continue. Regular inspections of all installed drainage components will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended.

If visible impact occurs, works will be suspended at the discretion of the resident/supervising engineer, in which case the problem will be identified and corrective action taken before recommencing works.

Surface water samples will also be collected to monitor for effects and any shifts in baseline conditions. The following sampling locations are proposed:

- On the Altderg River (by the existing single-span bridge) just downstream from Glenora Forest.
- On the Keerglen River at a location immediately downstream from the forest, at the first accessible sampling point near an existing farm to the east of the forest.

The samples will be collected on a monthly schedule during construction and decommissioning, and on a quarterly schedule during the first three years of the operational phase. Periodic review will determine the need for, or recommended amendments to, the monitoring programme in line with principles of adaptive monitoring (guided by the data review and findings).

The monthly samples will be analysed for general physico-chemical parameters, nutrients, dissolved organic carbon, true colour, and suspended solids. The quarterly samples will cover the same, but dissolved metals will be added to the list every six months. Adaptive monitoring will be practiced, whereby analytes and frequency of monitoring may change based on periodic review of results. All sampling events will be accompanied by field measurements of water temperature, pH, SEC, alkalinity and turbidity.

The broader purpose of the proposed monitoring is to track baseline conditions and how these might evolve under prevailing conditions. The baseline monitoring will begin three months prior to commencement of the construction phase. The data will be periodically reviewed to assess whether changes (trends) to water quality are occurring.

9.4 Likely Significant Effects and Associated Mitigation Measures

9.4.1 'Do-Nothing Scenario'

If the Proposed Development were not to proceed, the commercial forestry operations will continue, involving coniferous plantation and tree-felling operations.

In this scenario, the existing surface water drainage will continue to function in the manner currently observed and experienced. Because there will be no changes to forestry operations or drainage, there will be no further or additional effects from current operations.

If there are new coniferous plantations, or re-ploughing to facilitate afforestation is planned, then reviews of the existing drainage systems will be required before activity commences in order to protect watercourses from chemical and sediment loads, and from potential physical damage to watercourses. The same applies before tree-felling operations commence, to assure that adequate protective measures are in place for the planned activity.

9.4.2 Construction Phase – Likely Significant Effects and Mitigation Measures

The likely significant effects of the Proposed Development and mitigation measures that were considered during the approximate 2-year construction phase (see Chapter 4 of this EIAR) relate to:

- Clearfelling of coniferous plantations
- Earthworks
- Culvert installations
- Cable works installations
- Hydraulic effects of drainage
- Water quality effects of drainage
- Pumping from open pits
- Accidental spills or leaks
- Release of cement-based products
- Wastewater management
- Turbine delivery route
- Public and private water supplies
- WFD water body status
- Designated sites

Mitigation measures consider specific actions which are designed to avoid, prevent or lessen potential effects – *i.e.,* mitigation by avoidance and mitigation by design.

9.4.2.1 Clear-Felling of Coniferous Plantation

As described in Chapter 4 of this EIAR, a total of 116 ha of forest will be felled to accommodate the Proposed Development. The felling activity will occur intermittently through the first year of the 2-year total construction period. Tree felling is subject to a Felling Licence application to the Forest Service, in accordance with the Forestry Act 2014 and the Forestry Regulations 2017 (SI No. 191/2017) and as per the Forest Service's policy on granting felling licenses for wind farm developments.

Clear-felling involves the use of machinery. The activity results in physical disturbance of residual peat and subsoil. The disturbance is from vehicle tracking and skidding, forwarding extraction methods, and damage to existing tracks and timber/brush in stacking areas.

The related activity can release sediments, organic matter (including dissolved organic carbon) and nutrients into drains.

Pathways: Runoff, drains.

Receptors: Local streams and the Altderg, Oweninny and Keerglen Rivers downstream.

Pre-Mitigation Potential Effects: Without mitigation, potential effects will be indirect, negative, moderate, temporary, reversible, and of high probability.

Proposed Mitigation Measures: Best practice methods will be incorporated into the forestry management. These are set out below and will be in accordance with:

- DAFM (2019): Standards for Felling and Reforestation.
- Coillte (2009): Forest Operations and Water Protection Guidelines.
- Coillte (2009): Methodology for Clear Felling Harvesting Operations; Forest Service (Draft).
- Forest Service of the Department of Agriculture, Food & the Marine (2008): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures.
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Mitigation by Avoidance: There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document “Forestry and Water Quality Guidelines” are shown in **Table 9-14**.

Table 9-14 Recommended Buffer Zone Widths Adjacent to Aquatic Zones

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	0-15%	10 m	15 m
Steep	15-30%	15 m	20 m
Very steep	>30%	20 m	25 m

Mitigation by Design: Mitigation measures will be implemented wherever clear-felling is planned. The objective will be to mitigate the risk of mobilising suspended solids and nutrients into drains and surface watercourses, as follows:

- Small felling areas (<25ha), sequencing of felling to avoid intense felling in one subcatchment
- Limiting felling areas and sequencing the felling to avoid intense felling in one subcatchment.
- Machine combinations (*i.e.* handheld or mechanical) will be chosen which are most suitable for ground conditions and which will minimise soils disturbance.
- Sediment/Silt traps will be strategically placed downslope within forestry drains near streams before ground preparation. The purpose is to slow water flow, increase residence time, and allow settling of silt. No direct discharge of such ditches to watercourses will occur.
- Crossing of streams away from bridges and culverts will not be permitted. Checking and maintenance of roads and culverts will be on-going throughout felling activity. No tracking of vehicles through watercourses will occur. Existing interceptor drains will also not be disturbed.
- Clay, soil and silts will be removed from roads during wet periods and dust will be suppressed during dry spells.
- Main drains that accommodate the discharge from collector drains will include rock armour, as required, where there are steep gradients.
- On steep slopes and where felling inside the 50 metre buffer is required, double or triple sediment traps will be installed. All drainage channels will taper out before entering the buffer zone. This ensures that discharged water fans out over the buffer zone before entering the aquatic zone, with sediment filtered out by ground vegetation within the zone.
- Drains and silt traps will be maintained throughout all felling works, ensuring that they are clear of sediment build-up and are not severely eroded. Machine access will be maintained

to enable the accumulated sediment to be excavated. Sediment will be carefully disposed of in dedicated disposal areas.
- Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimized and controlled.
- Brash management/removal.
- Brash mats will be used to support vehicles on soft ground, reducing soil erosion and avoiding the formation of rutted areas. Brash mat renewal will take place when they become heavily used and worn. Provision will be made for brash mats along all off-road routes, to protect the soil from compaction and rutting. Where there is risk of severe erosion, extraction will be suspended during periods of high rainfall.
- Timber will be stacked in dry areas and outside a 50 metre buffer. Straw bales and check dams will be emplaced on the downgradient side of timber storage/processing sites.
- Works will not be conducted during significant rainfall events (see Section 9.4.2.2) in order to minimise entrainment of exposed sediment in surface water run-off.
- Branches, logs or debris will not be allowed to build up in aquatic zones. All such material will be removed when tree-felling operations have been completed.

Drain Inspection and Maintenance: The following items will be conducted during pre-felling inspections and after:

- Communication with tree felling operatives in advance to determine whether any areas have been reported where there is unusual water logging or bogging of machines (*i.e.,* hot spot areas).
- Inspections of plant and machinery will be conducted prior to any works to assure all are in good condition.
- Inspection of drainage ditches and outfalls. During pre-felling inspections, the main drainage ditches will be identified. The pre-felling inspection will be conducted during rainfall events.
- Following tree felling, all main drains will be inspected to ensure that they are functioning.
- Extraction tracks nears drains will be broken up and diversion channels created to ensure that water in the tracks spreads out over the adjoining ground; Culverts on drains exiting the site will be unblocked.
- All accumulated silt will be removed from drains and culverts, and silt traps, and this removed material will be deposited away from watercourses to ensure that it will not be carried back into the trap or stream during subsequent rainfall.

Surface Water Quality Monitoring: Surface water monitoring will be conducted as presented in Section 9.3.14. Field measurements will be conducted upstream and downstream of the felling activity. Visual observation will be relied on to shut down activity if necessary, in order to fix or upgrade any components of mitigation which may be failing or underperform. Surface water monitoring forms will be kept onsite for record and inspection.

Residual Effects: The proven forestry best practice measures proposed above will break the pathway between sources and receptors. Residual effects will be indirect, negative, slight, temporary, and of low probability.

Significance of Effects: With implementation of the proposed mitigation measures, likely significant effects on surface water receptors will not occur.

9.4.2.2 Earthworks

The construction phase involves earthworks in the form of excavation, movement, staging, and reinstatement of excavated materials. The scale of earthworks and the means and methods of conducting earthworks were presented in Chapter 4 of this EIAR. Within the Wind Farm Site, which encompasses 1,290 hectares (12.9 km^2), the proposed permanent development footprint is approximately 49 ha or 3.25 % of the total area.

The main risks associated with earthworks are direct releases/discharges of sediment load to surface watercourses. Releases of sediments to surface watercourses increases suspended sediment and organic matter loads. In a blanket bog environment, such releases can affect water quality, water clarity, morphology, and aquatic habitats in the downstream direction. Clogging of streambed substrate is a morphological effect.

Compared to tree-felling, the scale of earthworks during the construction phase are considerably greater. This means that the potential magnitude of likely effects are also greater.

Pathways: Drainage, runoff, surface water discharge routes.

Receptors: Local streams and the Altderg, Keerglen Rivers and linked rivers further downstream.

Pre-Mitigation Potential Effects: Without mitigation, potential effects will be indirect, negative, significant, short-term, reversible, and of high probability.

Mitigation by Avoidance: Works areas will be kept at least 50 m from watercourses to the extent possible. The proposed setback distance/buffer will serve to avoid:

- Direct physical damage to watercourses and associated releases of sediment.
- Direct entry of suspended sediments from earthworks into watercourses.
- Direct entry of suspended sediments from the drainage system into watercourses, which is achieved in part by ending drain discharges outside the buffer and allowing percolation across the vegetation within the buffer.

Risks and effects of earthworks are made greater during storm events. Hence, earthworks will not be conducted during significant storm events. The works programme for the entire construction stage of the Proposed Development will take account of weather forecasts, notably predicted rainfall. Large excavations and movements of soil/subsoil or vegetation stripping will be scaled back or suspended if heavy rain is forecast. Decisions to suspend works will be made from review of weather forecasts and visual observations, as judged and decided upon by the project hydrologist and/or environmental clerk of works.

The checking and communication of weather forecasts are part of the CEMP. Prior to suspending works for climatic reasons, the following control measures will be completed:

- Open excavations will be secured.
- Temporary or emergency drainage will be provided to prevent back-up of surface runoff in work areas.
- Working for up to 12 hours after heavy rainfall events will be avoided to ensure drainage systems are not overloaded. Decisions are subject to visual inspection and judgement by the resident (supervising) engineer. The intent and objective is to control erosion, avoid collapses of embankments, and limit the mobilisation and transport of sediments.

Mitigation by Design: Key mitigation by design measures that will be implemented comprise source controls, in-line controls and treatment systems, as follows:

- <u>Source control measures</u> cover working areas, staging areas and stockpiles. Methods that will be employed are diversion drains, flume pipes, sand bags, oyster bags filled with gravel, and filter fabrics. Flexibility to adapt methods will be required based on location-specific conditions, as judged by supervising engineers from visual inspection.
- <u>In-Line controls</u> involve settling of suspended sediments and particulate organic matter with the use of silt fences, straw bales, sand or oyster bags, weirs, baffles, and check dams. Flow limiters and sump pumping systems may be employed where needs arise in order to maintain the hydraulic functioning of the existing drain system.
- <u>Treatment systems</u> involve sediment traps and temporary sumps/attenuation ponds.

Moreover, soil accumulations will be removed from access roads during wet periods and dust will be suppressed during dry spells.

If discharge water fails to be of a high quality during regular inspection, then a filtration treatment system such as a “Siltbuster” or equivalent will be used to filter discharge water before release to watercourses. This applies for the entire construction phase.

For discharges near watercourses, within the 50 m buffer, and including discharges of greenfield runoff, double silt fences will be employed. These will be inspected and maintained, and remain in place throughout the entire construction phase.

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, the majority of the sediment is retained by the geotextile fabric allowing filtered water to pass through. Silt bags will be used with natural vegetation filters or sedimats. Sediment entrapment mats, consisting of coir or jute matting, will be placed at the silt bag location to provide further treatment of the outfall from the silt bag. Sedimats will be secured to the ground surface using stakes/pegs. Sedimats will extend the full width of the outfall to ensure all water passes through this additional treatment measure. Level spreaders will be designed for each outfall.

Management of Runoff from Peat and Spoil Placement Areas: Excavated peat and spoil will be used for landscaping, spread within the proposed peat placement areas around certain turbines and used to reinstate the 3 no. borrow pits. A Peat and Spoil Management Plan which describes details of the excavations is presented in **Appendix 4-2**.

During the initial placement of peat and spoil, silt fences, straw bales and biodegradable matting will be used to control runoff from reinstatement areas. ‘Siltbuster’ treatment trains will be employed if previous treatment is not to a high quality, as stated above.

Drainage from peat placement areas will ultimately be routed to swales and settlement ponds with storage and settlement designed for a 6-hour duration, 1 in 10 year storm event. Peat and spoil placement areas will be vegetated to reduce sediment entrainment in runoff, which will further help to reduce risks of sediment mobilisation.

Field Inspection: An inspection and maintenance plan for the construction drainage system will be prepared in advance of commencement of works. Regular inspections of installed drainage systems will be undertaken, especially after heavy rainfall, to check for damage and blockages, and ensure there is no escape or build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.

Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed. Checks will be conducted on a daily basis.

Surface Water Quality Monitoring: Monitoring will be performed as described in Section 9.3.14.

Residual Effects: Proven and effective measures to mitigate the risk of releases of sediment have been proposed which will break the pathway between potential sources and receptors. Hence, residual effects will be indirect, negative, not significant, short-term, and of low probability.

Moreover, residual effects will be monitored for and corrective action can be taken. Slight changes in current baseline conditions are expected during the construction phase but these are not sufficient to change the character or sensitivity of the receiving waters, and not sufficient to affect the WFD status classification of the watercourses within Glenora Forest that drain to the Altderg, Oweninny and Keerglen Rivers (**Appendix 9-3**).

Significance of Effects: For the reason outlined above, likely significant effects on surface water quality will not occur.

9.4.2.3 Culverts

Culverts are necessary where access roads cross watercourses and where runoff waters captured by interceptor drains and swales need to be led across roads. Based on the planned layout (**Appendix A of Appendix 4-4**), the planned works will require:

- Construction of 2 no. new watercourse crossings.
- Potential upgrade of 4 no. existing culverted watercourse crossings.
- Provision of an estimated 66 no. culverts, which includes upgrades to existing piped culverts and which are not related to natural watercourse crossings.

The works require use and movement of machinery and equipment which can result in physical disturbance of streambanks and streambeds, hence sediment mobilisation and both water quality and morphological effects.

Pathway: Runoff and streams.

Receptor: Local streams and the Altderg, Oweninny and Keerglen Rivers downstream.

Pre-Mitigation Potential Effects: Without mitigation, potential effects will be direct, negative, moderate, short-term, reversible, and of high probability.

Mitigation Measures by Avoidance: Machinery and personnel are kept out of the river directly. Direct in-stream works will be avoided.

Mitigation Measures by Design: All works will be conducted in accordance with the CEMP which incorporates the best practice IFI "Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters" (IFI, 2016). Related activity incorporates many of the same measures that are presented in Section 9.4.2.2 (earthworks). Moreover:

- All stream crossings will be bottomless-box or clear span culverts. Existing banks will remain undisturbed.
- Based on IFI (2016), the relevant work period is July to September inclusive, *i.e.,* the relatively drier summer period. Any deviation that may be temporarily necessary will be done in discussion with the IFI.
- During near-stream construction works, double-row silt fences will be emplaced immediately downgradient of work areas for the duration of activity.
- All new stream crossings will require a Section 50 application (Arterial Drainage Act, 1945). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

Underground cabling routes within the Wind Farm Site (e.g. from turbines) will follow access roads and cables will pass within the structure of the road and associated culverts.

Residual Effects: With the proposed mitigation measures, residual effects will be direct, negative, not significant, short-term, and of low probability.

Significance of Effects: For the reasons outlined above, likely significant effects on surface watercourses will not occur.

9.4.2.4 Grid Connection Installation

As described in Chapter 4 of this EIAR, the grid connection route follows existing roadways from the Wind Farm Site to the Tawnaghmore 110kV Electricity Substation near Killala in the east. Cables will be installed below ground in trenches except for 10 no. bridge crossings where horizontal directional drilling (HDD) will accommodate the crossing. HDD involves the use of a drill rig and ancillary plant. This requires secure and safe footing for operations, hence also preparatory earthworks, including use of basecourse or mats for protection purposes. The risks of effects are the same as those described in Sections 9.4.2.2, 9.4.2.3, and 9.4.2.8.

In-stream works will be avoided in all cases. With regard to HDD, mitigation measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling will be implemented in full, as follows:

- The area around the Clear Bore™ batching, pumping and recycling plants will be bunded using terram and sandbags in order to contain any spillages.
- One or more lines of silt fences will be placed between the works area and adjacent rivers and streams on both banks.
- Accidental spillage of fluids will be cleaned up immediately and transported off site for disposal at a licensed facility.
- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

Pathways: Runoff.

Receptors: All local streams and rivers along the grid connection route.

Pre-Mitigation Potential Effects: Without mitigation, potential effects will be direct, negative, slight, temporary, reversible and of medium probability.

Mitigation by Design: Applicable mitigation measures for dug trenches (involving earthworks) are those described in Section 9.4.2.2 and 9.4.2.3. Where trenches are dug with excavators, spoil will be kept adjacent to the trenches and filled in immediately upon of installation of cables. Cable works will proceed in sections or segments to avoid trenches remaining open over protracted periods of time. Where cables will cross streams in horizontally drilled boreholes, mitigation measures for earthworks and culverting also apply, per Sections 9.4.2.2 and 9.4.2.3.

Residual Effects: With mitigation measures, the residual effects are direct, negative, not significant, temporary, and unlikely.

Significance of Effects: For the reasons outlined above, likely significant effects on surface water quality will not occur.

9.4.2.5 Hydraulic Effects of Drainage

The shallow interceptor drains that are planned upslope of infrastructure components will capture greenfield runoff. While drainage within Glenora Forest will be managed, the water balance of the natural drainage system is maintained.

The main risks associated with the construction of interceptor drains are a) sediment mobilisation to watercourses, and b) the potential for draining peat. The latter involves hydraulic effects (see below) and can contribute to water quality effects (addressed in Section 9.4.2.6).

Draining of peat lowers water levels in the peat. This can result in subsidence/slumping of the peat surface and loss or changes to vegetation types/communities in the hydraulically affected area(s). As presented in Section 9.3.8.4, the peat is already drained in parts of the Wind Farm Site with depths to water in several piezometers exceeding 0.5 m.

Hydraulic effects of drainage propagate away from drains, in the upslope directions especially. There is no simple rule of thumb that can be applied to estimate how far the effect may extend, as bog hydrology is location-specific and both dynamic and transient, responding to event-based, seasonal, and longer-term climatic conditions. Researchers like Rezanezhad *et. al.* (2016), Holden (2009), and Ramchunder *et al.* (2009) highlight the combined influences of drain depths, peat depths, relative slopes, the potential interference with other nearby drains, as well as peat stratigraphy, permeability, and structure.

In the UK and Irish scientific literature, there are empirically-based examples of drainage effects, as follows:

- Based on monitoring data from Derrycolumb, Co. Longford, Gill (2020) reported that "*water levels on the high bog adjacent to a 1.5m high facebank (with drain along production side) are not significantly influenced by the facebank and associated drainage beyond c. 40m distance*". Gill (2020) concluded that a "*zone of influence distance of 60 m would be a conservative buffer*". For deep perimeter bog drains at the same site, Gill (2020) reported that a "*conservative buffer*" of 100 m would apply.
- Price *et al.* (2003) examined evidence for the "*efficacy of drainage*" and referred to studies where water tables in peat were lowered to distances "*up to 50m from the ditch in fibrous peat*".
- Based on monitoring at Clara Bog in Co. Offaly, Regan *et al.* (2019) estimated that the hydraulic influence of bog margin drainage extended up to 900 m into the bog, as indicated by subsidence of land surface. It was cautioned that the sensitivity of a bog system to environmental change (such as drainage) will vary depending on the connectivity of the bog to the regional hydrological regime. A similar observation was made by Siegel and Glaser, (2006). In the case of Clara Bog, the bog is underlain by thick and highly permeable glacial deposits.

In contrast to Clara Bog, the upland blanket bogs within the Wind Farm Site are:

- Underlain by glacial till (mainly silt/clay) and poorly productive bedrock, which limits rainfall-recharge and groundwater flow.
- Characterised by high and frequent rainfall.

From this, it is considered that the peat in Glenora Forest is rainfall-dependent more so than groundwater-dependent, even though hydrogeology is part of the mechanism that helps to maintain saturation of peat.

To advance the discussion pragmatically for the purposes of this EIAR, a distance of 100 m was used to guide the further discussion of potential effects, which would primarily occur during the operational phase (Section 9.4.3.2). As bog hydrology is both dynamic and transient, it will take time for potential effects at distance to become established - likely much longer than the 2-year construction phase. For this reason, the discussion of hydraulic effects has greater relevance during the operational phase of the Proposed Development.

In contrast to potential effects of linear interception drains, the smaller excavations that will serve the construction of other infrastructure components (e.g. foundations of turbines) will involve temporary sump pumping, which is addressed in Section 9.4.2.7.

Pathways: Peat, drains.

Receptors: Peat.

Pre-Mitigation Potential Effects: For drainage effects of 100 m, some drying out of saturated peat may occur, but effects will be countered by naturally high and frequent rainfall across Glenora Forest, and thus areas involved are small. Potential effects are considered to be direct, negative, not significant, long-term (extending beyond the construction phase, see Section 9.4.3.2) and likely.

Mitigation Measures by Design: Development footprints have been reduced to a minimum and interceptor drains will be shallow (<1.5 m) which serves to reduce the relative risk of drainage effects. The drainage system will be integrated with the existing drainage network in the forest to the maximum extent possible. All construction works will be supervised.

Residual Effects: Given the time span of construction (2 years), residual effects from the construction phase will occur in the operational phase (see Section 9.4.3.2).

Significance of Effects: For the reasons outlined above, likely significant hydrological or hydrogeological effects, beyond those already experienced in Glenora Forest, are not expected to occur. See Section 9.4.3.2 for further detail.

9.4.2.6 Water Quality Effects of Drainage

Drainage water can carry suspended matter, dissolved organic matter, and nutrients. If peat is excessively drained, drainage water can also affect the pH of surface water. Hence, local streams in Glenora forest can experience shifts in baseline conditions even if this is unlikely to affect the much larger rivers downstream.

Specific, potential water quality issues would relate to water clarity, colour, pH and nutrient concentrations. Sedimentation of suspended matter can also affect streambed substrate, which is also a stream morphological issue. All water quality items can affect aquatic habitats and biota.

Water quality deterioration has the potential to affect the WFD status classification of related surface water bodies, not in the construction phase but in the operational phase. This is described in Section 9.4.2.13 and in **Appendix 9-3**.

Pathway: Drains.

Receptor: Local streams and the Altderg, Oweninny, and Keerglen Rivers downstream.

Pre-Mitigation Potential Effects: Without mitigation, potential effects will be indirect, negative, slight, temporary, and of medium probability.

Mitigation by Design: Potential effects from construction works will be mitigated by drainage controls (e.g. Sections 9.4.2.1 through 9.4.2.3) which are established as part of drainage management. Further descriptions are presented in drainage-related **Appendices 4-1** and **4-4**, as well as Section 9.3.13.

Monitoring: Streams will be monitored as described in Section 9.3.14.

Residual Effects: With the planned drainage system, residual effects will be indirect, negative, not significant, temporary, and of low probability.

Significance of Effects: For the reasons outlined above, changes to current baseline conditions may be measurable but likely significant effects will not occur.

9.4.2.7 Pumping from Open Pits

It is expected that open excavations for foundation works (e.g. for turbines) and the Borrow Pits will have to be temporarily pumped to keep the excavations free of seepage water. As described in the Peat and Spoil Management Plan (**Appendix 4-2**), excavation depths will range from 1.2 mbgl at the electrical substation to 4 mbgl at turbine locations, and to approximately 22, 35, 9 mbgl maximum for Borrow Pits 1, 2 and 3, respectively. The maximum depth of peat to be excavated is up to 3 mbgl at turbine locations.

Water will enter directly from rainfall and via subsurface seepage when the groundwater table is intersected. In bedrock, groundwater may ingress from fractures and a 'transition zone' that may be present at the contact between subsoils and bedrock. The quantities to be pumped will be small given the generally low-permeability characteristics of both the till and bedrock groundwater flow system.

The pumping from excavations will only be needed for short periods of time. For most components, the time frame is measured in days to weeks. However, the Borrow Pits will be excavated in stages over an extended period of more than one year, requiring intermittent pumping.

The pumped water, which is expected to contain suspended solids, will be pumped to the nearest swale and led to the associated settlement pond which has been established in the first stage of construction, prior to diffuse discharge across open ground.

The excavation-related water will be discharged periodically, on an as-needed basis. It is not a continuous process, and the volumes pumped will vary from location to location.

Given the geology of the Wind Farm Site and poorly permeable nature of the bedrock aquifer, the volumes that will be pumped and managed are expected to be less than 10 m^3/hr (0.0026 m^3/s, or 2.6 l/s).

Discharges from sump pumping can affect the water quality of watercourses, especially with regard to suspended sediments.

Pre-Mitigation Potential Effects: Without mitigation, potential effects will be indirect, negative, not significant, temporary, reversible, and medium probability. Hydrogeologically, from a quantitative perspective, pumping effects are direct, neutral, imperceptible, temporary and unlikely.

Mitigation by Avoidance: An upslope interceptor drain will be established upslope of the excavation area to prevent greenfield runoff into the excavations. Berms will also be used, as necessary.

Mitigation by Design: The water pumped by sump pumps will pass through silt bags before being discharged into the swale. As the water pass through the silt bags, the majority of sediment and organic matter is retained by geotextile fabric. The silt bags will be used with natural vegetation filters or sedimats. The sedimats will be secured to the ground surface using stakes/pegs. They will extend to the full width of the outfall to ensure that all water passes through this treatment measure. Level spreaders will be installed for each outfall.

The footprints of excavations for infrastructure foundation works and hardstanding have been planned to be as small as practicable. Excavations will be backfilled after completion of installations, which will serve to restore water levels and drainage patterns, hence reduce the temporary drainage effects.

Residual Effects: As outlined in the CEMP, the methods above are standard practice methods which serve to reduce suspended matter loads from pumped discharges. In this manner, the sediment load is managed and residual effects will be indirect, negative, not significant, temporary, and of low probability. Hydrogeologically, from a quantitative perspective, residual pumping effects are direct, neutral, imperceptible, temporary and unlikely.

Significance of Effects: For the reasons outlined above, likely significant effects will not occur.

9.4.2.8 Accidental Spills, Leaks or Other Releases

Accidental spillage of fuels or chemicals represent a pollution risk to both groundwater and surface water, as well as aquatic habitats and biota.

Pathways: Runoff, drains, streams, groundwater.

Receptors: Groundwater, local streams and Altderg, Oweninny and Keerglen Rivers downstream.

Pre-Mitigation Potential Effects: Without mitigation, potential effects are direct and indirect, negative, imperceptible to profound, brief to long-term, reversible and of low probability.

Small spills and leaks may cause effects that are imperceptible. Large or continuous spills and leaks can potentially damage the habitats and living organisms in the receiving water.

Hence, effects can be brief to long-term, depending on the nature and scale of the spills or leaks. Potential effects can be mitigated.

Mitigation Measures by Design: The prevention of, and responses to, accidental spills and leaks of fuel and other chemicals are covered by the CEMP and SWMP. The following mitigation measures will be implemented:

- Trained personnel will conduct onsite refuelling only.
- Onsite refuelling of machinery will be done by mobile double-skinned fuel bowsers.
- Drip trays and fuel absorbent mats will be available and used during all refuelling operations
- A permit for the fuel system will be put in place.
- Fuels stored onsite will be minimised. Fuel storage areas will be bunded to contain 110%v of the fuel storage volume for the time period of the construction. Rainwater will not be allowed to accumulate within the bund, and will thus be fitted with a storm drainage system and appropriate oil interceptor.
- The plant used during construction will be regularly inspected for leaks and fitness for purpose.
- Spill kits will be available to deal with and accidental spillage in and outside the re-fuelling area.

Residual Effects: With mitigation, residual effects will be indirect, negative, imperceptible, short-term, and unlikely.

Proven, routine, and effective measures to mitigate the risk of releases of fuels and chemicals are proposed which will break the link between potential sources and receptors.

Significance of Effects: For the reasons outlined above, likely significant effects on surface water or groundwater quality will not occur.

9.4.2.9 Release of Cement-based Products

Entry of cement-based products into drains or surface water within the Wind Farm Site represents a risk to the aquatic environment at and downstream of the release.

Concrete and other cement-based products are alkaline and can be corrosive. They generate fine, highly alkaline silt (pH 11.5) that can physically damage fish. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of $\pm$ 0.5 of a pH unit.

Batching of wet concrete onsite is not proposed. Washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution.

Releases of cement-based products are obvious when they happen and can be stopped. They also involve small volumes (individually). Risks are increased with repeated poor practice.

Pathways: Drains, streams.

Receptors: Peat and local streams.

Pre-Mitigation Effects: Pre-mitigation effects on peat are covered in Chapter 8 of this EIAR. Pre-mitigation effects on surface waters can be direct and indirect (depending on how and where releases occur), and are negative, slight, temporary to short term, and of low probability.

Mitigation Measures by Avoidance:

- Concrete will be delivered in sealed concrete delivery trucks. Batching of wet-cement products will not occur on site.
- Ready-mixed supply of wet concrete products and emplacement of pre-cast elements will take place.
- Pre-cast elements for culverts and concrete works will be used.
- Concrete trucks will not be washed out on site but will be directed back to their batching plant for washout.

Mitigation Measures by Design:

- Where concrete is delivered on site, only the chute will be cleaned, using the smallest volume of water practicable. No discharge of cement-contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water will be undertaken at lined washout ponds.
- Where temporary lined impermeable containment areas are used, such containment areas are built using straw bales and lined with an impermeable membrane. These are covered when not in use to prevent rainwater collecting.
- Pour sites of cement will be kept free of standing water, and plastic covers will be ready in case of sudden rainfall events.

Concrete deliveries are often conducted outside of normal working hours in order to limit traffic effects on roads. Concrete pouring for turbine foundations is normally completed in a single day per turbine. The placed concrete begins curing straight away after placement and vibrations, it is solid in 24-48 hours, and it reaches its full strength after 28 days. As such, leakage from the formwork to the surrounding ground is not possible.

Risks of pollution will be further reduced as follows:

- Concrete will not be transported around the site in open trailers or dumpers so as to avoid spillage while in transport.
- All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete locally to the location where it is needed.
- Arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, confirming routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site.
- Weather forecasting will be used to assist in planning large concrete pours and large pours will be avoided where prolonged periods of heavy rain is forecast.
- Concrete pumps and machine buckets from slewing over watercourses will be restricted while placing concrete.

- Excavations will be sufficiently dewatered before concreting begins and dewatering will continue while concrete sets.
- Covers will be available for freshly placed concrete to avoid the surface washing away in heavy rain.
- Any potential, small surplus of concrete will be disposed of after completion of a pour in suitable locations away from any watercourse or sensitive habitats.

Residual Effects: Residual effects on peat are covered in Chapter 8 of this EIAR. With mitigation, residual effects on surface water quality will be indirect, negative, imperceptible, short-term, and unlikely.

Proven, routine, and effective measures to mitigate the risk of releases of cement-based products are in place which will break the link between potential sources and receptors.

Significance of Effects: For the reasons outlined above, likely significant effects on surface water or groundwater quality will not occur.

9.4.2.10 Wastewater Management

During the construction phase of the Proposed Development, staff welfare facilities will be provided at each of 5 no. construction compounds. Port-a-loos will be used. These will be collected regularly and brought offsite in fully enclosed tanks for disposal by authorised means (permitted wastewater collector) to a wastewater treatment plant.

Pathways: Runoff, drains.

Receptors: Local streams and Altderg, Oweninny and Keerglen Rivers downstream, and groundwater.

Pre-mitigation Potential Effects: Potential effects are direct and indirect, negative, not significant, short-term, reversible, and of low probability.

Mitigation Measures by Avoidance: Wastewater will not be treated or disposed of onsite.

Residual Effects: Use of sealed storage tanks and offsite disposal breaks the link between the source and potential receptors. With the planned management measures, residual effects will be indirect, neutral, imperceptible, short-term, and unlikely.

Significance of Effects: For the reasons outlined above, likely significant effects on surface water or groundwater quality from wastewater will not occur.

9.4.2.11 Turbine Delivery Route Accommodation Works

As described in Chapter 4 of this EIAR, accommodation works will be required: a) for an area of approximately 1,500 m^2 at the proposed link road off the R314 (access road between Ballycastle and Glenora Forest); and b) the intersection of the N17 and N5, comprising construction of widened junctions to facilitate the delivery of turbine components and other abnormal loads.

The activity involves earthworks, which was described in Section 9.4.2.2, and carries risk of accidental spills and leaks, which was described in Section 9.4.2.8.

Pathways: Runoff

Receptors: Local streams and the Altderg, Oweninny and Keerglen Rivers.

Pre-mitigation Potential Effects: Without mitigation, potential effects are direct, negative, moderate, temporary and of medium probability.

Mitigation Measures by Design: Mitigation measures in relation to earthworks are presented in Section 9.4.2.2. Mitigation measures in relation to accidental spills, leaks or other releases are described in Section 9.4.2.8.

Residual Effects: With planned mitigation, residual effects are indirect, negative, not significant, temporary and of low probability.

Significance of Effects: For the reasons outlined above, likely significant effects on nearby watercourses will not occur.

9.4.2.12 Public or Private Water Supply

The Wind Farm Site is not hydrologically linked to any sources of public water supply. Hence, the risk of affecting public water supplies are absent. The only risk is posed by private wells, at single dwellings and farms downgradient of the Wind Farm Site. The nearest dwellings/farms are approximately 2 km east of the nearest proposed turbine location. Groundwater flow in the poorly productive bedrock aquifer is localized, with short flow paths (hundreds of metres) to local streams. The nearest dwellings/farms are hydraulically sidegradient of the Proposed Development.

Pathway: Groundwater.

Receptor: Groundwater and private wells downgradient of the Site.

Pre-Mitigation Potential Effects: Indirect, negative, imperceptible, permanent, unlikely (high probability).

Proposed Mitigation Measures: By following the best practice measures outlined for other potential effects (e.g. accidental spills and leaks, wastewater management) risks to private wells are eliminated.

Residual Effects: With mitigation, residual effects are indirect, neutral, imperceptible, permanent, and unlikely (high probability).

Significance of Effects: For the reasons outlined above, likely significant effects on public or private water supplies will not occur.

9.4.2.13 WFD Water Body Status

WFD water body status was presented in Section 9.3.10 and a further WFD compliance assessment is presented in **Appendix 9-3.** The Proposed Development has the potential to affect surface water quality.

The duration of the construction phase is approximately 2 years, whereas WFD status is classified by EPA every 6 years. This means that risks of affecting (causing a deterioration of) WFD status in respective river water bodies become more relevant for the longer-term operational phase (Section 9.4.3.7).

Pathways: Runoff, drains, other discharges (e.g. spills and leaks).

Receptors: Streams/rivers, and groundwater.

Pre-Mitigation Potential Effects: During construction, and without mitigation, potential effects on the WFD status of named river water bodies within and downstream of the Wind Farm Site are both direct and indirect, negative, moderate, short-term, but unlikely. Effects are deemed unlikely due to the short duration of construction in relation to the WFD 6-year status classification and reporting cycle.

Along the grid connection route, potential effects are indirect, negative, imperceptible, short-term, and unlikely.

For groundwater, potential pre-mitigation effects are also indirect, negative, not significant, short-term, and unlikely.

Mitigation by Design: Mitigation measures are necessary and proposed to break potential source-receptor linkages and allow for sediment settling and attenuation. The means and methods of achieving the necessary levels of protection are understood and proposed, largely based on existing guidance (Section 9.1.4) and practical experiences from other comparable sites.

Relevant mitigation measures are all of those described in preceding sections for the construction phase. The Contractor will be legally required to adhere to the CEMP which encompasses the proposed mitigation measured. All works will be supervised and monitoring will be undertaken as described in Section 9.3.14 in order to be able to identify potential effects and take corrective action, as necessary.

Residual Effects: With mitigation, residual effects are indirect, negative, not significant, short-term, and unlikely (with high probability). The same applies for the underlying groundwater bodies.

Significance of Effects: For the reasons outlined above, likely significant effects on WFD status of the named river subbasins and groundwater bodies will not occur in the construction period.

9.4.2.14 Designated Sites/Protected Areas

As presented in Section 9.3.11, the following designated sites/protected areas that are considered to be within the "Likely Zone of Influence" of the Wind Farm Site are:

- Bellacorick Bog Complex SAC
- Bellacorick Bog Complex pNHA
- Killala Bay/Moy Estuary SAC
- Killala Bay/Moy Estuary SPA
- Killala Bay/Moy Estuary pNHA
- Inagh Bog NHA

Potential effects of the Wind Farm Site on each designated site and protected area that is hydrologically or hydrogeologically linked to the Proposed Development during construction are presented in **Table 9-15**.

The mitigation measures presented in Section 9.4.2 and SMWP will serve to protect and mitigate against the identified, potential effects. For the reasons described in **Table 9-15**, likely significant effects on the designated sites/protected areas will not occur during the construction phase.

Table 9-15 Assessment of Likely Significant Effects on Designates Sites and Protected Areas During Construction

Designated Site/Protected Area	Direct/Indirect Connection to Proposed Development	Description	Assessment of Likely Significant Effects
Bellacorick Bog Complex SAC	Indirect – Proposed Development is located upstream of, and entirely outside, the SAC.	There is potential for water pollution of the Oweninny River downslope from the Wind Farm Site. The Oweninny River marks the SAC boundary which coincides with the convergence of the Altderg and Inagh Rivers to form the Oweninny River. Although the SAC is downslope from the Wind Farm Site, there are no pathways that link the Proposed Development with habitats within the SAC. The habitats within the SAC boundaries are dependent on the hydrological and hydrogeological conditions within the SAC. Water within the SAC drains towards the Oweninny River. Hence, there will be no effects of the Proposed Development on the qualifying interests of SAC, neither during construction or any other subsequent phase. Mitigation measures described in Sections 9.4.2.1 through 9.4.2.10 will serve to protect the SAC further from any potential quality or quantity effects. The Altderg River which flows south from Wind Farm Site is a headwater subcatchment of the Oweninny River (and the Owenmore River further downstream). Other proposed and existing wind farms are situated within other subcatchments of the Oweninny River. Potential cumulative effects are presented in Section 9.4.5.	Without Mitigation: indirect, negative, not significant, short-term, and low probability. With Mitigation: indirect, negative, imperceptible, short-term, and unlikely.
Killala Bay/Moy Estuary SAC	Indirect – grid connection route and grid connection point at Tawnaghmore are upstream of the SAC.	The grid connection route crosses the Cloonaghmore River. The grid connection point at Tawnaghmore is part of the Moyne River subcatchment. Both rivers are hydrologically linked with and discharge into the estuary SAC. Hence, there is potential for water pollution of the estuary. Any pollution that discharges into the estuary will be significantly attenuated by dilution/mixing. The grid connection route crosses streams at approximately 30 locations. Crossings will occur through/across culverts and bridges but will also include horizontal directional drilling technology at 10 no. locations. There will be no earthworks at or immediately adjacent to stream crossings.	Without Mitigation: indirect, negative, not significant, short-term, and low probability. With Mitigation: indirect, negative, imperceptible, short-term, and unlikely.

Designated Site/Protected Area	Direct/Indirect Connection to Proposed Development	Description	Assessment of Likely Significant Effects
		Managed earthworks for the grid connection at Tawnaghmore will take place approximately 1.5 km from the nearest stream. There will be no direct discharges of stormwater or swale water to any local watercourses. Mitigation measures described in Sections 9.4.2.1 through 9.4.2.10 will serve to protect the SAC further from any potential effects.	
Special Protected Area (SPA)			
Killala Bay/Moy Estuary SPA	Indirect – grid connection route and grid connection point at Tawnaghmore are upstream of the SAC.	See SAC description above.	Without Mitigation: indirect, negative, not significant, short-term, and low probability. With Mitigation: indirect, negative, imperceptible, short-term, and unlikely.
National Heritage Area (NHA)			
Inagh Bog NHA	Indirect – Wind Farm Site is located sidegradient and downgradient of the NHA	The NHA is an area of upland blanket bog which borders the Wind Farm Site to the west. Construction works will take place more than 100 m from the NHA boundary. According to the site synopsis report by NPWS (2004), "*The blanket bog within the site can be divided into two basic types: wet, deep blanket bog on flat to gently sloping ground and shallower, drier blanket bog on the steeper slopes and mountain ridges. Below an altitude of approximately 200 m, most of the bog occurs as relatively deep and sometimes quaking peat on flat to gently sloping ground*". As an upland blanket bog, the NHA is water-dependent. Although the NHA borders the Wind Farm Site, the NHA is upgradient and sidegradient of the Proposed Development. For this reason, the NHA cannot be directly affected by the Proposed Development. Indirect effects are related to potential dust transmission and potential hydrological effects from the drainage of peat/subsoil within c. 100 m of the NHA boundary.	Without Mitigation: indirect, negative, not significant, short-term, and low probability. With Mitigation: indirect, negative, imperceptible, short-term, and unlikely.

Designated Site/Protected Area	Direct/Indirect Connection to Proposed Development	Description	Assessment of Likely Significant Effects
Proposed National Heritage Area (pNHA)			
Bellacorick Bog Complex	See SAC description above.		
Killala Bay/Moy	See SAC description above.		

9.4.3 Operational Phase - Likely Significant Effects and Mitigation Measures

The likely significant effects of the Proposed Development and mitigation measures that were considered during the 35-year operational phase (see Chapter 4 of this EIAR) relate to:

- Maintenance works.
- Hydraulic effects of drainage.
- Water quality effects of drainage – general.
- Water quality effects of drainage – designated sites.
- Compaction of access roads and hardstanding.
- Water well installation and pumping.
- Wastewater management.
- WFD water body status.
- Designated sites and protected areas.

Mitigation measures consider specific actions which are designed to avoid, prevent or lessen potential effects – *i.e.,* mitigation by avoidance and mitigation by design.

9.4.3.1 Maintenance Works

During the operational phase, impediments to drainage can generally occur as a result of blockages to watercourse crossings, ditches and watercourses resulting from vegetation and erosion debris. Maintenance works of access roads, structures, and drainage system components (e.g. settlement ponds) will be undertaken regularly per the CEMP. Maintenance is a repeated activity which includes cleaning and removal of accumulated sediments and debris.

For the drainage system, potential effects are related to sedimentation and damage to watercourses. However, risks are much reduced compared to the construction activity as the scale of works are significantly less.

Accidental spills and leaks can also occur. Oil used in transformers at the substation and within each turbine, and storage of oils in tanks at the substation, could leak during the operational phase and impact on streams and groundwater. Risk can be managed by following the mitigation measures presented in Section 9.4.2.8. The substation transformer and oil storage tanks will be in a concrete bund capable of holding 110% of the stored oil volume. Turbine transformers are located within the turbines, so any leaks would be contained within the turbine structure.

Pathway: Runoff and drains, surface water, and groundwater (for accidental spills and leaks).

Receptor: Local streams and Altderg, Oweninny and Keerglen Rivers downstream, and groundwater (for accidental spills and leaks).

Pre-Mitigation Potential Effects: Potential effects will be those that would occur without the SWMP, in which case the potential effects will be indirect, negative, slight, long-term, and of medium probability.

Mitigation by Design: Maintenance works will be subject to control measures contained in Section 3.2.3 of the SWMP (**Appendix 4-4**).

Monitoring: Monitoring will be performed as described in Section 9.3.14.

Residual Effects: With mitigation measures, residual effects will be indirect, negative, not significant, long-term, and of low probability.

Significance of Effects: For the reasons outlined above, likely significant effects from maintenance works will not occur.

9.4.3.2 Hydraulic Effects of Drainage

The planned interceptor drains will collect greenfield runoff. Where planned new drains, beyond those already in existence as part of forestry operations, intersect peat and subsoils, the new drains will contribute to some lowering of water levels in vicinity of the drains, notably in upslope directions, and as a function of the many variables that were identified in Section 9.4.2.5. Such water level lowering is a longer-term issue as the drains will be functional in all phases of the Proposed Development. The extent of water level lowering will be constrained by the depth of the drains.

The only sensitive habitat that could be affected by water level lowering is the Inagh Bog NHA. This is mostly sidegradient and only marginally upslope from the Wind Farm Site in Glenora Forest. As such, it was considered further below, on the assumption that the hydraulic influence of drainage within the Wind Farm Site will extend to the NHA.

Given the layout of the Proposed Development (Chapter 4), it is principally the planned interceptor drains at wind turbines T2, T3 and T4 at the western end of Glenora Forest that could influence the Inagh Bog NHA. Distance from wind turbines T2, T3, and T4 to the NHA boundary marginally exceed the 100 m threshold that was proposed in Section 9.4.2.5. The north to south oriented road which runs parallel to the NHA boundary is more than 200 m from the boundary, and thus poses a lower risk to the hydrology of the NHA.

To be conservative, a worst case scenario was considered which assumes that the hydraulic influence of planned, new drains at T2, T3, and T4 will extend 100 m into the NHA. The total area affected by lowering of water levels in the peat would thus be:

> 100 m × 100 m (width of turbine interceptor drains, perpendicular to drainage direction) × 3 turbines = 30,000 m^2, or 3 ha.

This equates to 0.5 % of the approximate total NHA area of 600 ha (6 km^2).

Pathways: Peat and shallow groundwater (subsoils).

Receptors: Peat/blanket bog.

Pre-Mitigation Potential Effects: Indirect, negative, not significant, long-term, and unlikely.

Mitigation Measures by Design: Development footprints have been reduced to a minimum and current drainage conditions are maintained to the maximum extent possible. Maintaining shallow drains as proposed also reduces the scope for and likelihood of drainage effects.

Residual Effects: Indirect, negative, not significant, long-term, and unlikely.

Significance of Effects: For the reasons outlined above, likely significant hydrological or hydrogeological effects on the Inagh Bog NHA will not occur.

9.4.3.3 Water Quality Effects - General

Water quality risks during the operational phase are much reduced compared to the construction phase. Maintenance activity is the main item that can affect water quality. Runoff waters may contain suspended and dissolved organic matter, and both drains and settlement ponds will require periodic cleaning.

Specific water quality issues relate to sedimentation, water clarity, pH and nutrient concentrations. Sedimentation is a stream morphology issue. All items can affect aquatic habitat and biota.

Drains and ponds will be visually assessed on an annual basis to determine the need for maintenance.

Pathway: Runoff, drains.

Receptor: Local streams and the Altderg, Oweninny and Keerglen Rivers downstream.

Pre-Mitigation Potential Effects: Without mitigation (e.g., maintenance), potential effects will be indirect, negative, slight, long-term, and of low probability.

Mitigation Measures by Design: During the operational phase, potential effects will be mitigated by measures contained in Section 3.2.3 of the SWMP (**Appendix 4-4).**

Monitoring: Streams will be monitored as described in Section 9.3.14.

Residual Effects: With mitigation, residual effects are expected to be indirect, negative, not significant, long-term, and of low probability.

Significance of Effects: For the reasons outlined above, and with the extensive mitigation and monitoring measures that are proposed, likely significant effects on the surface water receptor environment are not expected to occur.

9.4.3.4 Compaction of Access Track and Hardstanding

Access roads and hardstanding (e.g., turbine spaces) will reduce the permeability of the ground across respective areas. Over time, these may become compacted further, which in theory can increase runoff from such areas.

The total footprint of access roads and hardstanding for turbines is 288,195m^2. In **Appendix 9-2**, the runoff from these areas was calculated to be 0.404 m^3/s for a 1 in 10 year storm event, using a runoff coefficient of 0.7. Accounting for compaction in the future (which reduces ground permeability), by adjusting the runoff coefficient to 0.8, runoff volumes will increase by 0.057 m^3/s to 0.46 m^3/s. To settle out particles of 10 µm (**Appendix 9-2**), this increases the associated settlement pond area requirements by 247 m^2 in total, which does not pose a practical challenge across the Wind Farm Site.

Pathways: Drainage.

Receptors: Local streams and the Altderg, Oweninny and Keerglen Rivers downstream.

Pre-Mitigation Potential Effects: Without maintenance, potential effects will be indirect, negative, slight, long-term, and of medium probability.

Proposed Mitigation by Design: The operational phase drainage system (**Appendix 4-4**) will be functioning and maintained (Section 9.4.3.1).

Residual Effects: With maintenance, residual effects will be indirect, negative, imperceptible, long-term, and of low probability.

Significance of Effects: For the reasons outlined above, likely significant effects from surface compaction will not occur.

9.4.3.5 Water Well Installation and Abstraction

As described in Chapter 4 of this EIAR, staff welfare facilities will be provided at the control buildings and the operation and maintenance building during the operational phase. There will be a small water requirement for these facilities, albeit not for potable use. It is proposed to install a well adjacent to the electrical substation and to the operation and maintenance building in accordance with the Institute of Geologists Ireland (IGI) "*Guide for Drilling Wells for Private Water Supplies*" (IGI, 2007).

The wells will be flush to the ground and covered with a standard manhole. A pump house is not required as an in-well pump will direct water to a water tank within the roof spaces of the buildings. Bottled water will be supplied for drinking.

The volumes of groundwater that will be pumped are small, <5 m^3/d. The pumping will be intermittent. The hydraulic influence of pumping would be localised and will not result in any significant reduction in groundwater levels, peat water levels, or natural groundwater baseflow to streams.

Pathways: Groundwater.

Receptors: Groundwater, peat, and local streams.

Pre-Mitigation Potential Effects: Direct, negative, imperceptible, long-term, and of low probability.

Mitigation Measures: None is required.

Residual Effects: Direct, neutral, imperceptible, long-term, and unlikely.

Significance of Effects: For the reasons outlined above, likely significant effects will not occur from low-volume well pumping.

9.4.3.6 Wastewater Management

Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. It is not proposed to treat wastewater on site. Wastewater from the staff welfare facilities in the control building and operation and maintenance building will be managed by means of sealed storage tanks, with all wastewaters being transported offsite by permitted waste collector to wastewater treatment plants.

Pathways: Runoff, drains.

Receptors: Local streams and the Altderg, Oweninny and Keerglen Rivers downstream, and groundwater.

Pre-mitigation Potential Effects: Indirect, negative, imperceptible, long-term, reversible, and unlikely.

Mitigation Measures by Avoidance: Wastewater will not be treated or disposed of onsite.

Mitigation Measures by Design: The proposed wastewater storage tanks will be fitted with an automated alarm system that will provide sufficient notice that the tanks require emptying. Full details of the proposed tank alarm system will be submitted to the Planning Authority in advance of any works commencing on-site. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site.

Residual Effects: Use of sealed storage tanks and offsite disposal breaks the link between the source and potential receptors. Hence, residual effects will be indirect, neutral, imperceptible, long-term, and unlikely.

Significance of Effects: For the reasons outlined above, likely significant effects on surface water or groundwater quality from wastewater management will not occur.

9.4.3.7 WFD Water Body Status

During the operational phase, maintenance works can affect water quality but risks of effects are much reduced compared to the construction phase.

During the operational phase, the functional drainage management system and all necessary mitigation measures are in place to limit the entry of potential pollutants to streams, especially sediment and suspended and dissolved organic matter.

In the context of WFD status, all of the water quality parameters which can affect the biological quality elements of streams are addressed by the proposed mitigation measures. Maintenance works will be subject to strict maintenance protocols and procedures to avoid sediment mobilisation and potential siltation of streams. Other parameters like pH and ammonia, which can be influenced by drainage from peat, will undergo attenuation in the downstream direction by a) mixing/dilution with the greenfield runoff, b) further mixing/dilution in the streams, and c) in-stream transformation mechanisms (e.g. nitrification) that will take place in the downstream direction.

It is worth noting that 'High' and/or 'Good' status have been maintained in streams that exit Glenora Forest over three successive river basin management cycles. This means that existing forestry operations and land uses in and around Glenora Forest have not affected WFD status objectives to date. A possible exception is the Keerglen River, which was at 'High status from 2007 through 2015, but deteriorated to 'Moderate' in the period 2016-2021. The water quality of the Keerglen River is currently meeting the status classification thresholds used by EPA for at least Good status, but 'Fish' status is 'Moderate'. The precise cause for this is, as yet not known.

A monitoring programme will be implemented as described in Section 9.3.14.

Pathway: Runoff, drains

Receptor: Local streams and the Altderg, Oweninny and Keerglen Rivers downstream

Pre-Mitigation Potential Effects: Without mitigation potential effects are indirect, negative, slight, long-term, and of low probability.

Mitigation Measures by Design: During the operational phase, potential effects will be mitigated by implementation of measures specified in the CEMP which overs visual checks, de-silting of settling ponds with proposed offsite disposal and maintaining the physical integrity and functioning of the drainage system.

Monitoring: Streams will be monitored as described in Section 9.3.13.

Residual Effects: Mitigation measures are in place to address identified risks, and residual effects will be indirect, negative, not significant, long-term, and unlikely.

Significance of Effects: For the reasons outlined above, and with the extensive mitigation and monitoring measures that are proposed, no likely significant effects on WFD status of surface water and groundwater bodies are expected to occur during the operational phase.

9.4.3.8 Designated Sites/Protected Areas

Operational activities of the Proposed Development can affect the water quality and morphology of hydrologically linked streams and rivers. Risks are mainly associated with maintenance works, including drainage management and accidental spills of fuel.

Potential effects of the Proposed Development on each designated site and protected area that was considered further and assessed in **Table 9-16** for the operational phase. The mitigation measures presented in Section 9.4.3 will serve to protect and mitigate against the identified potential effects. For the reasons described in **Table 9-16**, likely significant effects on the named designated sites/protected areas will not occur during the operational phase.

Table 9-16 Assessment of Likely Significant Effects on Designates Sites and Protected Areas During Operations

Designated Site/Protected Area	Direct/Indirect Connection to Proposed Development	Description	Assessment of Likely Significant Effects
Bellacorick Bog Complex SAC	Indirect – Proposed Development is located upstream of, and entirely outside, the SAC.	There is potential for water pollution of the Oweninny River downslope from the Wind Farm Site during maintenance works of roads, drains and settlement ponds. This is a periodic activity and is always temporary in nature. Importantly, there are no pathways that link the Proposed Development with any habitats within the SAC. The habitats within the SAC boundaries are dependent on the hydrological and hydrogeological conditions within the SAC. Hence, there will be no effects of the Proposed Development on the qualifying interests of SAC. Mitigation measures described in Sections 9.4.3.1 and 9.4.3.3 through 9.4.3.6 will serve to mitigate potential effects. The Altderg River is a headwater subcatchment of the Oweninny River, Other proposed and existing wind farms are situated within other subcatchments of the Oweninny River. Potential cumulative effects are presented in Section 9.4.5.	Without Mitigation: Indirect, negative, not significant, long-term, and unlikely (high probability). With Mitigation: Indirect, negative, imperceptible, long-term, and unlikely (high probability).
Killala Bay/Moy Estuary SAC	Indirect – grid connection route and grid connection point at Tawnaghmore are upstream of the SAC.	There is potential for water pollution and sediment mobilisation during maintenance works, mainly related to trenching and backfilling activity. This is not regular and is always temporary in nature. Mitigation measures described in Sections 9.4.3.1 and 9.4.3.3 through 9.4.3.6 will serve to mitigate potential effects.	Without Mitigation: Indirect, negative, not significant, long-term, and unlikely (high probability). With Mitigation: Indirect, negative, imperceptible, long-term, and unlikely (high probability).
Special Protected Area (SPA)			
Killala Bay/Moy Estuary SPA	Indirect – grid connection route and grid connection point at Tawnaghmore	See above (SAC description).	Without Mitigation: Indirect, negative, not significant, long-term, and unlikely (high probability). With Mitigation: Indirect, negative, imperceptible, long-term, and unlikely (high probability).

Designated Site/Protected Area	Direct/Indirect Connection to Proposed Development	Description	Assessment of Likely Significant Effects
	are upstream of the SAC.		
National Heritage Area (NHA)			
Inagh Bog NHA	Indirect – Proposed Development is located sidegradient and downgradient of the NHA	Dust effects will not occur. Drainage effects are not expected to extend into the NHA as the NHA is situated across a topographic divide and the Wind Farm Site is characterised by high and frequent rainfall conditions. Mitigation measures described in Sections 9.4.3.1 through 9.4.3.6 will be relied on to mitigate potential effects.	Without Mitigation: Indirect, negative, not significant, long-term, and unlikely. With Mitigation: Indirect, negative, imperceptible, long-term, and unlikely.
Proposed National Heritage Area (pNHA)			
Bellacorick Bog Complex	See above (SAC description).		
Killala Bay/Moy	See above (SAC description).		

9.4.4 Decommissioning Phase - Likely Significant Effects and Mitigation Measures

The potential effects associated with decommissioning of the Proposed Development will be similar to those associated with construction but of a reduced magnitude.

Decommissioning works are described in Chapter 4 of this EIAR. During decommissioning, it will be possible to reverse or reduce any of the potential effects caused during construction, and to a lesser extent operations, by rehabilitating constructed areas such as turbine bases and hardstanding. This will be done by re-establishing vegetation, thereby reducing runoff and sediment loads.

Roadways will be kept and maintained following decommissioning of the proposed infrastructure, as these will be used by ongoing forestry works and for recreational purposes.

The electrical cabling connecting the proposed wind turbines to the intended on-site substation will be removed, while ducting will remain in-situ rather than excavating and removing it, as this is considered to have less of a potential environmental effect, in terms of soil disturbance, and thus on the possibility of the generation of suspended sediment.

The proposed turbines will be removed by disassembling them in a reverse order to their erection. This will be completed using the same model cranes as used in their construction. They will then be transported offsite along their original delivery route. The disassembly and removal of the turbines will not have an effect on the hydrological/hydrogeological environment at the Wind Farm Site.

Other effects such as possible soil compaction and contamination by fuel leaks will remain but will be of reduced magnitude than the construction phase because of the smaller scale of the works and reduced volumes on-site. As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is, therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm."*

Some of the effects will be avoided by leaving elements of the Proposed Development in place where appropriate. Turbine bases will be rehabilitated by covering with local topsoil/peat in order to regenerate vegetation which will reduce runoff and sedimentation effects.

Mitigation measures to avoid contamination by accidental fuel leakage and compaction of soil by on-site plant will be implemented as per the construction phase mitigation measures. With these measures, no significant effects on the hydrological and hydrogeological environment will occur during the decommissioning stage of the Proposed Development.

Table 9-17 Assessment of Likely Significant Effects on Designates Sites and Protected Areas During Decommissioning

Designated Site/Protected Area	Direct/Indirect Connection to Proposed Development	Description	Assessment of Likely Significant Effects
Bellacorick Bog Complex SAC	Indirect – Proposed Development is located upstream of, and entirely outside, the SAC.	There is potential for water pollution of the Oweninny River downslope from the Wind Farm Site during decommissioning works which is a short-term activity. Importantly, there are no pathways that link the Proposed Development with any habitats within the SAC. The habitats within the SAC boundaries are dependent on the hydrological and hydrogeological conditions within the SAC. Hence, there will be no effects of the Proposed Development on the qualifying interests of SAC. Mitigation measures described in Sections 9.4.2.1 through 9.4.2.10 will serve to mitigate potential effects. The Altderg River is a headwater subcatchment of the Oweninny River, Other proposed and existing wind farms are situated within other subcatchments of the Oweninny River. Potential cumulative effects are presented in Section 9.4.5.	Without Mitigation: Indirect, negative, not significant, short-term, and unlikely (high probability). With Mitigation: Indirect, negative, imperceptible, short-term, and unlikely (high probability).
Killala Bay/Moy Estuary SAC	Indirect – grid connection route and grid connection point at Tawnaghmore are upstream of the SAC.	There is potential for water pollution and sediment mobilisation during decommissioning works which is a short-term activity. Ducting will be left in ground rather than digging up, which reduces the scale of earthworks. Mitigation measures described in Sections 9.4.2.1 through 9.4.2.10 will serve to mitigate potential effects.	Without Mitigation: Indirect, negative, not significant, short-term, and unlikely (high probability). With Mitigation: Indirect, negative, imperceptible, short-term, and unlikely (high probability).
Special Protected Area (SPA)			
Killala Bay/Moy Estuary SPA	Indirect – grid connection route and grid connection point at Tawnaghmore are upstream of the SAC.	See above (SAC description).	Without Mitigation: Indirect, negative, not significant, short-term, and unlikely (high probability). With Mitigation: indirect, negative, imperceptible, short-term, and unlikely (high probability).

Designated Site/Protected Area	Direct/Indirect Connection to Proposed Development	Description	Assessment of Likely Significant Effects
National Heritage Area (NHA)			
Inagh Bog NHA	Indirect – Proposed Development is located sidegradient and downgradient of the NHA	Dust effects will not occur.	Without Mitigation: Indirect, negative, not significant, short-term, and unlikely. With Mitigation: indirect, negative, imperceptible, short-term, and unlikely.
Proposed National Heritage Area (pNHA)			
Bellacorick Bog Complex	See above (SAC description).		
Killala Bay/Moy	See above (SAC description).		

9.4.5 Cumulative Effects

The Proposed Development was considered in combination with other plans and projects in the area that could result in cumulative impacts on the identified receptor water bodies and designated sites/ protected areas. The plans and projects considered were those listed in Chapter 2 of this EIAR, which include existing forestry operations within the Wind Farm Site and wind farm developments within 20 km of the Wind Farm Site, as presented in **Figure 13-16** (see Chapter 13). The latter incorporates:

- Bellacorick wind farm (21 no. turbines) – existing wind farm.
- Oweninny Phase 1 (29 no. turbines) – existing wind farm.
- Oweninny Phase 2 (32 no. turbines) – existing wind farm.
- Oweninny Phase 3 (18 no. turbines) – proposed wind farm.
- Killala Community wind farm (6 no. turbines) – existing wind farm.
- Dooleg More wind farm (1 no turbine) – consented wind farm.
- Kilsallagh wind farm (13 no. turbines) – proposed wind farm.
- Sheskin South (21 no. turbines) – proposed wind farm.
- ABO Sheskin (8 no. turbines) – consented wind farm.

There is, additionally, a plan for the establishment of a hydrogen plant just northeast of the Bellacorick substation.

With the exception of the Killala Community wind farm, the listed wind farms are either in separate subcatchments from the Proposed Development or are downslope of the Proposed Development. As such, they will not interact with or influence the hydrological or hydrogeological conditions within the redline boundaries of the Proposed Development. The same is true for the proposed hydrogen plant near Bellacorick, which adjoins the Owenmore River and is approximately 15 km south and downslope of the Wind Farm Site.

The Proposed Development has, in combination with the other wind farm developments in the subcatchments of the Oweninny and Owenmore Rivers, the potential to affect the water quality (and biological conditions) of said rivers. To date, there has been no discernible or identified effects from the existing wind farms, as evidenced by the 'High' ecological status classification referred to in Section 9.3.10. With mitigation measures, the likely significant residual cumulative effects on the same rivers are considered indirect, negative, not significant, long-term, and unlikely.

With regard to the existing Killala Community wind farm, this is situated within the same subcatchment of the Moyne River ('Moyne_010' river water body) that encompasses the Tawnaghmore grid connection point. The trenching associated with the Proposed Development will pass approximately 300 m south of Killala Community wind farm. There are no expected cumulative effects of the Proposed Development in combination with the Killala Community wind farm. For the grid connection, mitigation measures will be implemented as outlined in Sections 9.4.2.2 and 9.4.3.1. Construction of the Tawnaghmore grid connection will be planned and coordinated such as not to interfere with the Killala Community wind farm operations.

With regard to existing forestry operations, these are subject to best management practices and licence conditions. Future forestry operations have the potential to influence water quality and biological conditions of local streams, as a result of sediment mobilisation and transport, and re-sedimentation, and from fertiliser and pesticide applications. Effects can be both direct and indirect. The integration of the drainage management systems and the addition of both check dams and settlement ponds, along with diffuse discharges at greenfield runoff rates, will serve to reduce or mitigate risks of water quality effects.

With the implementation of mitigation measures and best practice methods on the part of both the Proposed Development and forestry operators, risks of effects are reduced and potential cumulative effects can be monitored, managed and mitigated. As such, the likely significant residual cumulative effects are considered both direct and indirect, negative, not significant, long-term, and unlikely.

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APPENDIX 3

PEAT AND SPOIL MANAGEMENT PLAN

FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

PEAT & SPOIL MANAGEMENT PLAN

GLENORA WIND FARM

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PEAT AND SPOIL MANAGEMENT PLAN
GLENORA WIND FARM

REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT
User is responsible for Checking the Revision Status of This Document

Rev. No.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Draft for Comment	AW/IH	IH	TC	07.10.22
1	Draft for Comment	AW/IH	IH	TC	12.05.23
2	Final	AW/IH	IH	TC	07.09.23
3	Final	AW/IH	IH	TC	07.12.23

Client: MKO Ltd

Keywords: **Peat, Spoil, Management, Excavation, Borrow Pits**

Abstract: Fehily Timoney and Company (FT) were engaged by McCarthy Keville O'Sullivan (MKO) to compile a Peat and Spoil Management Plan (PSMP) for Glenora wind farm. The purpose of this report is to provide a Peat and Spoil Management Plan for the construction phase of the wind farm. The report describes how peat and spoil which will be excavated from infrastructure locations such as turbine bases and roads and will be handled and placed/reinstated onsite. The report also provides construction details for the types of roads which will be put in place at the site and proposed peat and spoil placement/reinstatement areas which will be developed at the site.

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1. INTRODUCTION

1.1 Fehily Timoney and Company

Fehily Timoney and Company (FT) is an Irish engineering, environmental science and planning consultancy with offices in Cork, Dublin and Carlow. The practice was established in 1990 and currently has c.100 members of staff, including engineers, scientists, planners and technical support staff. We deliver projects in Ireland and internationally in our core competency areas of Waste Management, Environment and Energy, Civils Infrastructure, Planning and GIS and Data Management.

This Report was written by Ian Higgins (FT Principal Geotechnical Engineer, MSc in Geotechnical Engineering) and Alan Whelan (FT Project Engineer, BEng (Hons) Civil Engineering). Ian is a Principal Geotechnical Engineer with Fehily Timoney and has 25 years' experience in geotechnical engineering. Alan is a Project Engineer with Fehily Timoney and has two years' experience in geotechnical engineering.

1.2 Project Description

Fehily Timoney and Company (FT) was engaged in March 2021 by MKO on behalf of Glenora Wind Farm DAC to compile a Peat and Spoil Management Plan for the Proposed Development.

The Proposed Development will be located at a site approximately 6km southwest of Ballycastle in County Mayo.

The Proposed Development site comprises predominantly commercial forestry underlain by blanket peat with a mainly man-made drainage network.

1.3 Purpose

The purpose of this report is to provide a peat and spoil management plan with particular reference to peat stability for the construction phase of the project. Such peat and spoil management measures have been successfully implemented on numerous wind farms over the past 15 years.

This peat and spoil management plan also includes a monitoring programme which will be implemented during the construction phase of the wind farm and a contingency plan should peat instability/failure occur at the site.

As for all construction projects, a detailed engineering construction design will be carried out by the appointed construction stage designer prior to any construction work commencing on site. This will take account of the consented project details and any conditions imposed by that consent. This will include a detailed peat stability assessment to account for any changes in the environment which may have occurred in the time leading up to the commencement of construction and a peat and spoil management plan to allow for the most appropriate geotechnical and environmental led solutions to be developed for the management of peat and spoil.

As work is carried out on site the contents of the peat and spoil management plan and peat stability monitoring programme will be implemented in full and updated (if required to comply with any planning conditions or requirements of the planning authority) in the Construction & Environmental Management Plan (CEMP) for the construction phase.

This peat and spoil management plan contains some drainage guidelines for construction works and for management of peat on site. It should be noted that the control of water quality and drainage measures for site is outlined in detail in the relevant chapter of Environmental Impact Assessment Report (EIAR).

1.4 Peat Instability Definition

Peat instability in this report is defined as a mass movement of a body of peat that would have a significant adverse impact on the surrounding environment. Peat instability excludes localised movement of peat that would occur below a floating access road, creep movement or localised erosion type events.

Adherence to the peat and spoil management plan will reasonably minimise the potential for all such peat movements. However, it is noted that due to the soft ground nature of the peat terrain it is not possible to completely avoid localised peat movement.

2. CONSTRUCTION ACTIVITIES COVERED BY PEAT AND SPOIL MANAGEMENT PLAN

2.1 Construction Activities

For the construction phase of the Proposed Development the activities that will generate peat and spoil are as follows:

(1) Upgrade of existing access tracks (excavate and replace, and floating tracks) including temporary widening of local road to facilitate deliver of turbine components

(2) Construction of new excavated roads through peat

(3) Construction of floating roads over peat (will not generate peat and spoil but the methodology for construction is included for completeness)

(4) Excavation and placement of arisings

(5) Excavations in peat for turbine bases, hardstands and other infrastructure foundations

(6) Excavations in peat for underground cables

Peat and spoil management of the above construction activities are covered individually in this report.

2.2 Road Construction Types

To provide access within the site and to connect the wind turbines and associated infrastructure existing tracks will need to be upgraded and new access roads will need to be constructed. The road construction design has taken into account the following key factors:

(1) Buildability considerations

(2) Maximising use of existing infrastructure

(3) Minimising excavation arisings

(4) Serviceability requirements for construction and wind turbine delivery and maintenance vehicles

(5) Requirement to minimise disruption to peat hydrology

Whilst the above key factors are used to determine the proposed road design, the actual construction technique employed for a particular length of road will be determined by the prevailing ground conditions encountered during confirmatory investigations along that length of road.

The proposed road construction techniques to be considered are given in Table 2-1.

It should be noted that this report does not include a detailed design for the access roads on the Proposed Development. This report includes the most suitable type of road construction envisaged for each section of access road based on the ground/site conditions recorded during the site walkovers. Where floating roads are proposed in this report, a proposed methodology is presented however a detailed design will be carried out prior to construction commencing on site. These measures are based on available guidance, including 'Constructed Tracks in the Scottish Uplands (Scottish Natural Heritage, 2nd Edition ,2015), Floating Roads on Peat (Scottish Natural Heritage/Forestry Commission Scotland, 2010) and 'Dealing with Bearing Capacity Problems on Low Volume Roads Constructed on Peat (ROADEX II, 2004).

Table 2.1: General Road Construction Techniques

Construction Method	Site Conditions			Comment
	Construction Type	Peat Depth (m)	Slope Inclination (degs)	
Upgrade of existing access roads	Type A	-	Varies	Upgrade existing excavated access roads to the required width and finished with a layer of selected granular fill – Drawing P20-312-0600-GLEN-0005
Construction of new excavated roads through peat	Type B	Normally proposed where less than 1.5m, locally up to 3.0m	Varies	New access road construction technique envisaged for various locations on site – Drawing P20-312-0600-GLEN-0005
Construction of new floating roads over peat	Type C	>2.0	<3	New access road construction technique envisaged for various locations on site – Drawing P20-312-0600-GLEN-0005

Further details on access road construction types A to C are given in Sections 3, 4 and 5 of the report.

3. UPGRADE OF EXISTING ACCESS ROADS – TYPE A

Up to 15km of existing access roads requiring upgrade are present across the Proposed Development site and have been in operation for a significant number of years. The existing access roads were constructed using both floating and excavate and replace construction techniques. Based on the site walkover carried out by FT the existing access roads were noted as being in relatively good condition. Upgrade works will involve both widening and resurfacing of the existing access road. The proposed locations for upgrade of the existing access roads on site are shown in Drawing P20-312-0600-GLEN-0005 and details are shown in Drawing P20-312-0600-GLEN-0006.

3.1 Upgrading Existing Access Tracks Construction Methodology

This methodology includes procedures that will be included in the construction methodology to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in Chapter 4 and 9 of the EIAR.

(1) Access road construction will be to the line and level requirements as per design.

(2) For upgrading of existing excavated access roads (Type A) the following guidelines will be implemented in full:

   (a) Excavation of the widened section of access road will take place to a competent stratum beneath the peat (as agreed with the designer) and backfilled with suitable granular fill.

   (b) Benching of the excavation may be required between the existing section of access road and the widened section of access road where the depth of excavation required exceeds 500mm.

   (c) The surface of the existing access road will be overlaid with up to 500mm of selected granular fill.

   (d) Access roads will be finished with a layer of capping across the full width of the track.

   (e) A layer of geogrid/geotextile may be required at the surface of the existing access road and at the base of the widened section of access road (to be confirmed by the designer).

   (f) For excavations in peat, side slopes will be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction. Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

(3) The finished road width will have a running width of 5m, with wider sections on bends and corners.

(4) On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.

(5) At transitions between new floating and existing excavated roads a length of about 10 to 20m will have all peat excavated and replaced with suitable fill. The surface of this fill will be graded to accommodate wind turbine construction and delivery traffic.

4. CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE B

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site. The proposed locations for new excavated access roads on site are shown in drawing P20-312-0600-GLEN-0005 and details are shown in drawing P20-312-0600-GLEN-0007.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique in shallow peat provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

4.1 Excavated Road Construction Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in Chapter 4 and 9 of the EIAR.

(1) Prior to commencing the construction of the excavated roads movement monitoring posts will be installed in areas where the peat depth is greater than 2.0m.

(2) Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.

(3) Excavation of roads swill be to the line and level given in the design requirements. Excavation will take place to a competent stratum beneath the peat.

(4) Road construction will be carried out in sections of up to 50m lengths i.e., no more than 50m of access road will be excavated without re-placement with stone fill.

(5) Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pits. All peat placement areas will be upslope of founded roads/hardstands and will be inspected by the Project Geotechnical Engineer before material is stored in the area.

(6) Excavation of materials with respect to control of peat stability:

  (a) Where Acrotelm (to about 0.3 to 0.4m of peat) is required for landscaping it will be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping will be undertaken prior to main excavations.

  (b) Where possible, the acrotelm will be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.

  (c) All catotelm peat (peat below about 0.3 to 0.4m depth) will be transported immediately on excavation to the designated placement areas.

(7) Excavation side slopes in peat will be not greater than 1 (v): 3 (h). This slope inclination will be reviewed during construction. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.

(8) End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the adjacent peat, is limited.

(9) The excavated access road will be constructed with a minimum of 800mm of selected granular fill. Granular fill will be placed and compacted in layers in accordance with the TII Specification for Road Works.

(10) Access roads will be finished with a layer of capping across the full width of the road.

(11) A layer of geogrid/geotextile may be required at the surface of the competent stratum where cohesive material is present to prevent mixing of the underlying material with the granular fill.

(12) At transitions between floating and excavated roads a length of road of about 10m will have all peat excavated and replaced with suitable fill. The surface of this fill will be graded so that the road surface transitions smoothly from floating to excavated road.

(13) Where slopes of greater than 5 degrees are encountered along with relatively deep peat (i.e., greater than 2m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.

(14) A final surface layer will be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.

(15) The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis (by the Site manager/Ecological Clerk of Works/Project Geotechnical Engineer) during the works, particularly before/following trafficking by heavy vehicular loads.

5. CONSTRUCTION OF NEW FLOATED ROADS OVER PEAT – TYPE C

The use of new floated access tracks will be limited on site to areas of flatter terrain, i.e., less than a 3 degree slope. The proposed locations for floating roads across the are shown in drawing P20-312-0600-GLEN-0005 and details shown in drawing P20-312-0600-GLEN-0008. Floating roads are not proposed on areas of sidelong ground.

A confirmatory stability analysis will be carried out by the designer where it is proposed to install floating access roads over the peat prior to any construction work commencing on site.

Floating roads minimise impact on the peat, particularly peat hydrology. As there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavate and replace type access road may be more suitable (see Section 6), although this is not anticipated at the location of the floated roads.

5.1 Floating Road Construction Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in Chapter 4 and 9 of the EIAR.

Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

(1) Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.

(2) Base geogrid will be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.

(3) Construction of road will be in accordance with appropriate design from the designer.

(4) The make-up of the new floated access road is up to 1,000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a geotextile separator (drawing P20-312-0600-GLEN-0008).

(5) Granular fill will be placed and compacted in layers in accordance with the TII Specification for Road Works.

(6) Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.

(7) The finished road width will be 5m, with wider sections on bends and corners.

(8) Stone delivered to the floating road construction will be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat will not be carried out.

(9) To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road will be tipped over at least a 10m length of constructed floating road.

(10) Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road will carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.

(11) Following end-tipping a suitable bulldozer will be employed to spread and place the tipped stone over the base geogrid along the line of the road.

(12) A final surface layer will be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

6. GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

The following general construction guidelines will be implemented for the access roads on site.

(1) Where an open ditch is present alongside an existing/proposed floating access track, the ditch will need to be filled prior to upgrading/constructing the access track. The ditch will be filled with suitable drainage stone. As applicable, a perforated pipe will be laid into a ditch prior to filling so as to maintain water flow within the ditch.

(2) Where existing drainage crosses the road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded access road. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.

(3) No excavations (e.g., drainage, peat cuttings) will be carried out within 5m distance of a completed floated access road edge, or at a distance determined following site inspection. The presence of excavations can destabilise the road. Temporary excavations will be excavated in short lengths and backfilled as soon as practicable.

(4) Floating roads will not be constructed on areas of sidelong ground.

(5) No stockpiling of materials will take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.

(6) End-tipping of stone onto the road during the construction/upgrading of the access road will be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.

(7) Due to the nature of floating road construction, it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 2m). These survey points will be surveyed on a weekly basis, and more frequently when construction activities are ongoing in the area.

(8) The construction and upgrading of access roads in areas of deep peat (greater than 2m) will be inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(9) In the event of excessive vertical displacement of the road during/following construction then mitigation measures will be required to ensure the stability of the road. This will include:

   (a) Introduction of pressure berms either side of the road (that are 2 to 5m wide by 0.5m deep stone layer).

   (b) Where peat is relatively willow then excavate peat and replace with suitable fill.

   (c) Slowing the rate of construction.

(10) Settlement of a floated access road is expected and will likely be in the order of several 100mm in the deeper peat areas; as such it will be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works, the road will be re-levelled using crushed stone.

7. EXCAVATION AND STORAGE OF PEAT AND SPOIL

7.1 Excavation and Storage of Arisings Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in Chapter 4 of the EIAR.

(1) All excavated peat and spoil will be transported immediately on excavation to one of the 3 no. borrow pits (see drawing P20-312-0600-GLEN-0005) or to one of the designated peat placement areas around turbine locations.

(2) Further details on the construction and reinstatement of the 3 no. borrow pits are given in Section 7.4.

(3) Further details on the placement of excavated material to designated peat placement areas close to turbines are given in Section 7.5.

(4) Some of the peat, in particular the acrotelm (upper layer of the peat), excavated during construction will be used for landscaping purposes.

7.2 Summary of Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the Proposed Development site is given in Table 7-1.

Table 7.1: Summary of Excvated Peat and Spoil Volumes on Site

Infrastructure Element (1)	Proposed Dimensions	Peat Volume (m^3) (2)	Spoil (non-peat) Volume (m^3) (2) and (3)	Comment
22 no. Turbines and Hardstands	28m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area.	309,000	135,000	Hardstanding area and foundation footprint
Access Roads	Assumed 5m running surface with 6m wide development footprint.	212,000	30,500	
Temporary Construction Compounds	Hardstanding area of 90 x 70m.	29,000	5,200	Hardstanding areas
Substation	Hardstanding area of 130 x 180m	44,300	7,900	
Met Mast	10 x 10m foundation footprint and 30 x 30m hardstanding area (met mast).	900	200	
Borrow Pits	3 no. borrow pits.	60,200	25,800	Borrow pit footprint
	Total =	**655,400m^3**	**204,600m^3**	**Total = 860,000m^3 (peat and spoil volume) (4)**

Note (1) The location of the infrastructure elements on site are shown on Drawing P20-312—0600-GLEN-0005.

Note (2) A factor of 10% (bulking factor of 10%has been applied to the excavated peat and spoil volumes to allow for expected increase in volume upon excavation and to allow for a variation in ground conditions across the site.

Note (3) The excavated spoil volumes have been determined based on a cut-fill assessment carried out for the site, see Section 13 of this report for further details.

Note (4) It should be noted that the excavated rock volume from the borrow pits is not included in the total volume quoted above in Table 7-1, see the cut-fill assessment in Section 13 of this report for further details. It is assumed that the excavated rock volume will be re-used on site as part of the construction works for the development and hence will not require reinstatement on site.

7.3 Summary of Peat and Spoil Placement/Reinstatement Areas on Site

A summary of the potential peat and spoil placement/reinstatement areas at the Proposed Development site is given in Table 7-2.

Table 7.2: Summary of Peat and Spoil Placement/Reinstatement Areas on Site

Location (1)	Peat and Spoil Volume (m^3)	Comment
Peat placement within clear fell areas around turbines	134,000	1.3m in height across specific areas shown in Drawing P20-312-0600-GLEN-0005. See Section 7.5 of the report and Drawing P20-312-0600-GLEN-0012 for further details.
Borrow Pits	744,000	See Drawing P20-312-0600-GLEN-0009 to 0011 for further details
Landscaping (2)	44,000	It is estimated that approximately 2,000m^3 of peat will be required for landscaping purposes at each of the 22 no. turbine locations.
Total =	**922,000m^3**	

Note (1) The location of the proposed borrow pits at the site are shown on Drawing P20-312-0600-GLEN-0005.

Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.

7.4 Summary of Construction Phasing

The Proposed Development will be constructed in phases, which each phase comprising 5-7 turbines and associated hardstands and access roads. This will allow for the borrow pits to be developed and backfilled in stages. An outline of the Phasing is provided below:

a. Phase 1: Construction of link road, widening of public road, upgrade of private access road between the local road and the on-site substation and the substation and primary construction compound (100,000m^3 of peat and spoil).
   i. All fill material will come from BP3
   ii. All excavated material will be transferred to BP3 once cells have been created

b. Phase 2: Upgrade of all existing roads within the main wind farm site and construction of all other construction compounds (180,000m^3 of peat and spoil).
   i. Fill material to be taken from BP1 and BP2.
   ii. All excavated material to be transferred to BP3 until cells open up in BP1

c. Phase 3: Construction of new access roads, hardstands and foundation bases for Turbines 1, 2, 3, 4, 6 (150,000m^3 of peat and spoil).
   i. Fill material to be taken from BP1
   ii. Excavated material to be transferred to BP1 and peat placement areas around those turbines

d. Phase 4: Construction of new access roads, hardstands and foundation bases for Turbines 7, 8, 9, 11, 12, 15, 18 (170,000m^3 of peat and spoil).
   i. Fill material to be taken from BP1
   ii. Excavated material to be transferred to BP1 and the peat placement areas around T8 and T12

e. Phase 5: Construction of new access roads, hardstands and foundation bases for Turbines 5, 16, 19, 20, 21, 22 (130,000m^3 of peat and spoil).
   i. Fill material to be taken from BP2
   ii. Excavated material to be transferred to BP 2 until full and then to BP1

f. Phase 6: Construction of new access roads, hardstands and foundation bases for Turbines 10, 13, 14, 17 and met mast (130,000m^3 of peat and spoil).
   i. Fill material to be taken from BP1
   ii. Excavated material to be transferred to BP1

The above phasing works are estimated to take 16-18 months in total.

7.5 Guidelines for the Construction and Reinstatement of Borrow Pits

Three number locations have been identified as borrow pits and are shown on Drawing P20-312-0600-GLEN-0005. The peat depth within the development footprint of the borrow pits is less than 1.5m. The borrow pit locations were selected based on the shallow depth of peat and overburden and accessibility from the existing forestry tracks. Bedrock within the borrow pits will be a mixture of sandstone and siltstone, based on GSI mapping, site observations and trial pit findings. Appendix B contains an example of a completed borrow pit from Galway Wind Park with a perimeter buttress.

Upon removal of the rock from the borrow pits, it is proposed to reinstate the borrow pits using excavated peat and spoil. The excavated rock from the borrow pits will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to construct cells within the borrow pits for the placement of the excavated peat and spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators. The text below provides design and construction guidelines for the borrow pits.

It should be noted that there are significant excavation works required in order to develop the borrow pits at the site. Excavation works will be undertaken and supervised by experienced contractor and suitably qualified personnel. The text below provides some design and construction guidelines for the borrow pit.

Drawings P20-312-0600-GLEN-0009 to 0011 show proposed construction details for the borrow pits.

The borrow pits will be constructed as follows:

(1) The rock within the proposed borrow pit footprints will be removed by either breaking or blasting depending on its excavatability, which will be determined from a confirmatory ground investigation carried out at the proposed borrow pits. The ground investigation will comprise rotary core drilling with associated engineering logging including rock quality designation and strength and durability testing. From site observations of rock exposures breaking is most likely to be suitable to remove the rock, however at depth some blasting may also be required.

(2) It is proposed to construct the borrow pits so that the base of the borrow pits are below the level of the adjacent section of access road.

(3) Slopes within the excavated rock formed around the perimeter of the borrow pits will be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes will be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.

(4) The stability of the rock faces within the borrow pits will be inspected by the Project Geotechnical Engineer upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock, in line with best practice guidelines.

(5) It will be necessary to construct rock buttresses founded on in-situ rock within the borrow pits to create individual cells (up to 6 no. depending on the borrow pit). The cells will be opened in sequence and filled as needed. The rock buttresses will be constructed of rock fill from the borrow pit excavation, placed and compacted in layers. The founding stratum for each rock buttress will be inspected and approved by the Project Geotechnical Engineer.

(6) The rock buttresses will be constructed in stages to allow infilling of peat and spoil within cells. The buttress will be constructed of selected rock fill and placed and compacted in suitable layers to form a buttress of sufficient stability to retain the placed peat and spoil.

(7) Infilling of the peat and spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress, allowing the borrow pit to be developed and infilled in cells. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat and spoil to be reinstated safely.

(8) A number of rock buttresses to form cells within the borrow pits will be required to ensure access for trucks and excavators can be achieved. See Drawings P20-312-0600-GLEN-0009 to 0011 for the location of the rock buttresses. The locations of the rock buttresses shown on Drawings P20-312-0600-GLEN-0009 to 0011 for the borrow pit are indicative only and may change subject to local conditions encountered on site during construction, or as a result of the confirmatory ground investigation.

(9) The rock buttresses will be wide enough (up to 4m) to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The permanent side slopes of the rock buttress will be constructed at between 40 to 60 degrees.

(10) A rock buttress will be required on the downslope side of the borrow pits to safely retain the infilled peat and spoil. The height of the berm constructed will be greater than the height of the reinstated peat and spoil to prevent any surface peat and spoil run-off. A berm of up to 8m in height will be constructed, depending on the borrow pit. The berm height for each borrow pit is provided on the drawings.

(11) The rock buttress will be founded on mineral soil or bedrock i.e., competent strata. Either material will be suitable provided a minimum shear strength of 75kPa is achieved (if the overburden material is cohesive). The founding stratum for the rock buttress will be inspected and approved by the Project Geotechnical Engineer. The stability of the proposed berms has been checked as Part of the Peat Stability Assessment, see Section 7.4 of that report.

(12) A level surface in the underlying mineral soil or bedrock will be prepared before placing and compacting the rock fill used to construct the perimeter berms.

(13) In order to prevent water retention occurring behind the buttresses, the buttress will be constructed of coarse boulder fill with a high permeability. The buttress will be constructed of well graded granular rock fill of 100mm up to 500mm in size. In addition, drains will be placed through the buttresses to allow excess water to drain.

(14) A layer of geotextile will be placed on the inside face of the perimeter berm to act as a separator layer between the berm and the placed peat/spoil, to prevent the placed peat/spoil infilling any voids on the inside face of the berm, maintaining the permeability of the berm.

(15) The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil will be required.

(16) The surface of the placed peat and spoil will be shaped following backfill using excavators to allow efficient run-off of surface water from the placed arisings towards the perimeter of the borrow pit.

(17) As the berms are slightly higher than the retained peat, drains will be provided at regular intervals through the berms, at the same level as the top of the peat surface, to prevent ponding of water around the edges of the repositories. These drains will be 150mm diameter flexible plastic drainage pipe or equivalent.

(18) A layer of geogrid to strengthen the surface of the placed peat and spoil within the borrow pits will be required.

(19) An interceptor drain will also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent water from ponding and lodging during construction and also when reinstated.

(20) Temporary control of groundwater within the borrow pits will be required and exact measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations will be required during construction.

(21) Settlement ponds will be constructed at the lower side/outfall location of the borrow pits.

(22) The acrotelm will be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the peat and spoil within the borrow pits.

(23) Supervision by the Project Geotechnical Engineer will be carried out for the development of the borrow pits.

(24) All the above-mentioned general guidelines and requirements will be implemented by the Contractor during construction.

7.6 Designated Peat Placement Areas within Turbine Clearfell Areas

The following commitments for the placement of peat within permanent clearfell areas around 9 no. turbines will be implemented during construction. These areas have been selected based on a combination of the depth of peat, the recorded peat strength in the area and the slope angle. A check of peat stability in each area was also undertaken, allowing for the additional loading from 1m of stored peat, and these results are included on the Peat Stability Assessment Report (FT, 2023). All of the proposed peat placement areas have an acceptable factor of safety against failure.

(1) Excavated peat will be placed/spread across the clearfell areas around 9 no. of the proposed turbines. These locations are shown in Drawing P20-312-0600-GLEN-0005.

(2) The peat placed within the areas shown on Drawing P20-312-0600-GLEN-0005 will be restricted to a maximum height of 1.3m. Weak/liquified peat will be placed within the proposed borrow pits and not stored within these areas.

(3) The placement of excavated peat will be avoided without first establishing the adequacy of the ground to support the load. The placement of peat and spoil within the placement areas will require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

(4) Where there is any doubt as to the stability of the peat surface then no material will be placed on to the peat surface. The risk of peat instability is reduced by not placing any loading onto the peat surface.

(5) It will be ensured that the surface of the placed peat will be shaped to allow efficient run-off of surface water. Shaping of the surface of the peat will be carried out as placement of peat within the peat placement area progresses. This will reduce the likelihood of debris run-off and reduce the risk of instability of the placed peat.

(6) Finished/shaped side slopes in the placed peat will be not greater than 1 (v): 4 (h). This slope inclination will be reviewed during construction, as appropriate.

(7) The acrotelm will be placed on the finished surface with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat and spoil within the placement areas.

(8) Movement monitoring instrumentation will be placed around the areas where peat has been placed. The locations where monitoring is required will be identified by the Project Geotechnical Engineer on site.

(9) Supervision by the Project Geotechnical Engineer will be carried out for the works.

(10) An interceptor drain will be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.

(11) All the above mentioned general guidelines and requirements will be undertaken by the Contractor during construction.

8. EXCAVATIONS IN PEAT FOR TURBINE BASES, HARDSTANDINGS AND INFRASTRUCTURE FOUNDATIONS

The turbine bases will be founded on competent founding strata which will require excavation through peat and soft overburden. Some turbine bases may require a piled solution following confirmatory ground investigations by the Contractor.

Similarly, crane hardstandings, construction compound, substation platforms and met mast foundations are to be founded on competent mineral soil and/or rock which will require excavation through peat and spoil. Excavations for the borrow pits will also remove the peat and non-peat spoil overlying the rock.

8.1 Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in Chapters 4 and 9 of the EIAR.

(1) With respect to placement of arisings from excavations the commitments given in Section 7 will be followed.

(2) All excavations within peat will be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be provided.

(3) Excavations will be kept reasonably free from water at all times. Water will be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.

(4) Where water is channelled or pumped from an excavation then this water is to be fed into an established watercourse or drainage ditch following suitable treatment, as described in Chapter 4 of the EIAR.

9. EXCAVATIONS FOR UNDERGROUND CABLES

A connection between the Glenora Wind Farm and the national electricity grid will be necessary to export electricity. It is proposed that the Glenora Wind Farm will connect to the national grid via an existing substation (Tawnaghmore) located in Killala to the west of the proposed wind farm development. The proposed grid connection is 26.1km in length and will follow existing and proposed tracks and the public road corridor.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in the EIAR.

It is proposed to excavate the trenches for the underground cable at a uniform level within the footprint of the access roads and TDR. The grid connection route will encounter peat and till derived from Devonian and Carboniferous sandstones and will be constructed on solid ground to Eirgird specifications.

9.1 Methodology

This methodology includes procedures that will be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are assessed in Chapters 4 and 9 of the EIAR.

(1) With respect to placement of arisings from excavations the guidelines given in Section 8 will be followed.

(2) All excavations within peat will be adequately supported or peat slopes will be battered to a safe slope inclination typically of 1 (v): 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required.

(3) Similarly, all excavations within non-peat overburden for the cable trench are to be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h). This slope inclination will be reviewed during construction, as appropriate.

(4) Excavations will be kept reasonably free from water at all times.

(5) Any overburden excavated from the cable trench will be transported to the borrow pits for storage. Any pavement materials containing tar will be transported to an authorised waste facility.

10. GENERAL MEASURES FOR GOOD CONSTRUCTION PRACTICE

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMS) for the project will also implement (as a minimum), the general measures below together with the specific measures above.

(1) Uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge will be avoided. All water discharged from excavations during work will be piped over areas specifically assessed as being unsuitable and hence directly into suitable drainage lines.

(2) All excavations will be suitably supported to prevent collapse and development of tension cracks.

(3) Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.

(4) Installation and regular monitoring of geotechnical instrumentation during construction in areas of possible poor ground, such as deeper peat deposits (see Section 11).

(5) Site reporting procedures will be implemented to ensure that working practices are suitable for the encountered ground conditions. Ground conditions will be assessed by a suitably experienced geotechnical engineer.

(6) Regular briefing of all site staff (e.g., toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.

(7) Routine inspection of wind farm site by the Contractor and Project Geotechnical Engineer will be undertaken and will include an assessment of ground stability conditions (e.g., cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g., blocked drains, absence of water in previously flowing drains, springs, etc).

11. INSTRUMENTATION

11.1 Movement Monitoring Posts

To monitor possible peat movements, it is proposed to install sighting posts upslope and downslope of the access road at staggered intervals at locations where the peat depth is greater than 2m. Additional monitoring locations will be provided at infrastructure locations with deeper peat deposits. Details of sighting posts are given below.

(1) A line of sighting posts will comprise:

- (a) A line of wooden stakes (proposed to be 1 to 1.5m long) placed vertically into the peat to form a straight line.
- (b) The sighting line will comprise 6 no. posts at 5m centres that is a line some 25m long.
- (c) A string line will be attached to the first and last posts and all intervening posts will be adjusted so they are just touching the string line.

(2) Lines of sighting posts will be placed across the existing slope about 5m away from the area to be worked. It is recommended that the posts are located along the road at 10m intervals in areas of deep peat (say greater than 2.0m). Where there are relatively steeper slopes or softer ground a sighting line will be placed down the slope, or at any location where monitoring is deemed useful by the Project Geotechnical Engineer.

(3) Each line of sighting posts will be uniquely referenced with each post in the line given a reference. The post reference will be marked on each post (e.g., reference 1-1, 1-2, 1-3, 1-4, 1-5, 1-6 for posts in line 1).

(4) The sighting lines will be monitored at the beginning of each working day, and during the day were considered appropriate (e.g., when working activity is concentrated at a specific location).

(5) Monitoring of the posts will comprise sighting along the line and recording any relative movement of posts from the string line.

(6) Where increased movements are recorded the frequency of monitoring will be increased.

(7) A monitoring record will be kept of the date, time and relative movement of each post, if any. This record will be updated and stored as a spreadsheet.

12. CONTINGENCY MEASURES

12.1 Excessive Movement

Where there is excessive movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g., cracking, surface rippling) then the following will be carried out.

(1) All activities (if any) will cease within the affected area.

(2) Increased monitoring at the location will be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.

(3) Re-commencement of activities will only start following a cessation of movement and agreement with all parties (Contractor/Engineer/Designer).

12.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g., cracking, surface rippling) then the following will be carried out.

(1) On alert of a peat slide incident, all activities (if any) in the area will cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.

(3) All relevant authorities will be notified if a peat slide event occurs on site.

(4) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrages

Whilst it is not anticipated from the analysis undertaken that a peat slide will occur on site, as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill will comprise well-graded coarse rock pieces from about 300mm up to 1000mm.

The rock fill for the check barrage will be sourced from locally won granular fill material on site.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

The check barrage will fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of at least 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

(1) Access to the check barrage location will be along the existing access roads on the wind farm site and/or along public roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.

(2) Operatives employed to carry out the construction of the check barrage will be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.

(3) The check barrage provides containment for peat debris in the highly unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage will be removed as soon as any measures to prevent further peat sliding is agreed with all parties (Contractor/Engineer/Designer).

13. CUT & FILL EARTHWORKS ASSESSMENT

FT carried out an assessment for the site which quantifies the total volume of cut and fill earthworks required for the construction of the wind farm. The cut & fill assessment is graphically presented in Drawing P20-312-0600-GLEN-0013.

The outputs from the cut & fill earthworks assessment includes the following:

- Plan drawings of the entire site showing an outline of cut & fill earthworks at all infrastructure elements (Drawing P20-312-0600-GLEN-0013)
- Preliminary cut & fill earthwork volumes (see Table 13-1 of this report)

A summary of the basis for the cut & fill earthworks assessment is included in Appendix A of this report.

A summary of the cut & fill earthwork volumes is given in Table 13-1.

13.1 Commentary on Earthworks Volumes

It will be noted that the earthwork volumes given in Table 13-1 are estimates and subject to detailed design. This section of the report should be read in conjunction with Sections 7.2 and 7.3 of the report which summarises the peat and spoil volumes for site and the placement/reinstatement areas on site.

In summary the following points are given,

1) The total volume of spoil (peat and non-peat superficial deposits) requiring placement/reinstatement on site is estimated at 860,000m^3. This material will be excavated and placed/reinstated to the borrow pits, with 134,000m^3 stored across clearfell areas near turbines and 22,000m^3 used for landscaping around the turbines.

2) The estimated quantity of available rock within the borrow pit is 805,000m^3. Note that limited ground investigation is available at the borrow pits to define rockhead level. Conservative assumptions were made in estimating the quantity of rock available in the borrow pits.

3) Note a number of assumptions were made during the cut & fill assessment, see Appendix A. A bulking factor of 10% has been applied to the excavation volumes.

Table 13.1: Summary of Cut & Fill Earthworks Volumes

Infrastructure Element	Description	Total Earthwork Volume (1) & (2) – Peat	Earthwork Volume (3) – Estimated non-peat overburden material	Earthwork Volume (4) - Estimated rock volume only	Stone Volume Requirements	Comment
		Cut (m^3)	Cut (m^3) (3)	Cut (m^3)	(m^3)	
22 no. Turbines and Hardstands	25m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area	309,000	135,000	-	330,000	Hardstanding area and turbine foundation footprint
Access Roads	Proposed 5m running surface with 6m wide development footprint	212,000	30,500	-	395,000	Excludes proposed floating sections of access road where no excavation of peat will take place (see Drawing P20-312-0600-GLEN-0005).
Various Infrastructure Locations	Includes substation, 5 no. construction compounds and met mast	74,200	13,300	-	70,000	-
Borrow Pits	3 no. Borrow Pits	60,200	25,800	805,000	15,000	Estimated potential rock volume from borrow pits is **805,000m³**. Note limited ground investigation in area of borrow pits to define rockhead level.
	Total =	**655,400**	**204,600**	**805,000**	**810,000**	

Notes

Note (1) The total earthwork volumes includes peat, non-peat superficial deposits and rock from the borrow pit.
Note (2) The earthwork volumes quoted for the non-peat material were calculated based on the total earthwork volume (peat & non-peat material) minus the peat volumes calculated and presented in Table 7-1 within Section 7.2 of this report.
Note (3) The in-situ rock volume from the borrow pits was estimated based on available ground investigation data to define rockhead level.
Note (4) It should be noted that the earthwork volumes given in Table 13-1 are subject to confirmatory design.

14. REFERENCES

Munro, R, 2004. Dealing with bearing capacity problems on low volume roads constructed on peat. Roadex II Northern Periphery.

Scottish Natural Heritage/Forestry Commission Scotland, 2010. Floating Roads on Peat.

Scottish Natural Heritage, 2015. Constructed Tracks in the Scottish Uplands. Scottish Natural Heritage.

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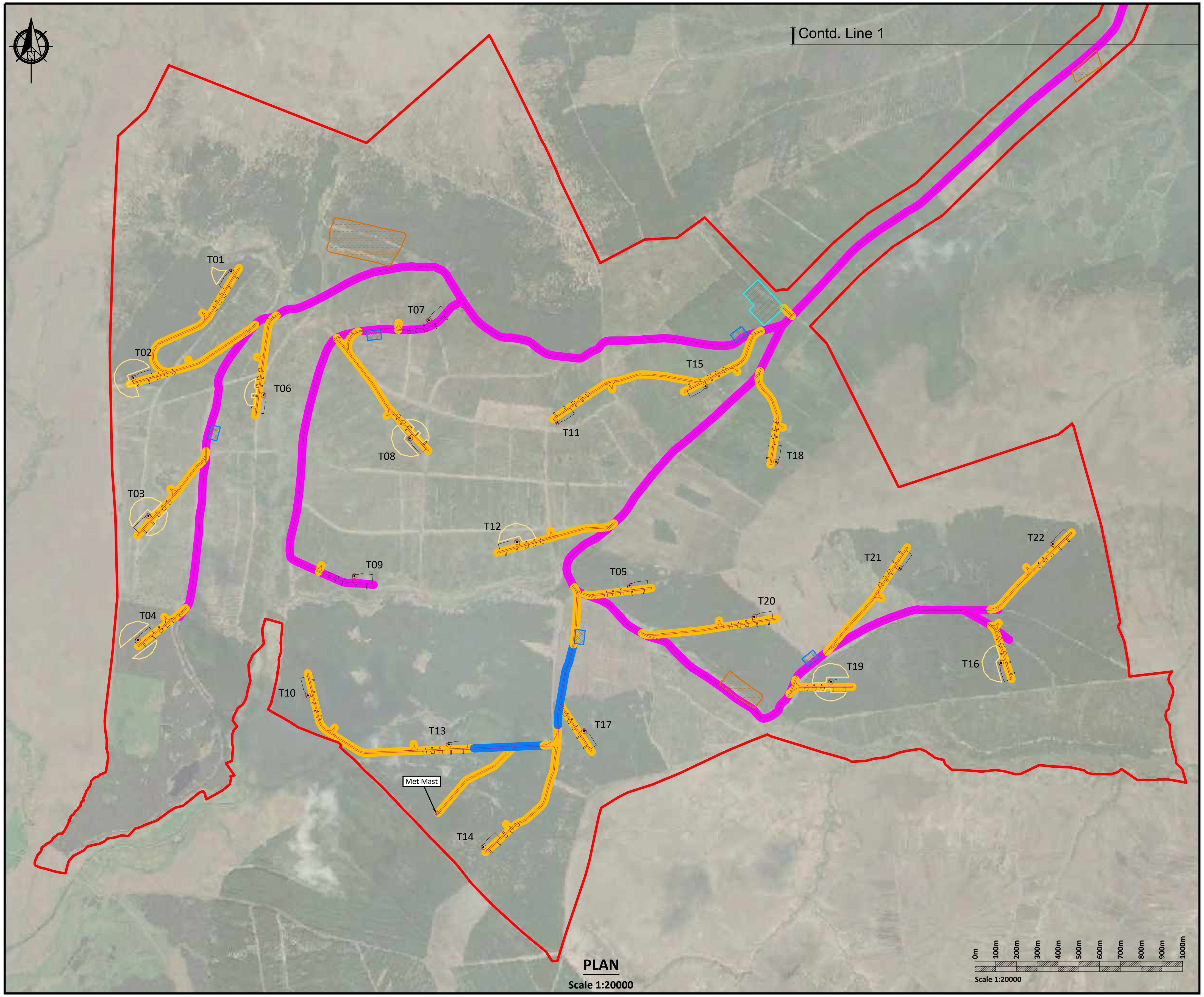
CONSULTANTS IN ENGINEERING,
ENVIRONMENTAL SCIENCE & PLANNING

DRAWINGS



PLAN

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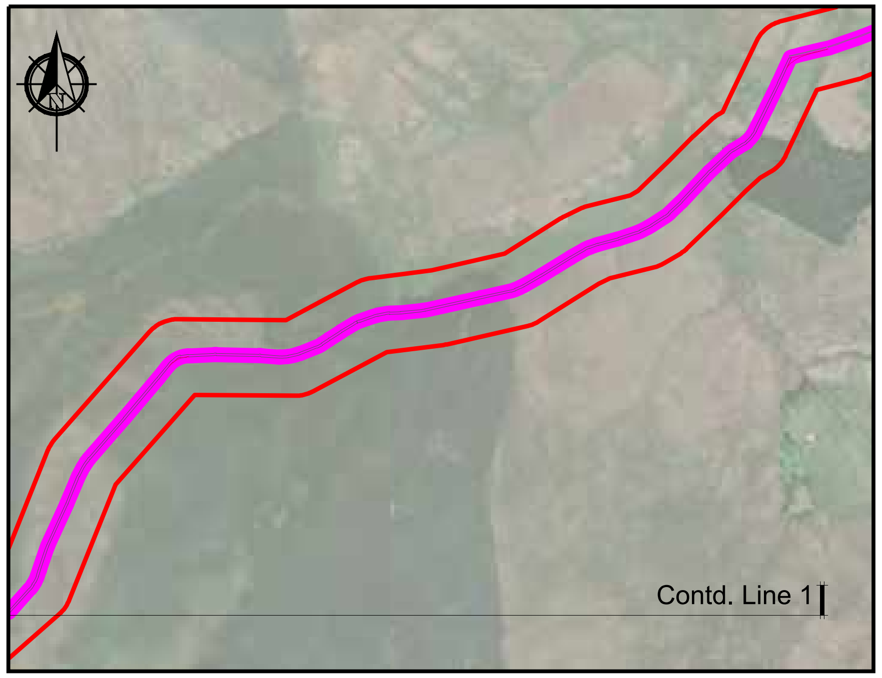

PLAN

Scale 1:20000

Road Type Legend:

- Type A - Upgrade of Existing Excavated Access Tracks
- Type B - New Excavate & Replace Access Road
- Type C - New Floated Access Road

Legend:

- EIAR Site Boundary
- Proposed Access Track
- Existing Access Track To Be Upgraded
- Existing Access Track
- Proposed Turbine
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Proposed Borrow Pit
- Proposed Peat Placement

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.05.23
B	FOR INFORMATION	BDH	30.11.23

PROJECT

GLENORA WINDFARM

CLIENT

MKO

SHEET

PLAN DRAWING OF WIND FARM WITH ROAD CONSTRUCTION TYPE

Date	Project number	Scale (@ A3)
30.11.23	P20-213	As Shown

Drawn by	POR	Drawing Number	Rev
Checked by	IH	P20-312-0600-GLEN-0005	B

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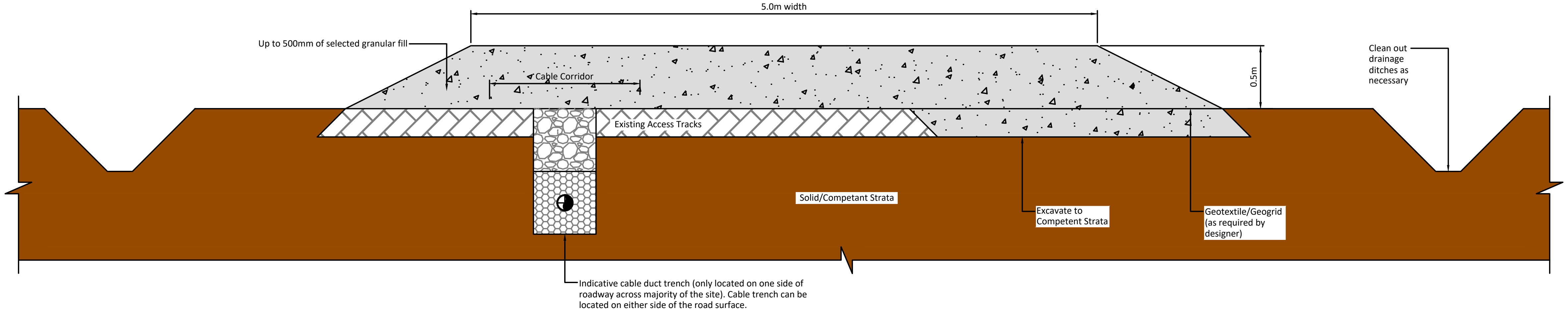
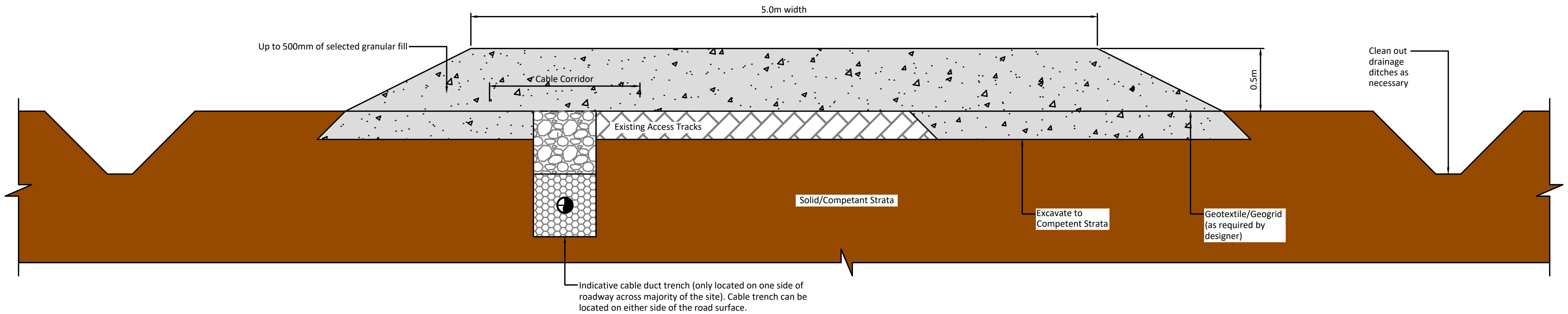
30 November 2023





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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.05.23

PROJECT: GLENORA WINDFARM

CLIENT: MKO

SHEET: TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACKS

Date	Project number	Scale (@ A3)
12.05.23	P20-213	As Shown

Drawn by	POR
Checked by	IH

Drawing Number	Rev
P20-312-0600-GLEN-0006	A

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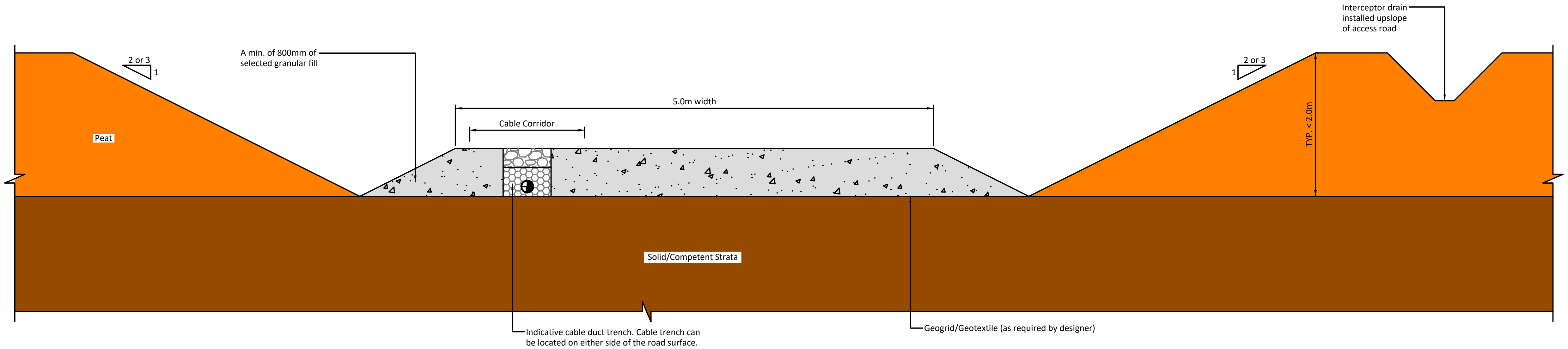
12 May 2023



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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.05.23
B	FOR INFORMATION	BDH	05.12.23

PROJECT
GLENORA WINDFARM

CLIENT
MKO

SHEET
TYPE B - NEW EXCAVATE AND REPLACE ACCESS ROAD

Date 05.12.23	Project number P20-213	Scale (@ A3) As Shown	
Drawn by POR	Drawing Number P20-312-0600-GLEN-0007		Rev B
Checked by IH			

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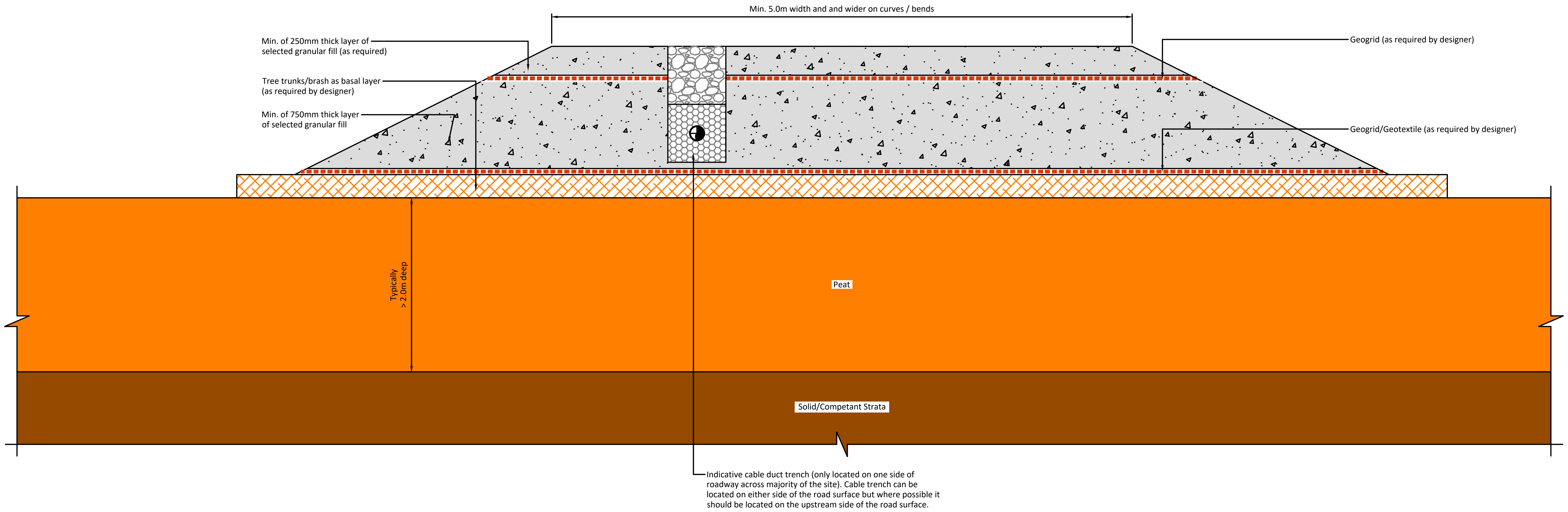
5 December 2023



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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.05.23
B	FOR INFORMATION	BDH	07.12.23

PROJECT
GLENORA WINDFARM

CLIENT
MKO

SHEET
TYPE C - NEW FLOATED ACCESS TRACK

Date 07.12.23
Project number P20-213
Scale (@ A3) As Shown
Drawn by POR
Checked by IH
Drawing Number P20-312-0600-GLEN-0008
Rev B

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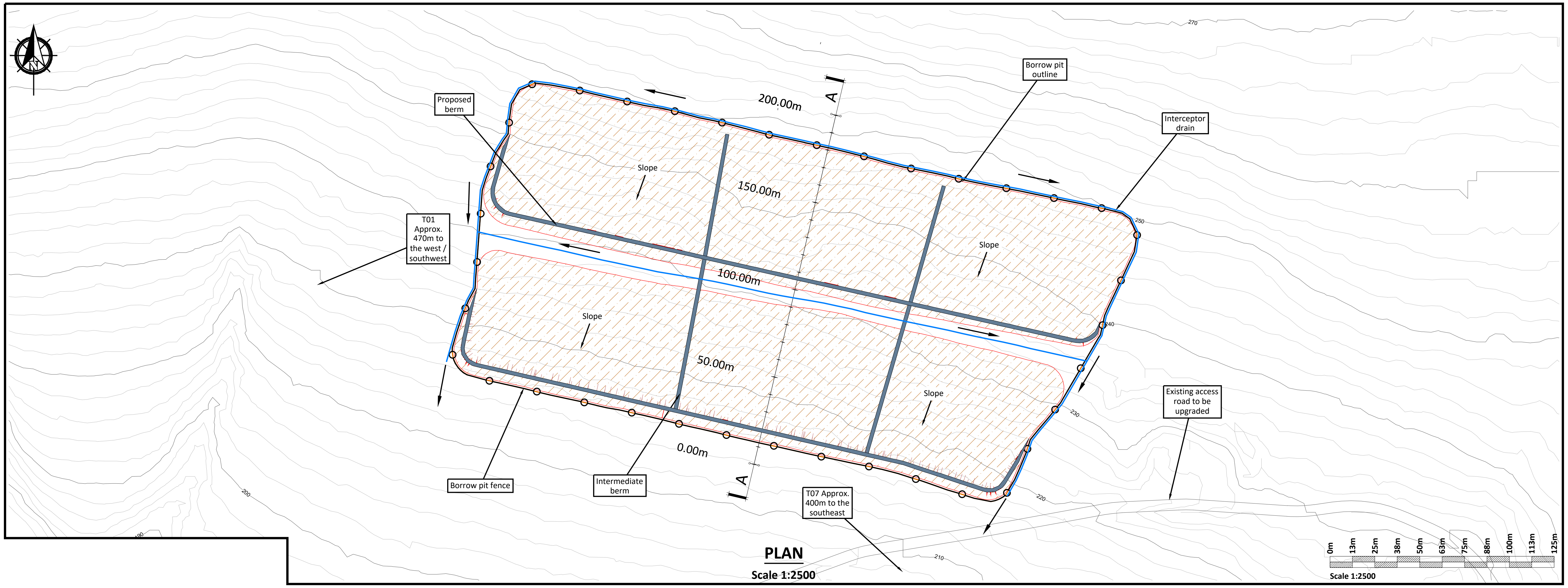
7 December 2023



PLAN

Scale 1:2500

Borrow Pit Construction Notes:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 9m (approx.) in height is likely to be required.

(5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress will be inspected and approved by the project geotechnical engineer.

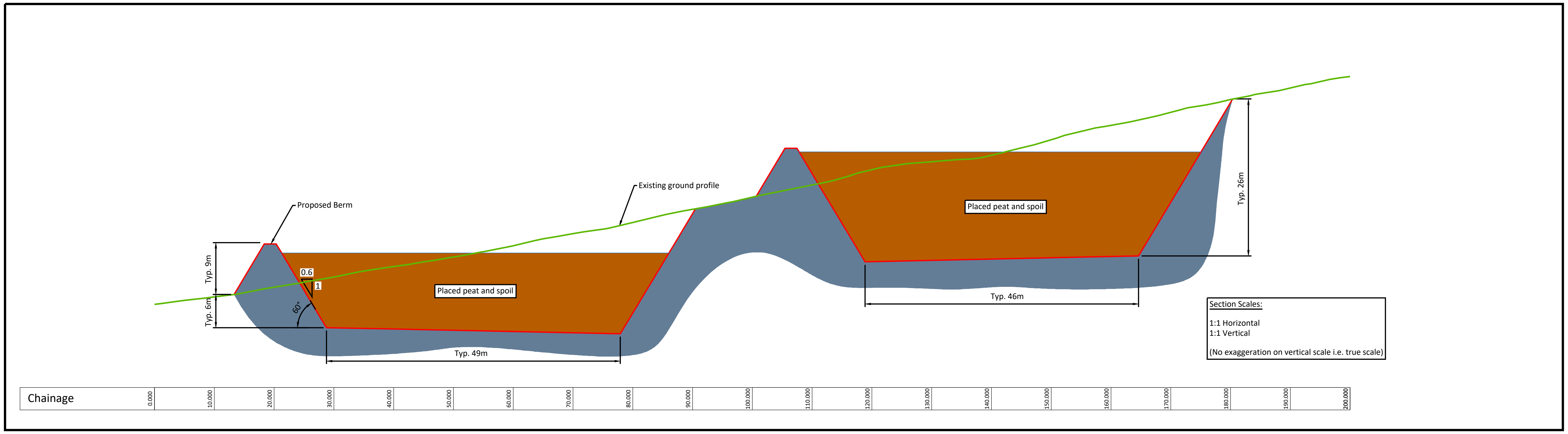
(6) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability.

(7) The surface of the placed peat & spoil will be shaped to allow efficient run-off of surface water from the placed arising's.

(8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(9) All the above-mentioned general guidelines and requirements will be confirmed by the designer prior to construction.

(10) Further guidelines on the construction of the borrow pit are included within Section 7.5 of the Peat & Spoil Management Plan



SECTION A - A

Scale 1:750

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	06.10.22
B	FOR INFORMATION	BDH	27.04.23
C	FOR INFORMATION	BDH	03.05.23
D	FOR INFORMATION	BDH	30.11.23

PROJECT: GLENORA WINDFARM

CLIENT: MKO

SHEET: BORROW PIT 1 PLAN AND SECTION

Date: 30.11.23

Project number: P20-213

Scale (@ A3): As Shown

Drawn by: POR

Checked by: IH

Drawing Number: P20-312-0600-GLEN-0009

Rev: D

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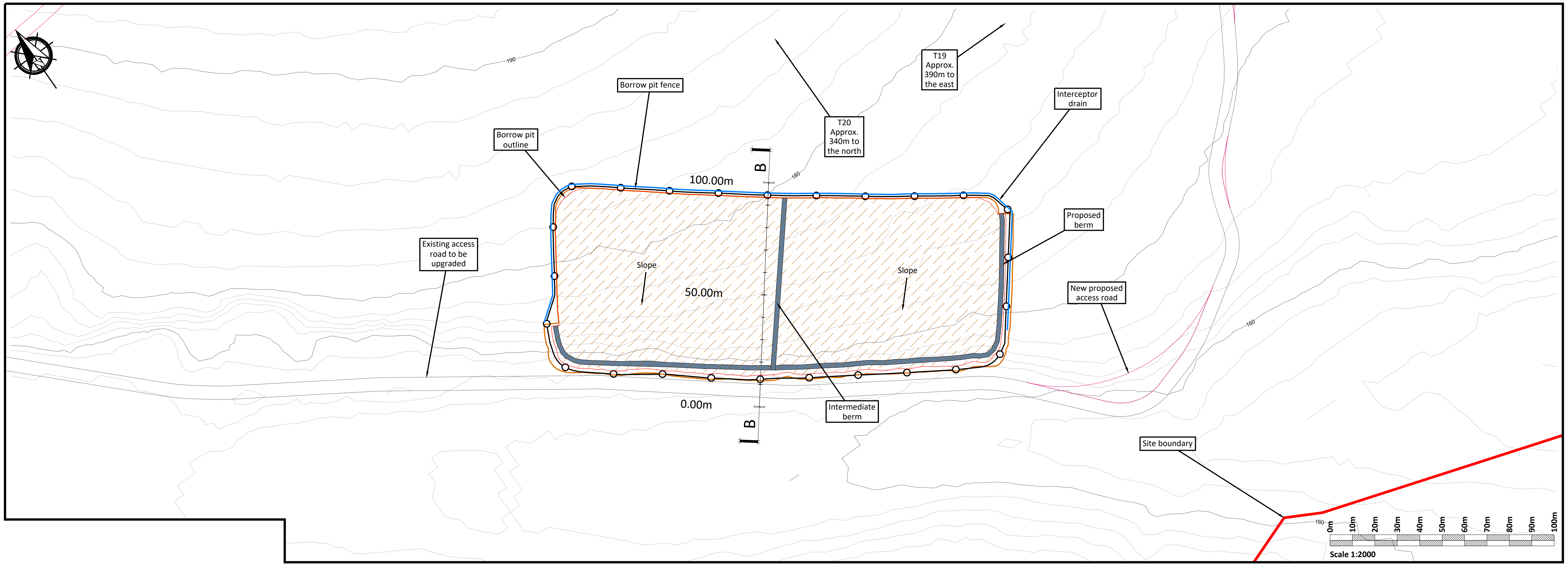
7 December 2023



PLAN

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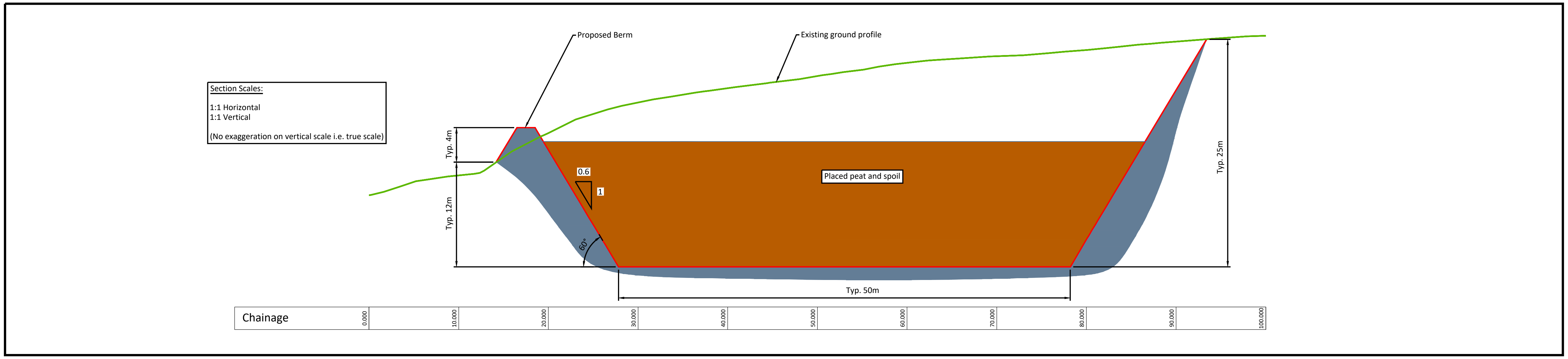

SECTION

Scale 1:500

Borrow Pit Construction Notes:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 5m (approx.) in height is likely to be required.

(5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress will be inspected and approved by the project geotechnical engineer.

(6) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability.

(7) The surface of the placed peat & spoil will be shaped to allow efficient run-off of surface water from the placed arising's.

(8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(9) All the above-mentioned general guidelines and requirements will be confirmed by the designer prior to construction.

(10) Further guidelines on the construction of the borrow pit are included within Section 7.5 of the Peat & Spoil Management Plan

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	06.10.22
B	FOR INFORMATION	BDH	27.04.23
C	FOR INFORMATION	BDH	03.05.23
D	FOR INFORMATION	BDH	30.11.23

PROJECT: GLENORA WINDFARM

CLIENT: MKO

SHEET: BORROW PIT 2 PLAN AND SECTION

Date	Project number	Scale (@ A3)	
30.11.23	P20-213		
Drawn by	Drawing Number		Rev
POR	P20-312-0600-GLEN-0010		D
Checked by			
IH			

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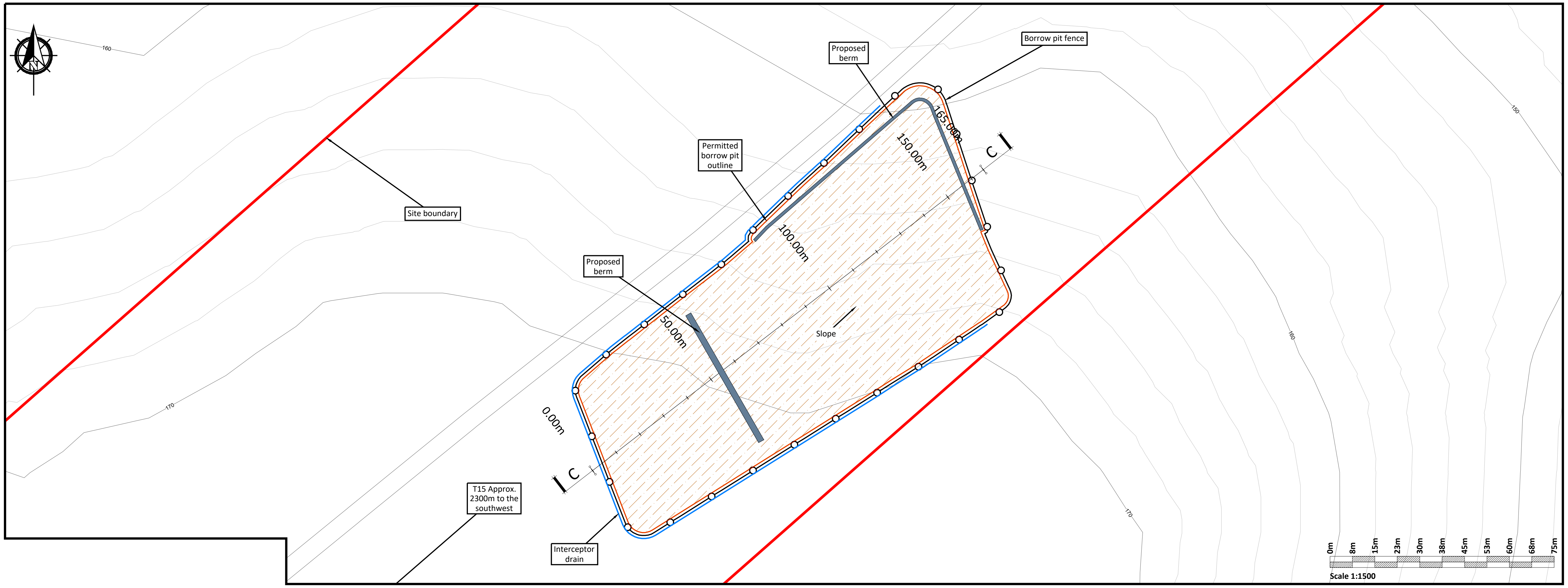
7 December 2023



PLAN
Scale 1:1500

Borrow Pit Construction Notes:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress.

(4) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed will be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 3m (approx.) in height is likely to be required.

(5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress will be inspected and approved by the project geotechnical engineer.

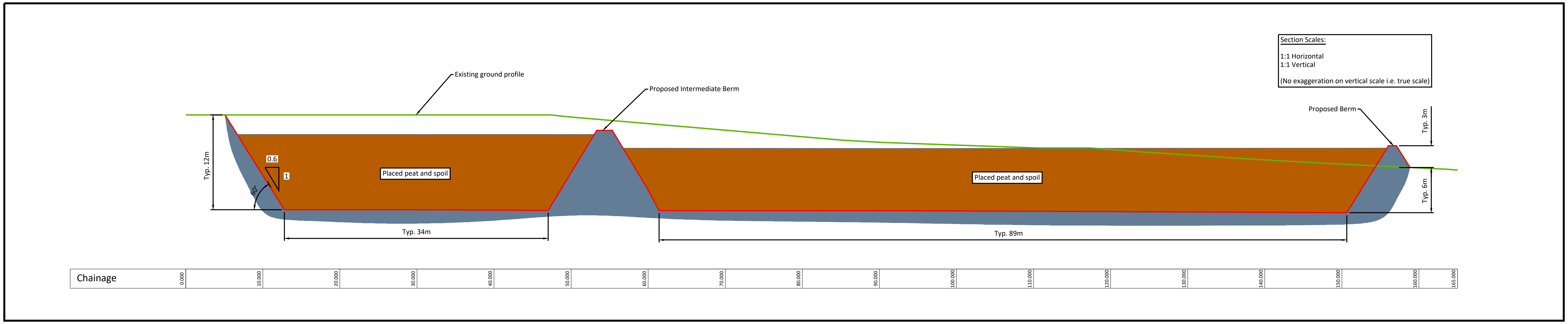
(6) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability.

(7) The surface of the placed peat & spoil will be shaped to allow efficient run-off of surface water from the placed arising's.

(8) Control of groundwater within the borrow pit may be required and measures will be determined as part of the ground investigation programme.

(9) All the above-mentioned general guidelines and requirements will be confirmed by the designer prior to construction.

(10) Further guidelines on the construction of the borrow pit are included within Section 7.5 of the Peat & Spoil Management Plan



SECTION
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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	06.10.22
B	FOR INFORMATION	BDH	27.04.23
C	FOR INFORMATION	BDH	03.05.23
D	FOR INFORMATION	BDH	30.11.23

PROJECT	GLENORA WINDFARM
CLIENT	MKO
SHEET	BORROW PIT 3 PLAN AND SECTION (OFFSITE BORROW PIT)
Date	30.11.23
Project number	P20-213
Scale (@ A3)	
Drawn by	POR
Checked by	IH
Drawing Number	P20-312-0600-GLEN-0011
Rev	D

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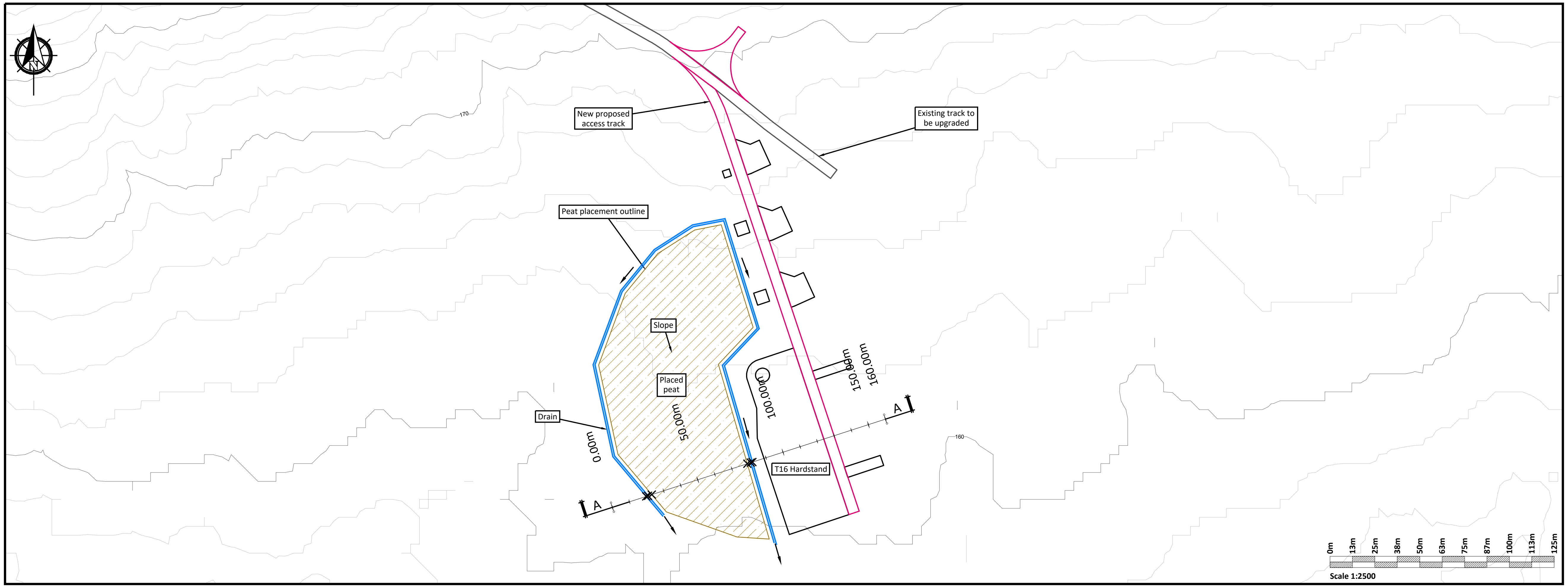
7 December 2023



PLAN

Scale 1:2500

Construction Notes Peat Storage Areas:

(1) An interceptor drain will also be installed upslope of the repository areas.

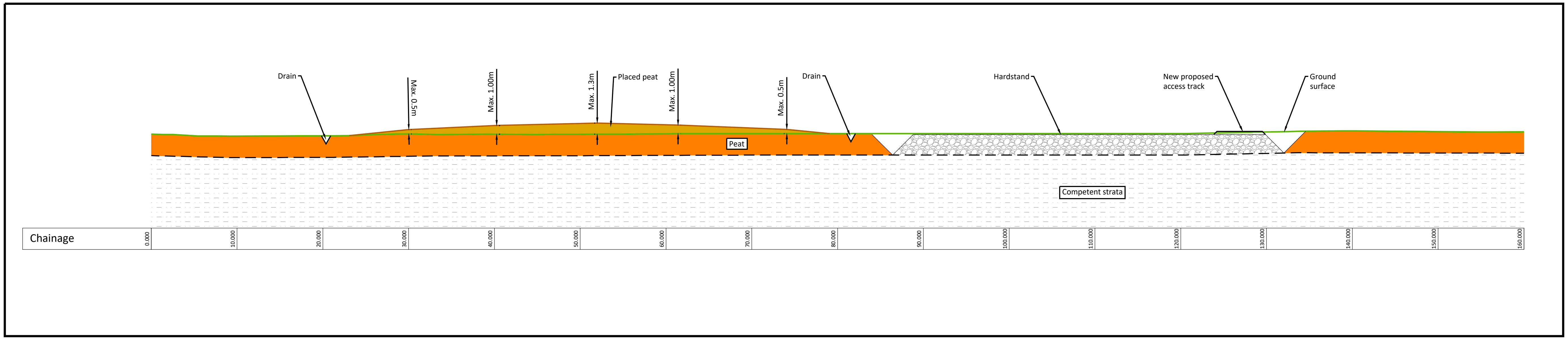
(2) A silting pond will be required at the lower side of the peat storage areas.

(3) It is important that the surface of the stored peat be shaped to allow efficient run-off of water from the stored spoil.

(4) Supervision by a geotechnical engineer or appropriately competent person is recommended for the construction of the peat storage area.

(5) All the above-mentioned general guidelines and requirements will be implemented during construction.

(6) Further guidelines on the construction of the peat storage area are included within Section 7.5 of the Peat & Spoil Management Plan.



SECTION A - A

Scale 1:500

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.05.23

PROJECT: GLENORA WINDFARM

CLIENT: MKO

SHEET: PEAT PLACEMENT WITHIN CLEAR FELL AREAS – TYPICAL DETAILS

Date	Project number	Scale (@ A3)
12.05.23	P20-213	As Shown

Drawn by	Drawing Number	Rev
POR	P20-312-0600-GLEN-0012	A

Checked by: IH

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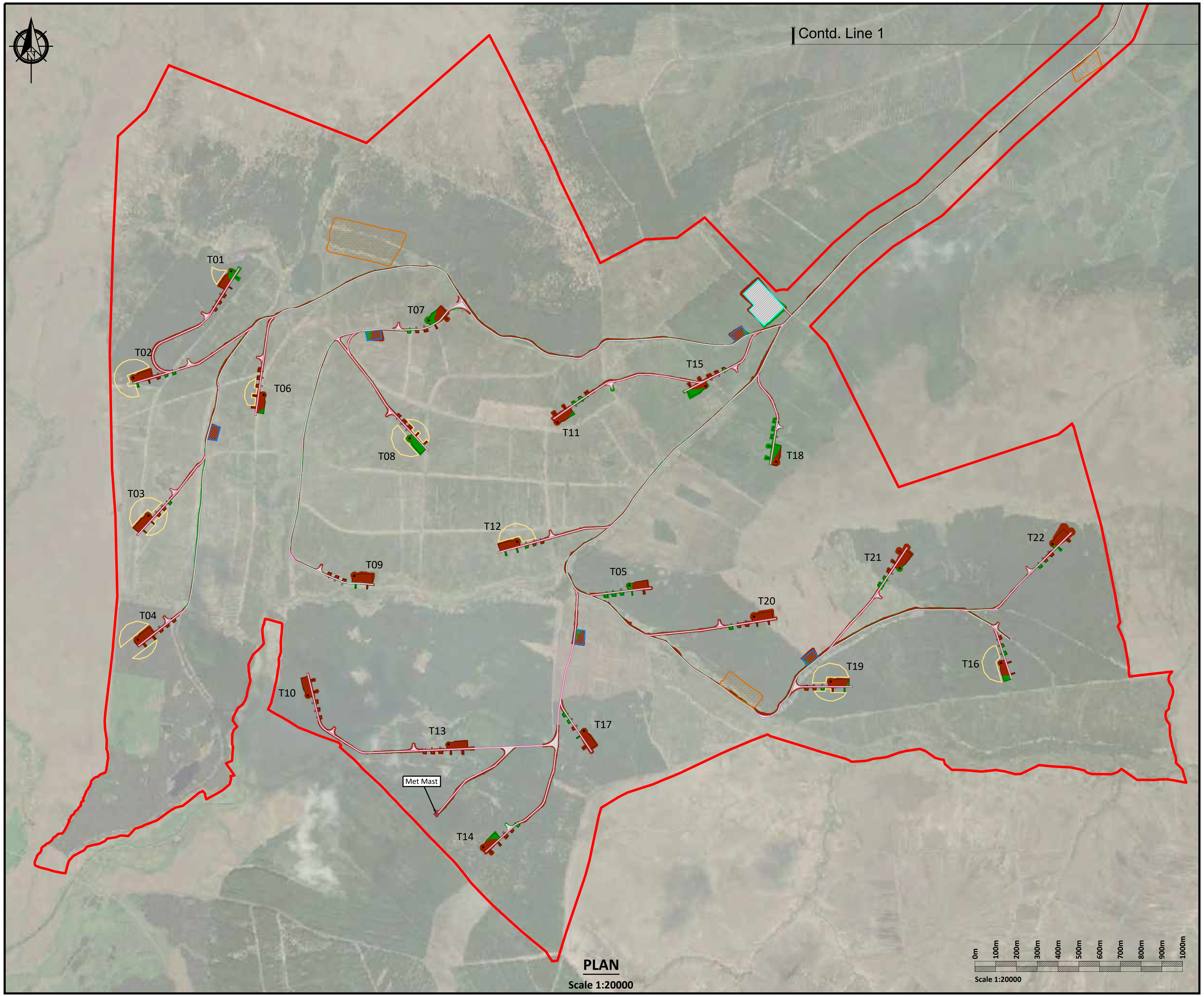
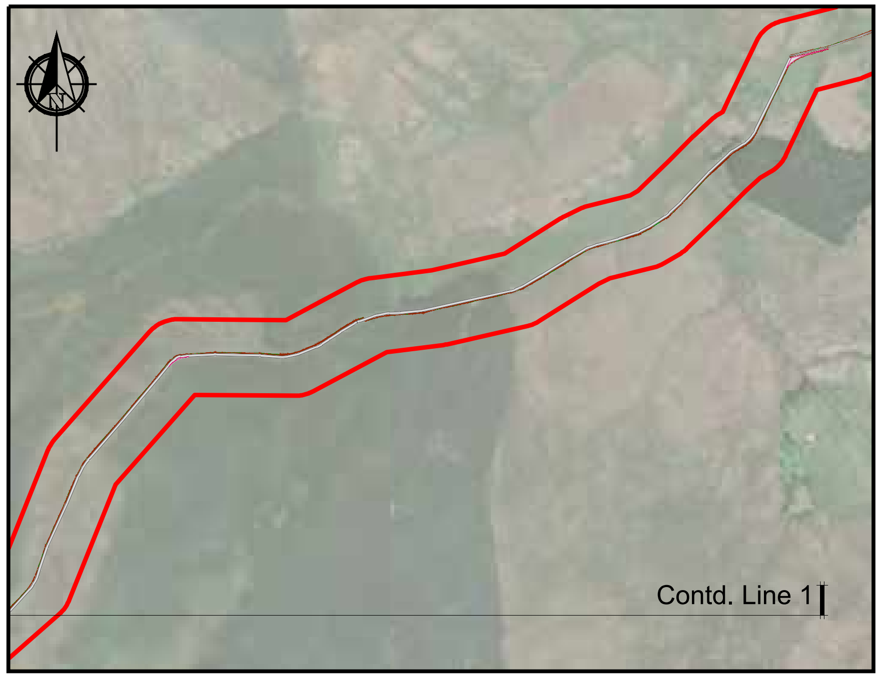
12 May 2023



PLAN

Scale 1:20000



PLAN

Scale 1:20000

Cut / Fill Legend:

- Areas of Cut
- Areas of Fill

Legend:

- EIAR Site Boundary
- Proposed Access Track
- Existing Access Track To Be Upgraded
- Existing Access Track
- Proposed Turbine
- Proposed Construction Compound
- Proposed Substation
- Proposed Met Mast
- Proposed Borrow Pit
- Proposed Peat Placement

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Rev.	Description	App By	Date
A	FOR INFORMATION	BDH	12.05.23
B	FOR INFORMATION	BDH	30.11.23

PROJECT: GLENORA WINDFARM

CLIENT: MKO

SHEET: PLAN DRAWING OF CUT FILL EARTHWORKS FOR SITE

Date 30.11.23	Project number P20-213	Scale (@ A3) As Shown	
Drawn by POR	Drawing Number P20-312-0600-GLEN-0013		Rev B
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30 November 2023

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APPENDIX A

Assumptions for Cut & Fill Earthworks Assessment

Assumptions for Cut/Fill Earthwork Assessment

Main Infrastructure Locations

Appendix A provides a summary of the main assumptions for the cut/fill earthworks assessment.

Table A1 provides a summary of the assumptions regarding the dig depths adopted for the cut/fill assessment for the main infrastructure elements at Glenora wind farm.

The assumed excavation footprint for the turbine foundation is the turbine base diameter of 25m plus 1m working room all around the base i.e., 27m.

Table A1: Summary of the dig depths at the main infrastructure locations

Turbine	Easting	Northing	Average Peat Depth for Turbines (m)	Dig depth for Turbine Foundation (m) (1)	Average Peat Depth for Crane Hardstands (m)	Max Dig depth for Associated Crane Hardstand (m) (2)
T1	502518	834923	2.12	4.0	2.12	2.4
T2	502047	834410	2.30	4.0	2.30	2.6
T3	502119	833745	2.38	4.0	2.38	2.7
T4	502069	833148	2.96	4.0	2.96	3.3
T5	504436	833410	2.50	4.0	2.50	2.8
T6	502673	834328	2.00	3.0	2.00	2.3
T7	503470	834687	1.12	3.0	1.12	1.5
T8	503379	834119	2.56	4.0	2.56	2.9
T9	503111	833456	1.54	3.0	1.54	1.9
T10	502887	832881	1.36	3.0	1.36	1.7
T11	504089	834197	1.82	3.0	1.82	2.1
T12	503894	833620	1.46	3.0	1.46	1.8
T13	503565	832645	1.58	3.0	1.58	1.9
T14	503732	832150	1.92	4.0	1.92	2.3
T15	504802	834370	0.72	3.0	0.72	1.0
T16	506225	833037	2.22	4.0	2.22	2.5
T17	504216	832709	1.92	4.0	1.92	2.4
T18	505141	834006	0.96	3.0	0.96	1.3
T19	505406	832947	2.36	4.0	2.36	2.7
T20	505036	833259	2.14	4.0	2.14	2.4

Turbine	Easting	Northing	Average Peat Depth for Turbines (m)	Dig depth for Turbine Foundation (m) (1)	Average Peat Depth for Crane Hardstands (m)	Max Dig depth for Associated Crane Hardstand (m) (2)
T21	505736	833494	1.86	3.0	1.86	2.2
T22	506474	833610	0.94	3.0	0.94	1.3
Infrastructure Element	**Easting**	**Northing**	**Average Peat Depth (m)**	**Max Dig depth for Infrastructure Element (m) (3) & (4)**		
Substation	505146	834797	0.9	1.2		
Construction Compound 1	502430	834183	1.4	1.7		
Construction Compound 2	503395	834636	1.8	2.1		
Construction Compound 3	504987	834672	1.0	1.3		
Construction Compound 4	504180	833199	2.5	2.8		
Construction Compound 5	505128	833102	2.8	3.1		
Met Mast	503515	832315	2.1	2.4		

Notes

(1) Founding depths for the turbines was assumed to be the average peat depth + 1m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. A minimum dig depth of 3m is assumed for each turbine foundation. For the purpose of this assessment, it is assumed that all turbine foundations will be gravity type founded bases i.e., no piled foundations.

(2) Founding depths for the crane hardstands was assumed to be the average peat depth + 0.3m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the crane hardstandings and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint of the hardstands, where possible.

(3) For the construction compounds and substation, the founding depth was assumed to be the average peat depth +0.3m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation. In areas of steeper terrain (say greater than 10% gradient), for the compounds and substation platform and for the purpose of this assessment, it was endeavoured to balance the earthworks for the footprint of the platforms, where possible.

(4) For the met mast the founding depth was assumed to be the average peat depth +1.0m to a competent stratum. To be confirmed at detailed design stage following confirmatory ground investigation.

(5) Note the maximum dig depths stated in the Table above are indicative and for information purposes only and are subject to confirmation at detailed design stage following a confirmatory ground investigation.

Access Roads

The following assumptions for the cut/fill assessment are given in relation to the access roads.

- Typical gradient requirements from turbine suppliers were assumed for the cut & fill assessment i.e., maximum gradients of 10 to 12%. A maximum gradient of 12% has been assumed for straight sections of access road on site.
- For the purpose of the assessment, it is assumed that the existing access tracks on site are 4m in width.
- There are 3 types of access tracks/roads proposed/present on site, which include:

- Existing excavated and replace type access tracks - some excavation works as a result of localised widening will be required. It is assumed that widening will typically take place on both sides of the road. In areas of side long ground/steeper terrain (say greater than 5% gradient), widening of existing tracks will take place on the upslope side of the road. Assumed dig depth to competent strata for both cases are 0.3m below the base of the peat.
- New proposed excavate & replace type access roads – excavation work will be required. Assumed dig depth to competent strata was 0.3m below the base of the peat.
- New proposed floating roads – no excavation will be required.

Borrow Pits

The cut/fill assessment for the borrow pits is based on the cross-section drawings (Drawings P20-312-0600-GLEN-0009 to 0011) included in this report. The borrow pits were sized to allow for the reinstatement of the excavated peat volume generated on site and to accommodate the estimated site-won stone fill requirements.

General Assumptions

A 1(v): 1(h) configuration for all excavation faces was assumed for the cut & fill earthworks assessment, except for excavations in rock at the borrow pit where a configuration of 1(v): 0.7(h) i.e., 60 degrees was assumed.

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APPENDIX B

Borrow Pit Example

Example of Borrow Pit backfill.

Construction of Seecon Wind Farm (part of Galway Wind Park) commenced construction in 2015. The majority of crushed stone required for the construction of the development was obtained from on-site borrow pits. The borrow pits, following the extraction of the necessary volume of rock, then became peat repositories. As per the proposed methodology for the restoration of the borrow pits within the Proposed Development, rock buttresses were constructed on the downslope edge of the borrow pits to safely retain the infilled peat and spoil. The buttresses were up to 6m in height when complete.

Peat and spoil material, excavated as part of the Seecon Wind Farm development, was placed within the borrow pits up to 1m below the top of the buttress. Plate 1 below shows one of the Seecon Wind Farm borrow pits following extraction of all of the required rock and the downslope edge buttress under construction (c. 2016). Plate 2 then shows the same borrow pit in November 2023. Over the intervening 7 years, the peat and spoil within the borrow pit has significantly reduced in volume as the water within the infilled material has gradually drained away. The surface of the infilled material is now approximately 3-4m below the top of the buttress. Significant revegetation of all of the surface of the infilled material and the rock buttress has also occurred. Both the drainage and revegetation will significantly increase the stability of the infilled material. This has occurred due to the implementation of the correct buttress construction methodology and drainage measures, as will be implemented as part of the Proposed Development.

This example is evidence of the suitability of borrow pits, with downslope buttresses, as permanent peat and spoil repositories.

Plate 1: Borrow Pit prior to backfilling (c.2016).

Plate 2: Borrow Pit following backfilling (image taken in 2023).

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APPENDIX 4

BIRD IMPACT ASSESSMENT REPORT

(NOTE: ALL FURTHER APPENDICES REFERRED TO IN THIS APPENDIX ARE INCLUDED IN EIAR VOLUME 3B APPENDIX 7-1)

MWP

Bird Impact Assessment Report

Glenora Wind Farm, Glenora, Co. Mayo.

SSE Renewables Ireland Limited

December 2023

Contents

Tables

Figures

Appendices

Project No.	Doc. No.	Rev.	Date	Prepared By	Checked By	Approved By	Status
21424	6005	B	13/12/23	HD, DO'B, BM	ÚW	ÚW, HD	FINAL

MWP, Engineering and Environmental Consultants
Address: Reen Point, Blennerville, Tralee, Co. Kerry, V92 X2TK
www.mwp.ie

1. Introduction

Consent is being sought by Glenora Wind Farm DAC (the "Applicant"), which is a joint venture between SSE Renewables Ireland Limited (SSE) and FuturEnergy Ireland, from An Bord Pleanála (ABP) (the competent authority), for the development of a 22 No. turbine wind development and associated works in Glenora and adjacent townlands, near the village of Ballycastle, County Mayo (the "Proposed Development''), as described in more detail in Chapter 4 of the Environmental Impact Assessment Report (EIAR), being prepared by McCarthy Keville O'Sullivan (MKO) Planning and Environmental Consultants.

Malachy Walsh and Partners (MWP) Engineering and Environmental Consultants undertook ornithological surveys of the proposed wind farm site on behalf of SSE on a monthly basis between April 2019 and March 2023. MWP were commissioned by SSE to prepare a Bird Impact Assessment Report (BIAR) which has been used by MKO in the preparation of the Ornithology chapter of the EIAR for the Proposed Development.

This BIAR describes the avian ecology of the ornithological study area, defined as the proposed wind farm site, as shown in Figure 1 and Figure 2 below and on all accompanying mapping appended, and the surrounding area, extending outwards to 500 m, to account for birds potentially affected by the proposed wind farm development (refer to Section 1.1 below). Relevant mapping, including the proposed wind farm site boundary, was provided by SSE at the outset and throughout the project.

The aim of this impact assessment is to assess whether the proposed wind farm development is likely to result in significant effects on those bird species considered to comprise potential avian receptors of the proposed wind farm development. Where potential impacts are identified, mitigation measures have been developed to avoid or reduce significant effects. This assessment is based on a desktop study including published literature, and on ornithological surveys completed consecutively at the ornithological study area over the four-year period from April 2019 to March 2023, inclusive.

This BIAR includes descriptions and results of all bird surveys undertaken by MWP during this timeframe, comprising the following survey periods:

- Summer 2019
- Winter 2019/2020
- Summer 2020
- Winter 2020/2021
- Summer 2021
- Winter 2021/2022
- Summer 2022
- Winter 2022/2023

Areas designated for nature conservation under Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (as amended) (the EU Habitats Directive) and Council Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the EU Birds Directive) (otherwise known as European Sites) have been considered in a standalone Screening for Appropriate Assessment report and Natura Impact Statement (NIS) report, both prepared by MKO and included as part of this planning application.

1.1 Scope of Assessment

This report comprises an ecological impact assessment of the proposed wind farm development focusing on avian species which may be potentially affected. The process will determine whether the site's avian fauna will be subject to impacts arising from the proposed wind farm development and will then characterise these impacts and their effects in terms of significance.

The report is set out as follows:

- Section 2 describes the methodology used to collect information on the avian features of the proposed wind farm site and surrounds (features may comprise species or protected sites of ornithological interest).
- Sections 3.2 to 3.4 describe the avian features considered to be within the Zone of Influence (ZOI) of the proposed wind farm development.
- Section 3.5 identifies and selects those features considered to comprise receptors upon which impacts ensuing from the proposed wind farm development are likely. These are referred to as Important Ecological Features (IEFs).
- Section 4 identifies the potential direct, indirect and cumulative impacts of the proposed wind farm development that are probable or likely to occur during its lifetime and assesses whether said impacts are likely to result in significant direct, indirect or cumulative effects upon the IEFs.
- Section 5, where necessary, proposes mitigation and monitoring measures to remove or reduce those impacts.
- Section 6 assesses the residual ecological effects of the proposed wind farm development (those remaining after mitigation).

The ZOI for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities (CIEEM, 2019). The ZOI of the proposed wind farm development was established using professional judgement and relevant information including details of the project's extent and characteristics, the desk study and field survey results, Scottish Natural Heritage (SNH) (2016) guidance for establishing connectivity with Special Protection Areas (SPAs), and CIEEM (2019) and EPA (2022) guidance. The ZOI differs between different ecological receptors and is generally considered to extend out to a 500 m distance around the proposed wind farm site, out to a maximum of 2 km in the case of some species.

Features of avian significance occurring or likely to occur within the ZOI of the proposed wind farm development were considered as potential IEFs. These are the important features that could potentially be affected by the proposed wind farm development and should be subject to detailed assessment (CIEEM, 2019). IEFs were considered to be bird species identified as important based on results of the ornithological surveys completed within the study area over the four-year survey period (April 2019 – March 2023, inclusive), as well as designated sites for nature conservation which support important bird populations.

This report quantifies any potential impacts relating to these IEFs and identifies any measures required to avoid, reduce and mitigate likely significant effects. Identification of effects and prescribed mitigation has been derived following a collaborative approach working with a multi-disciplinary team including ornithologists, ecologists, and project engineers. The results of the ornithological surveys have been utilised to inform the design of the project, thereby minimising potential effects on avian ecology and sensitive habitats.

The information provided in this report describes the baseline ornithological environment; provides an accurate prediction of the potential impacts on identified IEFs from the proposed wind farm development; prescribes mitigation where necessary; and describes the residual effects on avian ecology.

1.2 Legislation and Guidance

The most important legislation underpinning biodiversity and nature conservation in Ireland are the:

- Wildlife Acts 1976 to 2021 (as amended)
- European Union Habitats Directive
- European Union Birds Directive
- European Communities (Birds and Natural Habitats) Regulations 2011 to 2015 (as amended)
- Planning and Development Act (2000) (as amended)
- Planning and Development Regulations 2001 to 2022 (as amended)

The impact assessment was undertaken in accordance with the recent EPA best-practice guidance 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2022).

The following other guidance documents and relevant publications were also considered:

- Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species (NatureScot, 2022)
- Birds of Conservation Concern in Ireland 4: 2020 – 2026 (Gilbert *et al*., 2021)
- Guidance document on wind energy developments and EU nature legislation. Guidance document (European Commission, 2020)
- Guidelines for Ecological Impact Assessment in the UK and Ireland - Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2019)
- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009)
- European Commission Guidance on the preparation of the Environmental Impact Assessment Report (EC, 2017)
- Best Practice Guidelines for the Irish Wind Energy Industry (Irish Wind Energy Association, 2012)
- Recommended bird survey methods to inform impact assessment of onshore wind farms. Scottish Natural Heritage (SNH, 2017)
- Assessing Connectivity with Special Protection Areas (SPAs). Scottish Natural Heritage (SNH, 2016)
- Assessing the Cumulative Impact of Onshore Wind Energy Developments. Scottish Natural Heritage (SNH, 2012)
- Assessing Significance of Impacts from Onshore Windfarms on Birds Outwith Designated Areas (SNH, 2006)
- Birds and wind farms in Ireland: a review of potential issues and impact assessment (Percival, S. M., 2003).

1.3 Site Location

The proposed wind farm site is located in northwest County Mayo, approximately 6.2 km southwest of Ballycastle and 17 km northwest of Crossmolina. Access to the site is via a local road and existing forestry roads/tracks linked to the Regional R314 Road from Ballycastle which is the closest centre of population (see **Figure 1** below). The proposed wind farm site comprises mainly commercial forestry surrounded by peatland habitats.

Figure 1. Location of proposed wind farm development site (BIAR site)

1.4 Description of the Development

The proposed wind farm development comprises the construction of 22 No. wind turbines and all associated works. The proposed turbines will have a blade tip height of 180 metres above the top of the foundation. The applicant is seeking a ten-year planning permission. The full description of the Proposed Development as per the public planning notices, is as follows:

1. Construction of 22 no. wind turbines and all associated hardstand areas with the following parameters:
   a) A total blade tip height of 180 m,
   b) Hub height of 99 m, and
   c) Rotor diameter of 162 m.
2. 1 no. permanent Meteorological Anemometry Masts with a height of 99 m and associated hardstanding area;
3. Upgrade of existing tracks and roads, provision of new permanent site access roads, and upgrade of 1 no. existing site entrance including the provision of 1 no. security cabin with automatic traffic barriers;

4. Temporary widening of sections of public road in the townland of Ballyglass;
5. The provision of a new temporary roadway in the townland of Ballyglass to facilitate the delivery of turbine components and other abnormal loads;
6. 1 no. wind farm operation and maintenance control building in the townland of Glenora;
7. 3 no. borrow pits.
8. 13 no. permanent peat placement areas.
9. 5 no. temporary construction compounds with temporary site offices and staff facilities;
10. Permanent recreation and amenity works, including marked trails, seating areas, amenity car park, and associated amenity signage;
11. Site drainage;
12. Site Signage;
13. Ancillary forestry felling to facilitate construction and operation of the proposed development;
14. All works associated with the habitat enhancement and biodiversity management within the proposed wind farm site;
15. All associated site development works and ancillary infrastructure.

This application is seeking a ten-year permission and 35-year operational life from the date of the development's commissioning.

The layout of the proposed wind farm development has been led by consideration of constraints and facilitators, thereby avoiding the environmentally sensitive parts of the site. The roads layout for the proposed wind farm development maximises the use of the existing onsite access roads and tracks where possible, with approximately 15.4 km of existing roadway/tracks requiring upgrading and approximately 10.5 km of new access road to be constructed.

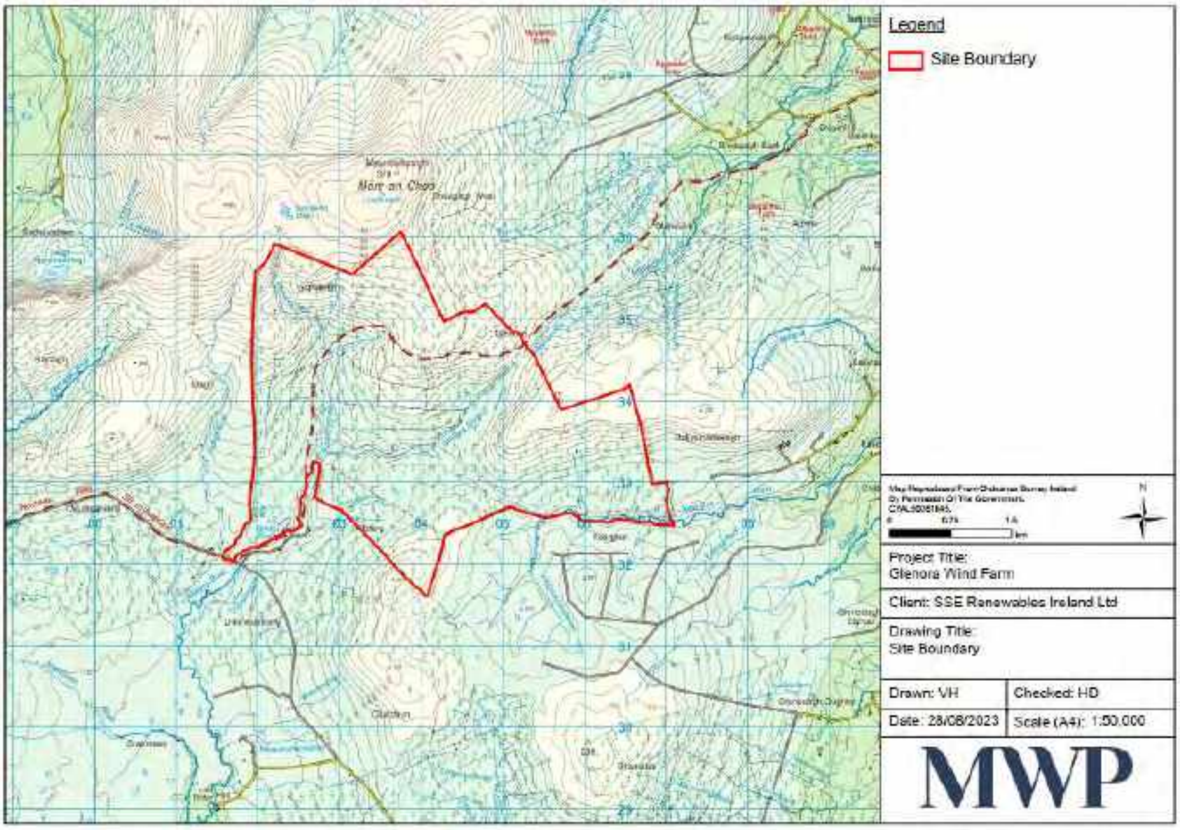

Figure 2. Proposed wind farm development site boundary (BIAR site boundary)

It is intended to construct a 110 kV substation within the site and to connect this to the existing Tawnaghmore 110 kV substation, located 14 km southeast of the intended on-site substation location, in the townland of Bellacorick. The intended grid connection route will be via underground cabling located within existing forestry tracks, local county roads and national secondary roads. The cabling route measures approximately 26 km in total.

The majority of the area encompassed within the proposed wind farm site boundary (BIAR site boundary) is currently used for commercial forestry, a small proportion of which will be felled to accommodate the proposed wind farm. A total area of approximately 116 hectares of commercial forestry will require replacement elsewhere in the State, subject to licence.

1.5 Consultation

A consultation exercise was undertaken by MKO with regard to the Proposed Development. **Table 1** below provides a list of the organisations consulted by MKO and notes where responses have been received.

Table 1. Scoping response summary (Source: MKO)

No.	Consultee	Response to Consultation
1	BirdWatch Ireland	No response received
2	National Parks and Wildlife Service (data request for protected and threatened species records for hectads F92 and G03)	Response to data request received 31st December 2021
3	Irish Raptor Study Group	No response received

No.	Consultee	Response to Consultation
4	Irish Wildlife Trust	No response received
5	Irish Red Grouse Association	No response received

As part of the scoping response received from the Department of Tourism, Culture, Arts, Gaeltacht, Sports and Media Development Application Unit (DAU), target species identified for the site included Annex I (Birds Directive) species and Birds of Conservation Concern (BoCCI) such as hen harrier, merlin, Greenland white-fronted goose (Bog of Erris flock), golden plover and red grouse, with reference made to other species of note recorded in the area such as snowy owl and golden eagle.

A pre-planning meeting was held between MKO, SSE and NPWS on the 24th of September 2021. During the meeting, the NPWS made reference to potential effects on merlin (*Falco columbarius*) should there be a requirement for pre-construction tree felling (please refer to **Section 4.2** and **Section 5**). They also emphasised the importance of acquiring bird data, pre and post construction, from other nearby wind farm projects (please refer to **Section 3.2.8**). A second pre-planning meeting was held with NPWS on the 24th January 2022, attended by MKO, SSE and MWP. During this meeting, merlin and other raptor species were discussed.

1.6 Statement of Authority

This report has been prepared by Hazel Dalton (BSc., BBus.), Senior Ecologist with MWP, and Deirdre O' Brien (BSc.), Ecologist with MWP, together with Brian Madden (BA. Mod., Ph.D., MCIEEM) of BioSphere Environmental Services, who completed the impact assessment and mitigation sections (**Sections 4, 5, 6** and **7**).

Hazel is a Senior Ecologist with over eight years' experience with MWP since graduating in 2015, having worked with the company on a periodic part-time basis prior to graduating. She has experience in ecological surveying and impact assessment for both Appropriate Assessment (AA) and EIA and has authored and contributed to numerous screening reports for AA, Natura Impact Statements (NIS) and Ecological Impact Assessment (EcIA) reports. She has completed assessments for a wide variety of projects including for renewable energy, infrastructure, coastal development, and other development projects. She is an experienced field ecologist and has a diverse ecological survey profile including for habitats and flora, mammals and birds.

Deirdre has been working with MWP since 2018 and on a full-time basis since 2019. During that time, she has carried out field surveys for flora and invasive species, birds and freshwater macroinvertebrate sampling and identification, including for freshwater pearl mussel. She has been formally trained in Stage 1 and Stage 2 freshwater pearl mussel Surveying (Dr. Evelyn Moorkens). She has also gained experience in standard field survey methodologies including mammal surveying and habitat mapping. She has acquired experience in the completion of AA screening reports, NIS reports and EcIA. She has experience with general ecological report writing, has completed numerous reports for bird survey work and is experienced in collation of survey data.

Brian graduated in Natural Sciences from the University of Dublin in 1984 and earned a Ph.D. degree in 1990 from the National University of Ireland for his research on ecosystem processes in raised bogs. Since 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 peatland 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. Brian has been the lead ecologist on the Oweninny Wind Farm Project since 2010.

This report was internally reviewed by Úna Williams (BSc., MSc.), Ecologist and Environmental Scientist with MWP. She is experienced in various ecological field survey methodologies including habitat mapping and zoological surveys and has spent time carrying out ecological research in Costa Rica and in Seville. She has undertaken assessments for a wide variety of projects including for renewable energy developments, and infrastructural and coastal development projects. Úna has carried out numerous Collision Risk Models and has completed many ecological reports including screening reports for AA, NIS reports, EIA and EcIA.

The field surveys were designed by John N. Murphy (former Project Ornithologist with MWP and consultant Senior Ornithologist). Field surveyors involved in the project included Páidi Cullinan, Shane Cully, Austin Cooney, John Collins, Luíse Ní Dhonnabháin, Joe Kelly, Stan Nugent and Frank Connelly.

The reliability of survey work is dependent upon the observers used to collect the underlying information. The surveyors used have the relevant competence, experience and expertise to carry out the surveys, as evidenced by their profiles included in **Appendix 1**.

2. Methodology

2.1 Scientific Nomenclature: Conventions

Species nomenclature follows the standard form of the common name, followed by the binomial, on the first instance of usage in the text or the first instance of usage in a table. Thereafter, for any subsequent usage, common names only are used.

2.2 Desktop Study

In 2019, an initial desktop study was carried out by MWP prior to the commencement of the field surveys. This was supplemented by further desktop studies undertaken during the preparation of the various bird survey reports prepared by MWP for the proposed wind farm development.

A comprehensive desk study was undertaken by MKO in February 2022 (updated January 2023) in relation to preparation of the BIAR for the proposed wind farm development to search for any relevant information on species of conservation concern that may potentially make use of the proposed wind farm site. The MKO desk-top assessment included a thorough review of available ornithological data and included a review of specially requested records from the NPWS Rare and Protected Species Database. This desk-top study was provided by MKO and was used in the preparation of this report.

The desktop studies provided the opportunity to gain an understanding of the bird populations' potentially occurring via an investigation of the habitats present and previous species records. The desktop study area included the lands encompassed within and surrounding the proposed wind farm development site, as well as areas that are geographically distant from the site but whose avian interests may be indirectly affected by the various phases of the proposed wind farm development from construction through to decommissioning.

As part of the desk-top studies undertaken, available ornithological information and data was reviewed, including:

- Ordnance Survey Ireland (OSI) aerial photography and 1:50000 mapping, and other sources of online aerial imagery
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), National Biodiversity Data Centre (NBDC)
- Review of Bird Atlases: (Sharrock, 1976; Lack, 1986; Gibbons *et al.*, 1993; Balmer *et al.*, 2013)

- Review of Birds of Conservation Concern in Ireland (BoCCI) 2020-2026 (Gilbert *et al*., 2021), and Birds of Conservation Concern in Ireland (BoCCI) 2014-2019 (Colhoun & Cummins, 2013)
- Review of BirdWatch Ireland I-WeBS (Irish Wetland Bird Surveys) site information
- General ornithological information available from BirdWatch Ireland (www.birdwatchireland.ie)
- Review of the 2015 National Survey of Breeding Hen Harrier in Ireland Report (Ruddock *et al*. 2016)
- Other information sources and reports footnoted throughout the report

2.3 Criteria for Identifying Target Species

A reconnaissance survey was undertaken by the Project Ornithologist prior to the commencement of bird surveys to review the habitats at the proposed wind farm site and the general landscape character of the study area in the context of its potential ornithological importance.

The results of the comprehensive desk-top study, in conjunction with the site reconnaissance surveys, were used to identify target bird species which were considered likely to occur within the ZOI of the proposed wind farm development. Target species are typically those species which are afforded a higher level of legislative protection or are considered to be more sensitive to potential impacts from wind farm developments by virtue of their behaviour (SNH, 2017). Target species should be restricted to those likely to be affected by wind farms (SNH, 2017).

With regards to drawing up the target species list for Glenora, the SNH (2017) guidance was followed. This guidance outlines important sources of potential target species.

In conjunction with the findings of the desk-top study, the target species list was drawn from:

- Annex I of the EU Birds Directive
- Red-listed birds of Conservation Concern (Gilbert *et al*., 2021; Colhoun & Cummins, 2013)
- Other species generally considered more sensitive to potential impacts from wind farms (such as species of raptor - buzzards, eagles, falcons, harriers, hawks, kites, osprey, owls (protected under the Fourth Schedule of the Wildlife Acts 1976-2021, as amended).

The target species formed the main focus of the bird surveys undertaken. To ensure other species which may potentially be sensitive to wind farms were not missed during surveys, all other species of gull, wader, duck, diver, goose, swan, cormorant and heron not included as target species were included as secondary species, and flight activity data recorded where it did not infringe on the collection of target species data.

It is generally considered that passerine species are not significantly impacted by wind farms (SNH, 2017); however, counts of passerines seen/heard during VP surveys were recorded to provide a complete picture of bird usage of the site.

Please refer to **Section 3.2.14** for the list of target species for the proposed wind farm development.

2.4 Field Surveys

Initial reconnaissance walkovers of the site were carried out to assist in determining the required scope and extent of the ornithological surveys.

Field surveys were undertaken to gather detailed information on bird distribution and flight activity to assist in predicting the potential effects of the proposed wind farm development on local bird populations.

The field surveys comprised two main elements: vantage point (VP) watches to gather flight activity data for target species (refer to Section 2.4.1 below), and distribution and abundance surveys to gain an understanding of bird species occurring in the area which may be subject to impacts from the proposed wind farm development (refer to Section 2.4.2 below).

2.4.1 Vantage Point (VP) Surveys

VP surveys were carried out in accordance with the SNH guidance document '*Recommended bird survey methods to inform impact assessment of onshore wind farms*' (SNH, 2017). The overall aim of these surveys was to quantify the level of target species flight activity within the flight activity survey area which was taken to be that area encompassing the proposed wind farm site extending out to a distance of 500 m beyond the site boundary.

SNH (2017) recommends a minimum 2-year survey period comprising 72 hours per VP location divided between seasons (36 hours breeding and 36 hours non-breeding) per year. VP surveys were undertaken on a monthly basis by qualified personnel for the winter and breeding seasons encompassed in the 4-year period April 2019 to March 2023, inclusive. The recommended minimum 36 survey hours were generally achieved at each VP location in each season during the overall 4-year survey period. Overall, the minimum total number of VP hours recommended by SNH (2017) was achieved at all VPs.

Please refer to Appendix 3 for more detailed information on VP survey effort.

2.4.1.1 Selection of VP Locations

To achieve maximum visibility of the site, VPs should ideally be located on elevated areas or other locations that provide clear views over the survey area.

To minimise observer effect on bird behaviour, VPs are best located outside the survey area where feasible; however, since detection of flight activity decreases with distance, VPs should be located as close to the survey area as possible. SNH (2017) stipulates that if VPs are located within the survey area, they should not be used simultaneously with other VP's which overlook them to minimise potential observer effect on bird behaviour. According to SNH (2017), VP viewsheds should extend out to a maximum distance of 2 km, the full extent of which should be readily viewed using a telescope.

VP locations were selected to provide maximum site coverage. Seven VP locations were selected and surveyed over the course of the winter and breeding seasons. The Irish Transverse Mercator (ITM) grid co-ordinates for each VP location are provided in Table 2 below. Maps showing the locations of each VP and the viewsheds from each VP in order to show the extent of site coverage are provided in Appendix 2. A summary of survey effort at individual VPs, including survey dates, times and weather conditions can be found in Appendix 3.

Table 2. VP locations

Vantage Point	ITM Grid Coordinates
1	501874 833565
2	503387 834934
3	504150 834475
4	505610 832136
5	507221 832235
6	503674 835781
7	505664 834300

2.4.1.2 Viewshed Analysis of VP Locations

Viewshed analysis was undertaken for each VP location to determine visual coverage of the survey area. Viewsheds were set to observer height of 1.6 m and a target height of 25 m. Viewsheds encompassed a 2 km radius with a 360-degree view. Each viewshed was then cropped to a 180-degree arc showing the relevant direction of view. VP viewshed extents were confirmed by surveyors as part of a ground truthing exercise. 92% of the current proposed turbine layout plus 500 m radius buffer around turbines is encompassed within the VP viewsheds (please also see Section 2.9.2 below). Viewsheds from each VP showing the extent of site coverage are provided in Appendix 2.

2.4.1.3 Flight Data Recording

During VP surveys the flight behaviour of target species was recorded. Based on the precautionary principle, flight behaviour of secondary species was also recorded; however, recording of secondary species was subsidiary to recording of target species (SNH, 2017). At the time of observation, the following information was recorded for each species:

- The time the bird was detected
- The flight direction and duration (seconds) within various flight height categories
- Sex and age of the bird(s) (adult/juvenile), where possible to determine
- Type of activity/behaviour such as hunting, flying, displaying, etc
- Estimation of actual flight height
- Habitat(s) in which the bird was observed
- Weather conditions at time of sighting including wind speed, direction, degree of visibility.

Once an initial sighting was made, each target or secondary species was observed until lost from view. Flight paths were recorded as they were observed, including where birds travelled to or if observed outside of the flight activity survey area; such that all flight activity within the broader landscape was encompassed.

This information is provided in tabulated format in Appendix 4. A unique map identifier code was assigned to each target/secondary species which corresponds to a mapped flight path. All flight paths are provided in Appendix 5.

2.4.1.4 Recording of Other Species

During the VP surveys, counts of non-target/secondary species were also recorded where recording did not infringe on recording of target/secondary species flight data. Monthly peak counts of all non-target/secondary species of conservation concern recorded during VP surveys are provided in Appendix 6.

2.4.2 Distribution and Abundance Surveys

A variety of distribution and abundance surveys were carried out to record numbers and distributions of local and migrant bird species using the site or surrounding area that might be affected, either directly or indirectly, by the proposal.

The project ornithologist and survey team decide the most suitable surveys to employ at a site in terms of site conditions and habitat diversity. This, in combination with the results of the desktop studies, informed the bird survey scope and approach taken for the distribution and abundance surveys at the study area.

The targeted distribution and abundance surveys undertaken comprised the following elements:

Breeding Season (April to September)

- Transect and Point Count surveys
- Walkover surveys
- Nocturnal Surveys
- Hinterland Surveys

Winter Season (October to March)

- Transect and Point Count surveys
- Walkover surveys
- Hinterland surveys

2.4.2.1 Breeding Season

2.4.2.1.1 Transect Surveys with Point Counts (within BIAR Site)

A transect survey is a survey along a defined route. The overall aim of the transect surveys was to assess the breeding distribution of target species, including breeding waders and raptors, and gather data on usage of the area encompassed within the proposed wind farm site boundary. Data was also recorded with regard to non-target species to capture abundance information on general breeding bird distribution within the wind farm development area. The methodology was broadly based on methods described in Bibby *et al*., (2000) and Gilbert *et al*., (1998).

Transects were completed on a monthly basis during the breeding season period for the first two years of surveys, as set out in **Table 3** below. Following the collection of two full years of monthly transect data (see also **Table 8** below with regard to winter season transect surveys) and having regard to the low numbers of target species recorded on a monthly basis within the wind farm site during both 2019 and 2020 (see **Section 3.3.1** and **Appendix 8** for transect results), the frequency of transect surveys was reduced and they were subsequently completed on a rotational basis comprising three months per breeding season for both 2021 and 2022, as set out in **Table 3** below. This revised approach was replicated for the 2021/22 and 2022/23 winter season transects (see **Section 2.4.2.2.1** below).

Table 3. Breeding transects survey months within BIAR Site (2019 - 2022)

Survey Period	Corresponding Transect Survey Months
Breeding 2019	April, May, June, July, August and September 2019
Breeding 2020	May*, June, July, August and September 2020
Breeding 2021	April, June and August 2021
Breeding 2022	June, July and September 2022

*May 2020 transects were done twice to account for transect surveys missed in April, due to Covid-19 restrictions

Transect surveys were completed within the proposed wind farm site boundary using two separate transect routes (A & B) which utilised the existing internal forestry access road network within the site (see **Appendix 2** for mapped transect routes). The transect routes were selected to provide representative coverage of all habitats, both open and closed, occurring within the proposed wind farm site boundary, comprising mainly mature forestry and clearfell.

Counts of all bird species seen or heard, typically within 100 m of the transect routes, were recorded, although the topography of the landscape often allowed for detection of birds at greater distances. Where target and/or secondary species were recorded, areas of activity and general behaviour was noted/mapped.

Birds were also surveyed during each transect using point count (PC) methodologies. Point count locations were sited at 500 m to 600 m intervals along the overall length of each transect route. Transect A encompassed ten PC locations (PC1- PC10) and Transect B encompassed five PC locations (PC1- PC5).

Details on each individual transect survey carried out including survey date, time and weather conditions can be found in Appendix 7. Tabulated results of peak counts for all target species and all other species recorded during transect and point count surveys are provided in Appendix 8.

2.4.2.1.2 Breeding Season Walkover Surveys (within 500 m survey area around BIAR Site)

Breeding season walkover surveys were undertaken to determine the presence of target species within areas of potentially suitable breeding habitat within the 500 m survey area buffer surrounding the proposed wind farm site. The methodologies were broadly based on methods described in Bibby *et al*., (2000) and Gilbert *et al.,* (1998).

Breeding season walkover routes encompassed areas of potentially suitable habitat, comprising open bog, occurring within the 500 m buffer surrounding the site. A total of two different survey routes (A & B) were utilised over the course of the overall breeding season survey periods (summer 2019 to summer 2022). Route A encompassed the open bog extending north and west from the proposed wind farm site boundary, while Route B encompassed the open bog situated to the north-east of the proposed wind farm site boundary.

The majority of open bog surrounding the proposed wind farm site was encompassed by the walkover routes utilised. An area of bog within the 500 m buffer to the east of the site was not included due to the very steep terrain and H&S concerns; however, this area was entirely covered by the viewsheds of VP4 and VP5 which would have contributed to the capture of target species activity in this area, where occurring. Breeding season walkover routes are mapped in Appendix 2.

With regard to the timing of breeding season walkover surveys, there were survey constraints (associated with weather conditions, Covid restrictions etc.,) which affected when surveys were ultimately undertaken. This is discussed further in Section 2.9.4 below.

During each breeding season walkover survey, surveyors walked the routes through open bog, recording any target and secondary species activity, with a focus on red grouse, merlin and other raptors, golden plover and other moorland breeding species such as snipe. Birds were considered to represent breeding birds if they were observed displaying or singing, if nest, eggs or young were located, if adults repeatedly alarm called or if they performed distraction displays or were observed in territorial disputes.

The dates on which breeding season walkover surveys were undertaken and the routes which were utilised on each date are outlined in Table 4 below.

Table 4. Breeding season walkover surveys 2019 – 2022 within 500 m survey area around BIAR Site

Survey Period	Survey Date	Survey Route
Breeding 2019	16th July 2019	Route A
Breeding 2020	8th May 2020	Route A & B
Breeding 2021	15th July 2021 21st July 2021 28th July 2021	Route A Route B Route A & B
Breeding 2022	17th June 2022 24th August 2022	Route A & B Route A & B

2.4.2.1.3 Nocturnal Breeding Surveys (within BIAR Site)

Nocturnal breeding surveys were undertaken within areas of suitable breeding habitat for woodcock (*Scolopax rusticola*) and nightjar (*Caprimulgus europaeus*) within the proposed wind farm site boundary to record any potential breeding activity. For H&S reasons, these surveys utilised the existing internal forestry access road network within the site.

Nocturnal walkover surveys were undertaken in the 2019, 2021 and 2022 breeding seasons (see **Table 5** below). Following the findings of the 2019 nocturnal walkover survey the route was revised. The 2021 and 2022 nocturnal walkover survey route utilised the same route as the general transect surveys (discussed in **Section 2.4.2.1.1** above). During each nocturnal breeding survey, surveyors slowly walked along pre-selected routes while recording any displaying and/or calling male birds.

Table 5. Nocturnal breeding surveys 2019 - 2022 within BIAR Site

Survey Period	Survey Date	Survey Time
Breeding 2019	20th June 2019 20th August 2019	23:15 – 00:30 Hrs 21:45 – 22:45 Hrs
Breeding 2021	18th June 2021	23:00 – 00:00 Hrs
Breeding 2022	22nd June 2022	22:00 – 23:15 Hrs

Please refer to **Appendix 2** for the locations of the nocturnal walkover survey routes utilised in the 2019, 2021 and 2022 breeding seasons. Details on the surveys carried out including survey dates, times and weather conditions and the results can be found in **Appendix 10.**

2.4.2.1.4 Breeding Season Hinterland Survey

Breeding season hinterland surveys, comprising primarily driven transects, encompassing the area surrounding the proposed wind farm site, were undertaken during the 2019, 2021 and 2022 breeding seasons. The driven transects utilised sections of the existing local road network extending out to an approximate 5 km radius of the site. The 2019 breeding season hinterland surveys also encompassed an area of cutover bog located approximately 1.5 km to the north of the site.

The main purpose of these surveys was to identify any potential areas of interest within the area surrounding the site for breeding waterbirds and birds of prey, and record evidence of breeding activity, if any. All target species were recorded, where encountered.

Table 6 below outlines the dates on which hinterland surveys were undertaken during the breeding 2019, breeding 2021 and breeding 2022 survey periods.

Table 6. Breeding season hinterland surveys 2019, 2021, 2022

Survey Period	Survey Date	Survey Type/Area
Breeding 2019	18th July 2019	**Count -** Cutover Bog north of site, and **Driven Transect**
Breeding 2021	28th June 2021	**Driven Transect**
Breeding 2022	15th September 2022	**Driven Transect**

Maps showing these survey locations are included in **Appendix 2**. Details on each survey carried out including survey date, time and weather conditions and tabulated results can be found in **Appendix 11**.

Wider Hinterland Surveys

Breeding season hinterland surveys were also undertaken on certain dates at pre-selected locations in the wider landscape surrounding the proposed wind farm site identified as having potential for target species to occur. These areas comprised the following:

- Ballycastle Strand/Buntrahir Bay – located approximately 6.1 km to the north-east.
- Downpatrick Head - located approximately 9.5 km to the north-east. This survey focused on counts of birds on sea cliff and on open water and included a driven transect around the area of the headland.

Table 7 below outlines the hinterland surveys undertaken in the wider landscape surrounding the proposed wind farm site over the breeding 2019 to breeding 2022 survey period.

Table 7. Breeding season wider hinterland surveys 2019 - 2022

Survey Period	Survey Date	Survey Type/Area
Breeding 2019	17th - 19th July 2019	Count Ballycastle Strand/Bunatrahir Bay Downpatrick Head Driven Transect Downpatrick Head route
Breeding 2020	17th June 2020	Count Ballycastle Stand/Bunatrahir Bay Downpatrick Hd Driven Transect Downpatrick Head route
Breeding 2021	28th June 2021	Count Downpatrick Head
Breeding 2022	29th June 2022	Count Downpatrick Head Driven Transects Downpatrick Head route

Maps showing these survey locations are included in **Appendix 2**. As these survey areas are located well outside the ZOI of the proposed wind farm development, details on each survey carried out including survey date, time and weather conditions and tabulated results are summarised in **Appendix 14** 'Non-core Bird Survey Data'.

2.4.2.2 Winter Season

2.4.2.2.1 Transect Surveys with Point Counts (within BIAR Site)

The overall aim of the transect surveys was to assess the wintering distribution of target species and gather data on usage of the area encompassed within the proposed wind farm site boundary. Data was also recorded with regard to non-target species to capture abundance information on general wintering bird distribution within the wind farm development area. The methodology was broadly based on methods described in Bibby *et al*., (2000).

Transect surveys were completed within the proposed wind farm site boundary using the same two transect routes (A & B) along existing forestry access tracks as were used during breeding season surveys (see **Appendix 2** for mapped transect routes). The transect routes provided representative coverage of the open and closed habitats, comprising mainly mature forestry and clearfell, encompassed within the proposed wind farm site boundary.

As for the breeding transect surveys (see **Section 2.4.2.1.1** above) transects were completed on a monthly basis during the winter season survey period for the first two full years of survey, after which they were completed on a rotational basis comprising three months per winter season survey period, as set out in **Table 8** below.

Table 8. Winter transects survey months (2019/20 to 2022/23) within BIAR Site

Survey Period	Corresponding Transect Survey Months
Winter 2019/20	October, November, December 2019 & January, February and March 2020
Winter 2020/21	October, November, December 2020 & January, February and March 2021

Survey Period	Corresponding Transect Survey Months
Winter 2021/22	October and December 2021 and January 2022
Winter 2022/23	November 2022 and February and March 2023

As for the breeding season, counts of all wintering bird species seen or heard were recorded. Where target and/or secondary species were recorded, areas of activity and general behaviour was noted/mapped. As for the breeding season, birds were also surveyed during each transect using point count (PC) methodologies.

Details on each individual transect survey carried out including survey date, time and weather conditions can be found in **Appendix 7**. Tabulated results of peak counts for all species recorded during transect and point count surveys are provided in **Appendix 8**.

2.4.2.2.2 Winter Season Walkover Surveys (within 500 m survey area around BIAR Site)

Winter walkover surveys were undertaken to determine the presence of target species within areas of potentially suitable habitat within the study area. As for the breeding season walkover surveys, these surveys focussed on suitable habitat located within the 500 m survey area buffer surrounding the proposed wind farm site. The same walkover routes (Route A & B) as were used during breeding season walkover surveys were used for the winter season walkover surveys (winter 2019/20 to winter 2022/23).

The methodology was broadly based on methods described in Bibby *et al*., (2000). All target and secondary species were recorded, with a focus on red grouse, merlin, golden plover and other wader and raptor species. During each walkover survey, surveyors walked the pre-selected route(s) within areas of suitable habitat and recorded any calls or activity observed. March surveys undertaken in 2022 and 2023 also contributed to the capture of data on target species potentially breeding in the 500 m survey area (i.e., potential early breeding attempts), where present.

The dates on which winter season walkover surveys were undertaken and the routes which were utilised on each date are outlined in **Table 9** below.

Table 9. Winter season walkover surveys 2019/20 – 2022/23 within 500 m survey area around BIAR Site

Survey Period	Survey Date	Survey Route
Winter 2019/20	21st February 2020	Route A & B
Winter 2020/21	19th February 2021 24th February	Route A Route B
Winter 2021/22	10th November 2021 9th February 2022 14th March 2022	Route A & B Route A & B Route A & B
Winter 2022/23	18th January 2023 17th February 2023 24th March 2023	Route A & B Route A & B Route A & B

Maps showing these survey locations are included in **Appendix 2**. Details on each survey carried out including survey date, time and weather conditions and tabulated results can be found in **Appendix 9**.

2.4.2.2.3 Winter Season Hinterland Surveys

Winter hinterland surveys, comprising driven transects, were undertaken within the area surrounding the proposed wind farm site on several dates during the 2021/22 and 2022/23 winter survey periods. As for summer, the driven transects utilised the existing local road network extending out to an approximate 5 km radius of the site.

The main purpose of these surveys was to identify any potential areas of interest within the area surrounding the site for wintering waterbirds and birds of prey, and record evidence of activity, if any, with a particular focus on large assemblages of wintering waterbirds, although all target species were recorded, where encountered.

The dates on which winter season hinterland surveys were carried out are outlined in **Table 10** below.

Table 10. Winter season hinterland surveys 2021/22 and 2022/23

Survey Period	Survey Date	Survey Type/Area
Winter 2021/22	15th November 2021 14th January 2022 8th March 2022	Driven Transect
Winter 2022/23	17th November 2022 1st March 2023	Driven Transect

Maps showing these survey locations are included in **Appendix 2**. Details on each survey carried out including survey date, time and weather conditions and tabulated results can be found in **Appendix 11**.

Wider Hinterland Surveys

Winter season hinterland surveys were also undertaken on several dates at Ballycastle Strand/Bunrathair Bay during the winter 2019/20, 2021/22 and 2022/23 seasons, taking into account the foraging distances of certain species during the winter season (SNH, 2016). This coastal site is located approximately 6 km north-east of the site. The dates on which these wider winter season hinterland surveys were carried out are outlined in **Table 11** below.

Table 11. Winter season wider hinterland surveys 2019/20, 2021/22 and 2022/23

Survey Period	Survey Date	Survey Type/Area
Winter 2019/20	17th December 2019 23rd January 2020	Count Ballycastle Strand (Bunrathair Bay)
Winter 2021/22	13th October 2021 15th October 2021 10th November 2021 18th November 2021 14th January 2022 8th February 2022 3rd March 2022	Count Ballycastle Strand (Bunrathair Bay)
Winter 2022/23	18th November 2022	Count Ballycastle Strand (Bunrathair Bay)

Maps showing these survey locations are included in **Appendix 2**. As these survey areas are located well outside the ZOI of the Proposed Development, details on each survey carried out including survey date, time and weather conditions and tabulated results are summarised in **Appendix 14** 'Non-core Bird Survey Data'.

2.5 Evaluation of Conservation Importance of Populations of Key Species

Estimates of national population sizes were obtained from the NPWS Article 12 Reporting (2008-2012) which details the status and trends of bird species occurring in Ireland, as well as other sources referenced in relevant sections of this report. Where available, estimates for mean county wintering populations of relevant species were derived from recent I-WeBS data for sites in County Mayo, provided by MKO.

2.5.1 Geographical Framework

The conservation importance of populations of key species identified to occur within the study area was evaluated in accordance with *'Guidelines for Assessment of Ecological Impacts of National Roads Schemes'* (NRA, 2009).

These guidelines, which are specific to Ireland, set out the context for the determination of value on a geographical basis with a hierarchy (International through to Local) assigned based on the importance of any particular ecological receptor.

The NRA (2009) guidelines provide a basis for determination of whether any particular site or species is of importance on the following scale:

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

The NRA (2009) guidelines clearly set out the criteria by which each geographic level of importance can be assigned. At the lowest end of the scale, Locally Important (lower value) receptors comprise habitats and species that are widespread, of low ecological significance, and are of importance only in the local area. In contrast, Internationally Important receptors can comprise sites designated for conservation at an international level as part of the Natura 2000 Network or which provide the best examples of habitats, or internationally important populations of protected flora and fauna. The value of bird species is assessed on biodiversity value, legal status and conservation status.

2.6 Identification of Important Ecological Features (IEFs)

For species, Important Ecological Features (IEFs) were considered to comprise target species which were recorded within the ZOI of the proposed wind farm development during bird surveys undertaken over the 4-year survey period. For these species, it is considered that there is potential for likely effects and thus these species are subject to impact assessment. Those species identified as IEFs (**Section 3.5**, below) were brought forward to the impact assessment stage (**Section 4**, below) to determine the likelihood of significant ecological effects to the selected bird species.

Target species which were not recorded at any stage during bird surveys undertaken over the 4-year survey period and for which pathways for significant effects could not be identified were not considered IEFs and thus were excluded from further assessment.

IEFs were also considered to potentially include designated sites for nature conservation which support important bird populations, such as SPAs (internationally important sites classified for the conservation of birds listed in Annex I of the Birds Directive[1], as well as regularly occurring migratory species not listed in Annex I) and Ramsar sites, as well as other internationally important sites, such as Special Areas of Conservation (SACs), where considered to be of importance for birds.

2.6.1 Determining Sensitivity of Bird Species Selected as IEFs

The sensitivity of a species can be defined as its ecological importance and nature conservation interest at the site being assessed (Percival, 2003). Methodology outlined in Percival (2003) was used to evaluate the sensitivity of those bird species selected as IEFs. This guidance outlines a number of factors used to determine sensitivity:

- Whether the species is listed on Annex I of the EU Birds Directive

[1] 2009/147/EC

- Whether the species is particularly ecologically sensitive – this includes large birds of prey and rare breeding birds (including divers, common scoter, hen harrier, golden eagle, chough etc)
- Whether the site contains populations of species considered to be of international/national importance (>1% of Irish population)
- Whether the site contains populations of species considered to be of regional importance (>1% of regional population, taken at be at the County level)
- Whether the species is subject to special conservation measures, such as red or amber listed species on the Birdwatch Ireland's list of Birds of Conservation Concern in Ireland (BOCCI).

Table 12 below presents the criteria used to evaluate the sensitivity of a species, as per Percival (2003).

Table 12. Evaluation of the sensitivity of bird species (adapted from Percival, 2003)

Sensitivity	Determining Factor
Very High	Species that form the cited interest of SPAs and other statutorily protected nature conservation areas. Cited means mentioned in the citation text for the site as a species for which the site is designated.
High	Species that contribute to the integrity of an SPA, but which are not cited as species for which the site is designated. Ecologically sensitive species including the following: divers, common scoter, hen harrier, golden eagle, red necked phalarope, roseate tern and chough. Species present in nationally important numbers (>1% Irish population)
Medium	Species on Annex 1 of the EU Birds Directive. Species present in regionally important numbers (>1% regional (county) population). Other species on BirdWatch Ireland's red list of Birds of Conservation Concern.
Low	Any other species of conservation interest, including species on BirdWatch Ireland's amber list of Birds of Conservation Concern not covered above.

2.7 Impact Assessment Methodology

Significance is a concept related to the weight that should be attached to effects when decisions are made (CIEEM, 2019). A significant effect is an effect that undermines either the long-term distribution or abundance of bird populations, at the appropriate geographical scale (locally, regionally, or in the case of rare and restricted species, nationally (Drewitt and Langston (2006)), or the conservation objectives of a designated site (NRA, 2009; CIEEM, 2019).

Ecological impacts and effects were characterized using EPA (2022) guidance and criteria for characterising ecological impacts.

Table 13. Criteria for assessing impacts based on EPA (2022)

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

Parameter	Description	
Extent	The size of the area, the number of sites and the proportion of a population affected by an effect.	
Context	Whether the extent, duration or frequency will conform or contrast with established (baseline) conditions	
Duration	• Momentary – effects lasting from seconds to minutes • Brief – effects lasting less than a day • Temporary – effects lasting less than a year • Short-term – effects lasting 1 to 7 years • Medium term – effects lasting 7 to 15 years • Long term – effects lasting 15 to 60 years • Permanent – effects lasting over 60 years • Reversible – effects that can be undone • Frequency – how often effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)	
Describing the significance of effects (EPA, 2022)	Imperceptible	An effect capable of measurement but without significant consequences.
Describing the significance of effects (EPA, 2017)	Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
	Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
	Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
	Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
	Very significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
	Profound	An effect which obliterates sensitive characteristics

2.7.1 Collision Risk Assessment

A collision risk model was undertaken separately by MKO for thirteen species of conservation concern:

- Buzzard
- Golden Plover
- Great Black-backed Gull
- Grey Heron
- Hen Harrier
- Kestrel
- Lesser Black-backed Gull
- Mallard
- Merlin

- Peregrine
- Snipe
- Sparrowhawk
- Whooper Swan

The collision risk assessment was based on vantage point surveys undertaken at the wind farm site from April 2019 to March 2023, inclusive. This represents a 48-month survey period, consisting of four breeding seasons and four winter seasons. Surveys were undertaken from six fixed vantage points[2] (VP1, VP2, VP3, VP4, VP5 & VP7).

The Band Collision Risk Model (Band *et al*., 2007) was used in this assessment. The Band Model is used to predict the number of bird collisions that might be caused by a wind farm development. It uses species-specific information on bird biometrics, flight characteristics and the expected amount of flight activity, along with the number and layout of turbines and turbine specifications such as hub height, rotor diameter, pitch and rotational speed to estimate the risk of collision.

The Band modelling method involves two stages:

Stage 1: Estimating the number of birds or flights that pass through the air space swept by the turbine rotors. These transits are calculated by using either the "Regular or Random flight" model depending on flight distribution and behaviour.

Stage 2: Calculating the probability of a bird being struck (collision risk) when making a transit through a rotor.

The figures obtained in both stages are then multiplied together to give a theoretical annual collision mortality rate based on the supposition that birds make no attempt to avoid collision. However, in "real-life" circumstances, birds demonstrate high rates of avoidance - usually 98-99% according to SNH (2018). To account for these evasion measures, known avoidance rates are applied as a percentage to the theoretical collision value as a final step.

Band Model values are theoretical predictions and draw conclusions by assuming likely levels of active avoidance by specific species. Accordingly, results obtained are dependent on the quality of field observation data and accuracy of the avoidance rates used and must therefore be interpreted with a certain degree of caution.

Further information can be found in the Collision Risk Assessment prepared by MKO for the proposed wind farm development (see **Appendix 15**).

2.8 Mitigation

Where potentially significant effects on IEFs are predicted, mitigation has been prescribed to avoid, reduce and/or remove such effects.

Proposed best practice design and mitigation measures are specifically set out and are realistic in terms of cost and practicality. They have been subject to detailed design and will effectively address the effects on the identified IEFs.

The potential effects of the proposed wind farm development were considered and assessed to ensure that all effects on IEFs are adequately addressed, and no significant residual effects are likely to remain following the implementation of mitigation measures/best practice.

[2] Note that VP6 does not cover any of the proposed turbine locations and was therefore omitted from the collision risk analysis.

2.9 Statement on Limitations and Difficulties Encountered

2.9.1 COVID-19 Restrictions and Implications for Survey Effort in 2020

Scheduling and resourcing of bird surveys during the very end of the 2019/20 winter season and the very start of the 2020 breeding season survey periods were significantly constrained due to Covid 19 government restrictions with regards to work, travel and booking overnight accommodation, and the resulting knock-on field survey implications.

Due to Covid-19 restrictions, no field surveys were completed at the site in April 2020. When fieldwork resumed in May 2020, VP surveys were prioritised over other breeding season surveys given the time constraints imposed on completion of fieldwork by the restrictions and considering the heavily afforested nature of the site and thus potentially lower value to target species relative to areas not used for commercial timber production.

VP surveys were undertaken twice in May 2020 to account for VP surveys missed in April. There were no impacts on VP surveys for the remainder of the 2020 breeding season. However, the prioritisation of VP surveys in May had knock-on effects on the completion of other 2020 breeding season surveys (see Section 2.9.3 and 2.9.4, below).

Due to the limitations imposed by Covid-19 travel restrictions in place in spring 2020, as outlined above, a precautionary approach has been taken with regard to data collected during the 2020 breeding season. This is in line with recommendations contained within the CIEEM guidance document '*Guidance on Ecological Survey and Assessment in the Republic of Ireland and Northern Ireland during the Covid-19 Outbreak*' (CIEEM, 2020). The 2021 and 2022 breeding season survey periods were unaffected with regards to Covid-19 restrictions and were thus unaffected in terms of data collection as part of VP and distribution and abundance surveys.

2.9.2 Change to Proposed Site Boundary/Increase in Size of Proposed Development Site

Large areas encompassed within the southern section of the current proposed wind farm site boundary were added at a later stage in the project. This information, in the form of an updated wind farm site boundary map, was relayed to MWP after MWP's involvement in bird surveys at the site had ceased (as of March 2023). The bird surveys undertaken by MWP were therefore based on the original site boundary which was smaller in extent. Implications for surveys undertaken are discussed further in Section 2.9.3 and 2.9.4 below.

2.9.3 Vantage Point Surveys

- Efforts were made to ensure that the most appropriate VP locations were selected, as per SNH. VPs were selected to maximise coverage of the site on the basis of the wind farm site boundary under consideration at the time.
- All of the proposed turbine locations are covered by the existing VP viewsheds (see Appendix 2).
- The percentage of the current proposed wind farm site not covered by the 7 No. VP viewsheds is 8%. It is often difficult to get full VP viewshed coverage of a site. Factors which influenced the extent of viewshed coverage included the change in site boundary (see Section 2.9.2 above and discussed further below) and to a lesser extent topography and the extent of forestry cover, which constrained viewshed coverage of the site in certain minor areas.
- In the case of the very south-western corner of the site and south-central section of the site, the boundary change (discussed in Section 2.9.2, above) has subsequently resulted in the current proposed wind farm site boundary extending beyond the original extent of viewshed coverage.

- However, the additional areas added along the former southern boundary of the site are largely encompassed within the existing VP viewsheds, as follows:
  - the additional area in the south-west corner is largely covered by VP1.
  - the additional area in the south-central section is largely covered by VP1, VP2, VP3, VP4 and VP7.
  - the additional area in the south-eastern corner is covered by VP4, VP5 and VP7.
- The extent of VP viewshed coverage is considered sufficient so as to have allowed for the capture of adequate flight data with regard to the impact assessment and the collision risk assessment which has been undertaken.
- SNH (2017) stipulates that where VPs are located within the survey area, they should not be used simultaneously with other VP's which overlook them to minimise potential observer effect on bird behaviour. VP6 overlooks VP2 and VP7 overlooks VP3. There was a minor degree of overlap in timing between some of the VP survey watches undertaken at these VPs. For example, VP6 and VP2, and VP7 and VP3 were undertaken simultaneously on a total of 3 dates and 7 dates respectively over the course of the 4-year survey period.
- Regarding the number of VP hours achieved at each VP location during the survey period, the minimum required hours per year, as per SNH (2017) were not achieved in Year 1 (April 2019 to March 2020) and Year 4 (April 2022 to March 2023) with a minor shortfall of 2 hours and 6 hours for each year's total VP hours, respectively (see **Appendix 3**). These minor shortfalls in number of VP survey hours are not considered to have affected the quality of the flight data captured in the context of the overall volume of data obtained and number of VP survey hours completed on-site.

2.9.4 Breeding Season Distribution and Abundance Surveys

2.9.4.1 Breeding Season Transects and Walkovers

Table 14. Summary of Breeding Season Transect and Walkover Surveys Spatial and Temporal Coverage

Breeding Season	Summary
2019	In addition to monthly transects within the proposed wind farm site, a walkover of the open bog located within the 500 m survey area buffer to the north and west, was undertaken once in mid-July, with a focus on red grouse, merlin and other raptors, golden plover and other moorland breeding species such as snipe.
2020	Completion of the 2020 breeding season distribution and abundance surveys was constrained due to knock-on implications arising from Covid-19, as outlined in **Section 2.9.1** above. For example, April 2020 transect surveys were completely missed. Monthly transects were therefore undertaken twice in May to make up for missing April. Only one breeding walkover survey was undertaken at the site in May 2020, primarily located within the 500 m site buffer; however, this survey encompassed an additional walkover route, encompassing open bog to the east/north-east of the site, as well as to the north and west, which provided greater coverage of potentially suitable breeding habitat for breeding target species. The 2020 breeding season walkovers encompassed the majority of open bog within the 500 m survey area buffer (excluding an area to the east of the site excluded due to H&S reasons).
2021	In addition to bi-monthly transects within the proposed wind farm site (undertaken in April, June and August 2021), walkovers of the majority of open bog encompassed within the 500 m survey area were undertaken twice in mid- to late July, utilising the same walkover routes as for 2020.
2022	In addition to the transects within the proposed wind farm site (undertaken in June, July and September 2022), walkovers of the majority of open bog encompassed within the 500 m survey area buffer were undertaken twice (mid-June and late August), utilising the same walkover routes as for 2020 and 2021.

Spatial Coverage Rational and Constraints

Any apparent reduced extent of site coverage for breeding season walkover surveys has primarily been influenced by the subsequent change to the proposed wind farm site boundary, as discussed above in Section 2.9.2.

At the time of the 2019 to 2022 breeding surveys, the proposed wind farm site boundary was surrounded by a much greater degree of forestry in contrast to the current proposed wind farm site boundary. This was a critical factor in the selection of the 500 m survey area buffer walkover routes used for the 2019 to 2022 breeding seasons in terms of potential habitat suitability for target species.

The 2019 to 2022 breeding season walkover surveys encompassed the vast majority of open bog and moorland habitat which surrounded the site at the time. The areas of open bog to the south-west, south and south-east of the current proposed wind farm site boundary were not encompassed within the 500 m buffer area at the time of the 2019 to 2022 breeding surveys. These areas were partially encompassed within VP viewsheds (to the south and south-east); however, this limitation in coverage may mean that breeding birds may have been under-recorded in these areas.

With regard to breeding waders and wildfowl, at the time of these surveys, the proposed wind farm site comprised predominantly commercial forestry plantation with no permanent lakes or ponds present. Any standing water occurring would have been restricted to temporary/ephemeral standing water which may have been present within parts of the site on occasion. Therefore, it is noted that, at the time of surveys, the habitats encompassed within the proposed wind farm site boundary under consideration at the time were considered to be of limited use to breeding and/or foraging/roosting wader and wildfowl species.

It is noted that the lakes and permanent ponds located within the southern sections of the current proposed wind farm site e.g., Altderg Lough, are situated within the additional areas of land which were subsequently incorporated into the proposed site boundary. This limitation in coverage may mean that breeding birds may have been under-recorded in these areas.

Temporal Coverage Constraints

In terms of survey timings and frequency, SNH (2017) recommends an adapted Brown and Shepherd (1993) survey method for moorland breeding birds. This requires four survey visits spaced at least seven days apart which should cover the whole breeding season between mid-April and early July. With regard to this specific survey methodology, the 2019 to 2022 breeding walkover surveys undertaken within the 500 m survey area buffer were significantly constrained as they were undertaken outside this core recommended breeding period and/or were limited in terms of the number of survey visits achieved.

In relation to the area encompassed within the proposed wind farm site, data from a total of 36 monthly transects has been gathered from this area. With regard to breeding waders and wildfowl potentially occurring within the site, late winter and all summer transects undertaken within this area , completed on a monthly basis for the first two years of survey (and encompassing the key breeding survey periods of April to July), and then on a bi-monthly basis for the following two full years of survey, would have contributed to the capture of data on waders and wildfowl potentially breeding within the area, although the habitats occurring were considered of limited value to these species. The timing of some breeding season abundance and distribution surveys, such as the early 2022 breeding season transects, were affected by factors such as inclement weather, which resulted in no transect surveys being undertaken within the proposed wind farm site at the start of the 2022 breeding season (in either April or May 2022).

Due to the temporal and spatial limitations of the breeding season distribution and abundance surveys, in particular the breeding walkover surveys undertaken within the 500 m survey area buffer, a precautionary approach has been taken with regard to results for wader and wildfowl species

2.9.4.2 Breeding Raptor Surveys

With regard to breeding raptors, Hardey *et al*., (2013) recommends that for species such as kestrel, merlin and sparrowhawk a total of four survey visits should be made throughout the breeding season in line with a specific survey schedule to capture key periods. However, if time is limited and a home range appears to be unoccupied on the basis of the first two visits, then further visits to that home range can be omitted for kestrel and merlin. Four visits are still recommended for sparrowhawk (Hardey *et al*., 2013).

Targeted breeding raptor surveys in line with Hardey *et al.* (2013) were not undertaken within the proposed wind farm site or within a 2 km radius of the site.

Instead, breeding season walkover surveys encompassing the open bog located within the 500 m survey area buffer and targeting merlin and other raptors, as well as breeding waders, were undertaken during the 2019 to 2022 breeding season survey periods; however, these were limited in terms of frequency and the recommended survey timings.

With regard to forested areas within the proposed wind farm site boundary, comprising potentially suitable habitat for breeding raptors, although not in accordance with the specific recommended breeding raptor survey methodology outlined above, transects, encompassing both open and closed habitats, were undertaken monthly during the 2019 and 2020 breeding seasons survey (and encompassed the key breeding survey periods of April to July), and regularly during the 2021 and 2022breeding seasons. These would have contributed to the capture of data on breeding raptors potentially occurring within the proposed wind farm site.

VP surveys, undertaken monthly over the four breeding season survey periods (2019 to 2022) would also have contributed to the capture of data on breeding raptors, where present, both within the closed forestry and more open areas within the proposed wind farm site and within the open bog, moorland and forestry encompassed within the 500 m survey area buffer surrounding the site at the time.

Due to the temporal and spatial limitations outlined above, and the associated potential for breeding raptors to have been under-recorded, a precautionary approach has been taken with regard to breeding raptor results.

2.9.4.3 Nocturnal Breeding Surveys

Spatial Coverage Rational

The 2019, 2021 and 2022 nocturnal breeding surveys, which utilised the existing internal forestry access road network, covered the majority of suitable woodcock breeding habitat encompassed within the proposed wind farm site boundary which was under consideration at the time of the surveys. Due to H&S reasons, it was not considered feasible to survey forested areas which were not readily accessible on foot via existing access tracks.

As discussed in Section 2.9.2 above, large areas in the south of the current proposed wind farm site, comprising mainly forestry and suitable woodcock breeding habitat, were added at a later stage.

Temporal Coverage Constraints

Surveys for breeding woodcock were limited to two visits (June and August) in 2019, and one visit in June in both 2021 and 2022. This comprises a reduced survey effort relative to that outlined in Gilbert *et al*. (1998), which recommends three visits per breeding season (between May and June).

It is noted that all records and/or incidental sightings of woodcock over the 4-year survey period comprised winter season records only. Woodcock was not recorded at any stage during either targeted nocturnal or non-targeted surveys during the 2019, 2020, 2021 or 2022 breeding seasons. However, due to the temporal and spatial limitations outlined above with regard to the targeted nocturnal surveys undertaken, and the associated potential for breeding woodcock to have been under-recorded, a precautionary approach has been taken with regard to breeding woodcock results.

3. Existing Environment

3.1 Site Description

The proposed wind farm site (BIAR site) site is located in northwest County Mayo, approximately 6.2 km southwest of Ballycastle and 17 km northwest of Crossmolina. The proposed wind farm site encompasses the townlands of Altderg in the south-west, Lugnalettin in the north-west, Glenora in the north-east, and Ballykinlettragh and Keerglen in the south-east.

The proposed wind farm site principally consists of conifer plantation of varying age profiles including clear-fell, pre- and post-thicket phases and mature closed canopy. Internal forestry access roads are located throughout the site. Areas of upland heath/bog habitat are also encompassed within the site, predominantly in peripheral areas, and extending away from the site, primarily to the north, west, east and south-east. Such habitats are representative of the habitats and landscape character that pertained prior to the development of forestry in the area.

According to the CORINE (Co-Ordinated Information on the Environment) data series (last updated 2018), land cover on the site comprises of '*Transitional woodland scrub (324)*', '*coniferous forests (312)*' and '*peat bogs (412)*' in the surrounding area[3]. A review of the Teagasc map viewer determined that soil composition throughout the site comprises 'peat'[4].

The site lies within the Blacksod-Broadhaven catchment. The majority of the site to the west lies within the Owenmore [Mayo] sub-catchment. The south-eastern section lies within the Glencullin [North Mayo] sub-catchment. The site is primarily drained by an unnamed stream (IE_WE_33O040050) to the southwest which flows into the River Owenmore. A number of 1st order streams drain the south-eastern section of the site to the Keerglen River.

3.2 Desktop Study

3.2.1 Other Wind Farm Developments

A search was undertaken for other wind farm projects with which the proposed wind farm development could potentially interact to result in cumulative impacts to avian receptors. The following table outlines operational, permitted and proposed wind farm projects located within a 20 km radius of the proposed wind farm.

Table 15. Wind farms located within a 20 km radius

Wind Farm	No. Turbines	Distance	Status
ABO Sheskin	8	5-10 km	Under construction since February 2022
Oweninny 1	29	5-10 km	Operational
Oweninny 3	18	5-10 km	Proposed
Bellacorrick	21	5-10 km	Operational
Sheskin South	21	5-10 km	Proposed
Oweninny 2	25	10-15 km	Operational
Killala	6	10-15 km	Existing
Kilsallagh	13	15-20 km	Proposed

[3] https://gis.epa.ie/EPAMaps/
[4] http://gis.teagasc.ie/soils/map.php

There are two other wind farms located in the area surrounding the proposed wind farm site; Keerglen Wind Farm, located directly south of the proposed wind farm location, and Tirwaley Wind farm, located 5-10 km from the proposed wind farm location. Both projects are at design stage and no additional information is available.

3.2.2 Natura 2000 Designated Sites

3.2.2.1 Special Protection Areas (SPAs)

The EU Birds Directive requires Member States to designate legally protected areas for the conservation of endangered or migratory species of bird, as listed on Annex I of the Directive. These areas are known as Special Protection Areas (SPAs) and, since 1994, all SPAs form part of the Natura 2000 network of protected sites. The EU Birds Directive is implemented in Irish law under the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

An on-line search for SPAs within the greater area surrounding the proposed wind farm site was carried out to identify any potential for 'connectivity' between the site and SPAs by assessing whether pathways exist through which the proposal could impact on certain qualifying interest species, as recommended in the guidance document '*Assessing Connectivity with Special Protection Areas (SPAs)*' (SNH, 2016). Within this SNH document, core foraging ranges from nest-sites and roost-sites are published for both the breeding and winter seasons for the bird species frequently encountered when considering wind farm development proposals. SNH recommends that typically the core foraging range should be used when determining whether there is connectivity between the proposal and qualifying interest species. Core foraging ranges for wind farm sensitive species can range from <5 km to up to 20 km, in the case of certain wide-ranging species of geese in the winter season (SNH, 2016).

Therefore, an on-line search for SPAs located within 20 km of the proposed wind farm development was carried out. This search determined that there are six SPAs within 20 km, as outlined in Table 16 and Figure 3 below.

Table 16. SPAs within a 20 km radius of the proposed wind farm development (BIAR Site Boundary)

Designated Site	Distance from BIAR Site Boundary	Special Conservation Interests (SCIs)
Killala Bay/Moy Estuary SPA (004036)	10.3 km	• Ringed Plover (*Charadrius hiaticula*) [A137] • Golden Plover (*Pluvialis apricaria*) [A140] • Grey Plover (*Pluvialis squatarola*) [A141] • Sanderling (*Calidris alba*) [A144] • Dunlin (*Calidris alpina*) [A149] • Bar-tailed Godwit (*Limosa lapponica*) [A157] • Curlew (*Numenius arquata*) [A160] • Redshank (*Tringa totanus*) [A162] • Wetland and Waterbirds [A999]
Illanmaster SPA (004074)	10.9 km	• Storm Petrel (*Hydrobates pelagicus*) [A014]
Owenduff/Nephin Complex SPA (004098)	13.4 km	• Merlin (*Falco columbarius*) [A098] • Golden Plover (*Pluvialis apricaria*) [A140
Blacksod/Broad Haven Bay SPA (004037)	14.4 km	• Red-throated Diver (*Gavia stellata*) [A001] • Great Northern Diver (*Gavia immer*) [A003] • Slavonian Grebe (*Podiceps auritus*) [A007] • Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] • Common Scoter (*Melanitta nigra*) [A065] • Red-breasted Merganser (*Mergus serrator*) [A069] • Ringed Plover (*Charadrius hiaticula*) [A137] • Sanderling (*Calidris alba*) [A144] • Dunlin (*Calidris alpina*) [A149] • Bar-tailed Godwit (*Limosa lapponica*) [A157]

Designated Site	Distance from BIAR Site Boundary	Special Conservation Interests (SCIs)
		• Curlew (*Numenius arquata*) [A160] • Sandwich Tern (*Sterna sandvicensis*) [A191] • Dunlin (*Calidris alpina schinzii*) [A466] • Wetland and Waterbirds [A999]
Carrowmore Lake SPA (004052)	16.4 km	• Sandwich Tern (*Sterna sandvicensis*) [A191]
Lough Conn and Lough Cullin SPA (004228)	18.2 km	• Tufted Duck (*Aythya fuligula*) [A061] • Common Scoter (*Melanitta nigra*) [A065] • Common Gull (*Larus canus*) [A182] • Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] • Wetland and Waterbirds [A999]

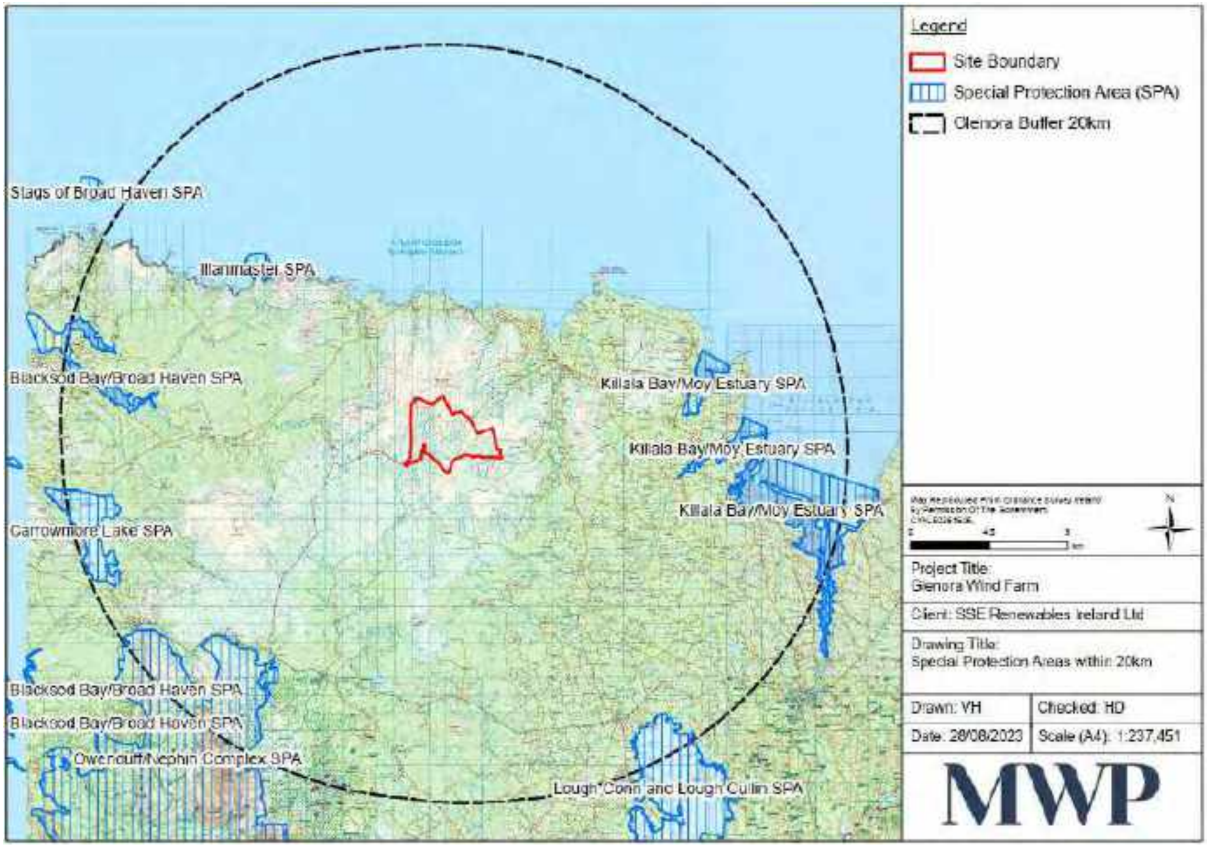

Figure 3. SPAs located within 20 km radius of the proposed wind farm site (BIAR Site)

3.2.2.2 Special Areas of Conservation (SACs)

Although not designated for qualifying bird species, Special Areas of Conservation (SACs) can provide important habitats that support bird populations which are of conservation concern, and which have the potential to be impacted by the proposal. On a precautionary basis, it was therefore decided to include SACs considered to be of importance for bird species and not encompassed within SPAs as part of the desk-top search for designated sites within the potential ZOI of the proposal.

An on-line search of SACs within a 20 km radius of the proposed wind farm development was carried out. SAC site synopses, and other information gathered as part of the desk-top study, was reviewed. SACs identified to be of ornithological importance as part of this review have been included in **Table 17** and shown in **Figure 4** below,

Table 17. SACs of ornithological interest (not encompassed within SPAs) located within a 20 km radius of the proposed wind farm development (BIAR Site)

Designated Site	Distance from BIAR Site Boundary	Ornithological relevance (based on desk-top study)
Glenamoy Bog Complex SAC (000500)	150 m north of site's northern boundary.	Of importance for: • Variety of breeding seabird species • Breeding peregrine (*Falco peregrinus*), chough, merlin and golden plover • Wintering barnacle goose (*Branta leucopsis*)
Slieve Fyagh Bog SAC (000542)	7.7 km	Of importance for: • Breeding golden plover, dunlin and redshank (*Tringa tetanus*)
Carrowmore Lake Complex SAC (000476)	11 km	Of importance for: • Greenland white-fronted goose (*Anser albifrons flavirostris*) (sub-flock of the nationally important Bog of Erris flock) • Breeding merlin, golden plover, Arctic tern (Sterna *paradisaea*), sandwich tern, common gull (*Larus canus*) • Tufted duck (*Aythya fuligula*), pochard (*Aythya farina*), wigeon (*Anas penelope*), goosander (*Mergus merganser*)

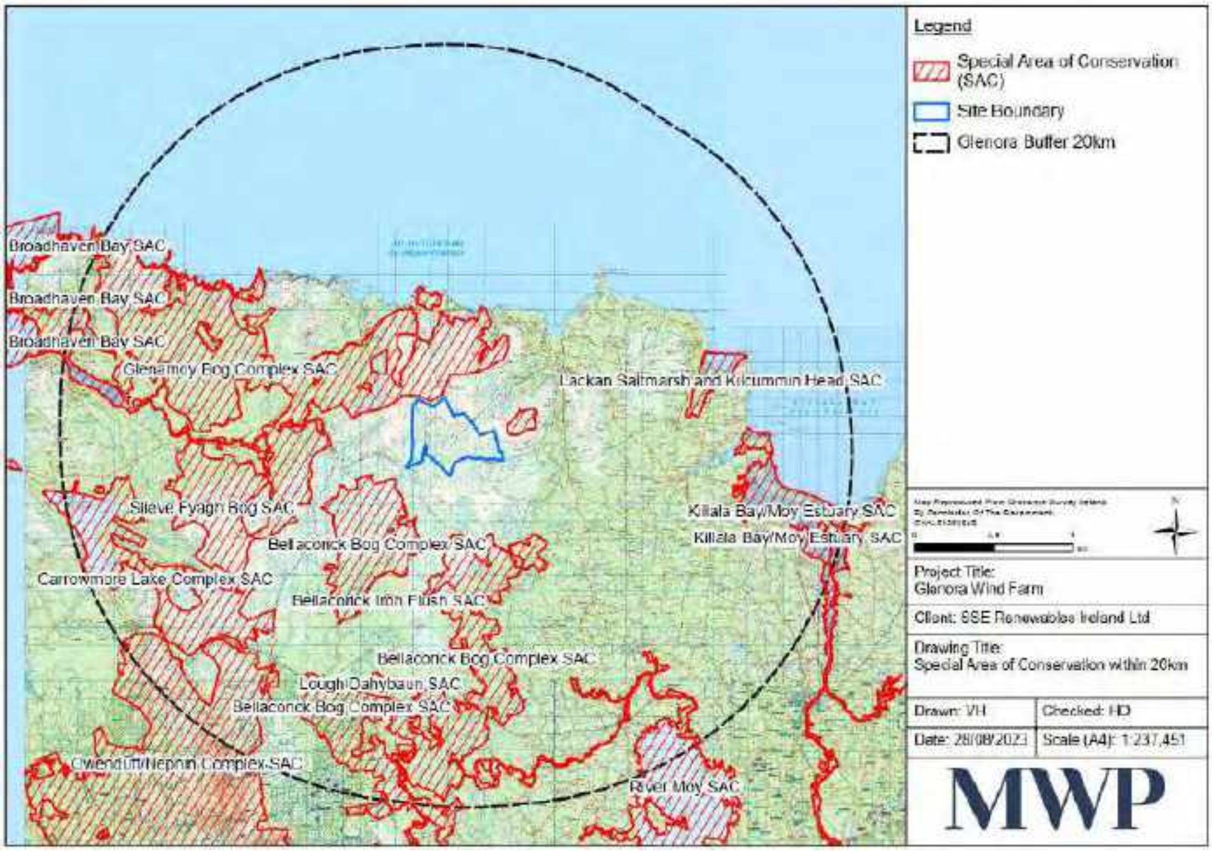

Figure 4. SACs within a 20 km radius of the proposed wind farm site (BIAR Site)

3.2.3 Nationally Designated Sites

Two Natural Heritage Areas (NHAs) adjoin the proposed wind farm site, as follows (with listed species of conservation importance from site synopses):

- Inagh Bog NHA (code 002391) – adjoins the western boundary, with breeding populations of golden plover and red grouse;
- Ummerantarry Bog NHA – adjoins the southern boundary, with breeding populations of golden plover (with baseline surveys confirming red grouse also present).

3.2.4 Ramsar Sites/Important Bird and Biodiversity Areas (IBAs)

The Convention on Wetlands, also known as the Ramsar Convention, is an intergovernmental treaty which aims to conserve and protect wetlands and their resources around the world[5]. It was ratified by Ireland in 1984 and came into force on 15th March 1985. While this convention is not legislation, it is an international treaty. Ireland presently has 45 sites designated as Wetlands of International Importance, with a surface area of 66,994 hectares.

The desk-top review concluded that there are three Ramsar sites within 20 km of the proposed wind farm site: 'Knockmoyle/Sheskin', located approximately 3.5 km to the south-west, 'Owenboy', located approximately 13.6 km to the south and 'Killala Bay/Moy Estuary', located approximately 13.3 km to the east.

The Important Bird and Biodiversity Areas (IBAs) Programme, overseen by Birdlife International, aims to identify, conserve and protect those areas throughout the world considered to be of the greatest significance to bird populations[6]. The desk-top review concluded that there are three IBA sites within 20 km of the proposed wind farm site boundary: 'Killala Bay'[7], located approximately 10.6 km to the east, 'Owenduff River Catchment and Nephin Beg'[8], located approximately 13.4 km to the south-west, and 'Broadhaven, Blacksod and Tullaghan Bays and parts of the Mullet Peninsula'[9], located approximately 13.6 km to the north-west.

3.2.5 I-WeBS Sites

I-WeBS (Irish Wetland Bird Survey) is a joint project between BirdWatch Ireland and the National Parks and Wildlife Service (NPWS) in which specific wetland sites are surveyed (BirdWatch Ireland, 2019). In order to count the wetland birds, a 'look-see' method (Bibby *et al*, 2000) is used in which all birds present within a pre-defined area are counted. The aim of these surveys is to monitor non-breeding birds in Ireland and contribute to population counts. The information is also important to help assess the quality of these wetland areas. The bird groups to be counted for I-WeBS consist of swans and geese, ducks, divers, waders and gulls. Counts are made once per month from September to March annually (BirdWatch Ireland, 2019)[10].

The proposed wind farm site is not located within, or near, any I-WeBS site. The nearest I-WeBS site is located at Killala Bay, approximately 10.3 km to the east. There are a total of four I-WeBS sites situated within 20 km of the proposed wind farm site (see **Table 18** below).

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[5] http://www.ramsar.org/
[6] http://www.birdlife.org/worldwide/programmes/important-bird-and-biodiversity-areas-ibas
[7] http://datazone.birdlife.org/site/factsheet/killala-bay-iba-ireland/map
[8] http://datazone.birdlife.org/site/factsheet/662.0
[9] http://datazone.birdlife.org/site/factsheet/570.0
[10] https://birdwatchireland.ie/our-work/surveys-research/research-surveys/irish-wetland-bird-survey/.

Table 18. I-WeBS sites within 20 km of the proposed wind farm site (BIAR Site)

I-WeBS Site	Proximity to BIAR Site
Killala Bay (Site code – 0D486)	10.3 km east of the site
Broadhaven & Sruwaddacon Bays (Site code – 0D475)	14.7 km west of the site
Carrowmore Lake (Site code – 0D062)	16.6 km west of the site
Lough Conn (Site code – 0D517)	18.2 km south-east of the site

There are a total of 35 I-WeBS sites located in County Mayo, as follows. Birdwatch Ireland data from these I-WeBS sites can be used to estimate county populations of wintering waterbirds.

- Achill Island
- Attymass Lake
- Balla Wetlands
- Ballybackagh
- Ballyglass Wetlands
- Ballyhaunis Lakes
- Blacksod & Tullaghan Bays
- Brees Wetlands
- Broadhaven & Sruwaddacon Bays
- Callows Lakes
- Carrowmore Beach
- Carrowmore Lake
- Carrownacon Lakes
- Cashel Turlough
- Castlebar Lakes/Islandeady Chain
- Clew Bay
- Keel Lough
- Kilglassan Turlough/Greaghans
- Killala Bay
- Knappaghbeg Lough
- Lough Conn
- Lough Cullin
- Lough Levally
- Lough Mask
- Lough Muck (Mayo)
- Lough Nahaltora
- Manulla Lakes
- Mullet West
- River Moy
- Rostaff Lake

- South Mayo Coast
- Tawnyard Lough
- Termoncarragh & Annagh Marsh
- Washpool Lough
- Wetland near Drumcarrabaun (Belcarra/Ballyglass Road)

Datasets for the above I-WeBS sites were downloaded from www.birdwatchireland.ie by MKO in January 2023 and reviewed by MKO as part of their desk-top study. Summary tables for the species recorded at each of these I-WeBS sites during the most recent 5-season survey period available (2016/17 to 2020/21) were reviewed and used to calculate mean counts for wintering species within the county (see **Section 3.4** below).

The following I-WeBS sites did not have any data for the survey period 2016/17 to 2020/21:

- Keel Lough
- Kilglassan Turlough/Greaghans
- Knappaghbeg Lough
- Lough Muck (Mayo)
- Lough Nahaltora
- River Moy
- Tawnyard Lough

3.2.6 BirdWatch Ireland Bird Sensitivity Tool

A Bird Sensitivity Mapping Tool for wind energy development was developed by BirdWatch Ireland and provides a measured spatial indication of where protected birds are likely to be sensitive to wind energy developments. The tool can be accessed via the National Biodiversity Data Centre Website (www.biodiversityireland.ie) and is accompanied by a guidance document (McGuiness *et al*. (2015). The criteria for estimating a zone of sensitivity (i.e., 'low', 'medium', 'high' and 'highest') is based on a review of the behavioural, ecological and distributional data available for each species.

The southernmost section of the proposed wind farm site lies partially within a zone of medium sensitivity for golden plover and red grouse, and a zone of low sensitivity for red grouse. These zones also encompass the lands extending south from the site boundary. Additionally, there is minor overlap between the south-eastern and north-western corners of the site with other zones of low sensitivity for red grouse. Please see **Figure 5** below.

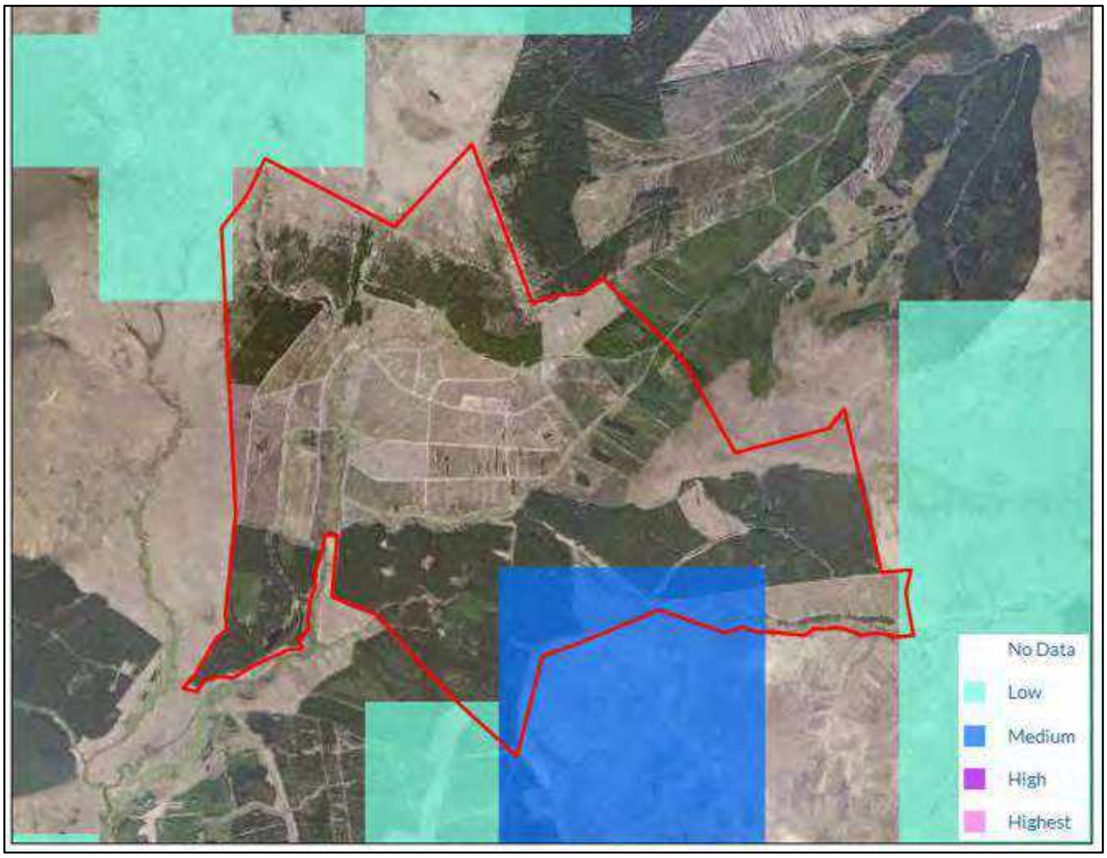

Figure 5. Proposed wind farm site boundary (BIAR Site) in the context of Bird Sensitivity Mapping as per tool available on the NBDC website (Adapted from https://maps.biodiversityireland.ie/Map)

3.2.7 Bird Atlas Records and Distribution

'*Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland*' (Balmer *et al*., 2013) is the most recent comprehensive work on wintering and breeding birds in Ireland. Previous Bird Atlases have been the primary source of information on the distribution and abundance of British and Irish birds prior to Bird Atlas 2007–11. The three previously published atlases were:

- Sharrock, J.T.R. (1976) The atlas of breeding birds in Britain and Ireland.
- Lack, P.C. (1986) The atlas of wintering birds in Britain and Ireland.
- Gibbons, D.W., Reid, J.B. & Chapman, R.A. (1993) The new atlas of breeding birds in Britain and Ireland: 1988-1991.

The proposed wind farm site lies within the hectad G03. Table 19 below presents Breeding Bird Atlas data for potential target species previously recorded within this hectad. Table 20 below presents Wintering Bird Atlas data for potential target species previously recorded within this hectad. The full list of all bird species which have been previously recorded in the hectad, including their conservation and protection status in an Irish and European context and their most recent Bird Atlas wintering and breeding status, is provided in Appendix 13.

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Table 19. Breeding Bird Atlas data (G03) with breeding status[11]

Species Name	Breeding Atlas (68-72)	Breeding Atlas (88-91)	Breeding Atlas (07-11)	Conservation Status[12]
Corncrake (*Crex crex*)	Probable	-	-	BD, RL
Golden Plover (*Pluvialis apricaria*)			Probable	BD, RL, SCI
Kestrel (*Falco tinnunculus*)	Probable	Seen	Confirmed	RL
Red Grouse (*Lagopus lagopus*)	Probable	-	Probable	RL
Ringed Plover (*Charadrius hiaticula*)	Confirmed	-	-	AL, SCI
Snipe (*Gallinago gallinago*)	Probable	-	-	RL
Sparrowhawk (*Accipiter nisus*)	Possible	-	Possible	GL, Schedule IV

Table 20. Wintering Bird Atlas data (G03) with wintering status

Species Name	Wintering Atlas (81-84)	Wintering Atlas (07-11)	Conservation Status
Bar-tailed Godwit (*Limosa lapponica*)	-	Present	BD, RL, SCI
Curlew (*Numenius arquata*)	Present	Present	RL, SCI
Golden Plover (*Pluvialis apricaria*)	Present	Present	BD, RL, SCI
Great Northern Diver (*Gavia immer*)	Present	-	BD, RL, SCI
Hen Harrier (*Circus cyaneus*)	-	Present	BD, AL
Kestrel (*Falco tinnunculus*)	Present	Present	RL
Merlin (*Falco columbarius*)	-	Present	BD, SCI, AL
Oystercatcher (*Haematopus ostralegus*)	Present	Present	RL
Purple Sandpiper (*Calidris maritima*)	Present	-	RL
Red Grouse (*Lagopus lagopus*)	-	Present	RL
Redshank (*Tringa totanus*)	Present	Present	RL
Red-throated Diver (*Gavia stellata*)	Present	-	BD, SCI, AL
Ringed Plover (*Charadrius hiaticula*)	-	Present	SCI, AL

[11] Breeding status: Seen = recorded; Possible = possible breeding; Probable = probable breeding; Confirmed = confirmed breeding; - = not recorded; Non-B = non-breeding; Breed = breeding

[12] Conservation Status: BD = Annex I of the Birds Directive; RL = BoCCI Red-listed; SCI = Special Conservation Interest species of nearby SPA; Schedule IV = protected under Schedule IV of the Wildlife Act

Species Name	Wintering Atlas (81-84)	Wintering Atlas (07-11)	Conservation Status
Sanderling (*Calidris alba*)	Present	Present	SCI, GL
Snipe (*Gallinago gallinago*)	Present	Present	RL
Woodcock (*Scolopax rusticola*)	-	Present	RL

3.2.8 Previous Bird Records for the Wider Area

As part of the desktop study, a detailed review of other previous bird records for the wider area, such as for other wind farm developments, as available on-line and/or in published sources, was undertaken.

There are no other wind farm developments existing or proposed within a 5 km radius of the proposed wind farm site (please refer to **Section 3.2.1** above). The previous bird records which were available for the wider area extending beyond this radius are summarised as follows.

As part of the desk-top study, a review was carried out of the report '*Breeding bird populations on the Oweninny cutaway peatlands, County Mayo*' (Copland *et al*., 2011) which pertained to 2009 surveys of rehabilitating cutover bog at Bellacorick, Co. Mayo, located approximately 6 km south of proposed wind farm site. A summary of the bird survey results is given as follows. More detailed information can be found in Copland *et al*., (2011). Annex I species recorded included a single dunlin (believed likely to have been a failed or non-breeder) and a golden plover (probable breeding). Teal (*Anas crecca*) and kestrel were recorded as probable breeding species., while snipe and common sandpiper (*Actitus hypoleucos*) were recorded as possible breeding species. Little grebe (*Tachybaptus ruficollis*) (1 pair), ringed plover (1 pair confirmed with at least 5 territories recorded), common gull (3 pairs) and meadow pipit (*Anthus pratensis*) were confirmed breeding (Copland *et al*., 2011).

A review of records from other wind farms in the wider area, together with local bird knowledge, ascertained that one pair of breeding golden plover are known from O'Boyle's Bog, located in excess of 10 km south-west of the proposed wind farm site. This pair was recorded during surveys for Oweninny Wind Farm (ABP Ref No. PL16.PA0029) between 2010 and 2012 and have occurred at this location annually since at least that period.

Surveys for Oweninny Wind Farm (2010 and 2013) recorded similar species as those recorded during the 2009 Oweninny cutover bog surveys (Copland *et al*., 2011). A breeding attempt by greenshank (*Tringa nebulaira*) was also recorded. During the Oweninny Wind Farm (2010 – 2013) surveys, low numbers of whooper swan were occasionally recorded. Greenland white-fronted geese were recorded on one occasion. Red grouse were found to be widely distributed across the Oweninny site in areas of suitable habitat.

The revised EIAR for the proposed amendments to the previously permitted Sheskin Wind Farm (ABO Wind Energy Ltd.) (ABP Ref No. PL16.311157; Planning Ref No. 20834) was reviewed as part of the review of existing available bird records for wind farms in the wider area.

Surveys undertaken for the original permitted Sheskin Wind Farm development in 2014 and 2015 recorded several species of note, including golden plover, curlew, merlin, peregrine, kestrel, sparrowhawk, red grouse, snipe, teal, woodcock and lesser black-backed gull. During the breeding season, golden plover were observed on Slieve Fyagh, in excess of 10 km south-west of the proposed wind farm development, with a possible breeding pair recorded in April 2015. This may have been the pair previously recorded on Boyle's Bog. At least one pair of kestrel are thought to have bred in the vicinity of the Sheskin Wind Farm site. There were two observations of merlin; however, no evidence of breeding was recorded. One merlin territory may have been located approximately 3 km northwest of the Sheskin Wind Farm site boundary (in excess of 5 km from the proposed wind farm site boundary).

An estimated 4-5 red grouse territories were believed to occur on intact lowland blanket bog within the Sheskin Wind Farm bird survey area, to the east and the northwest of the Sheskin Wind Farm site. A minimum of 4 pairs of snipe were recorded breeding approximately 2 km northwest of the Sheskin Wind Farm site during surveys in 2015, while one breeding pair was recorded on the lowland blanket bog to the west of the site. During hinterland surveys within 6 km of the Sheskin Wind Farm site between April and July 2015, golden plover, red grouse, peregrine and merlin were recorded. During the winter months, hinterland surveys recorded whooper swan at Carrowmore Lake (in excess of 15 km west of the proposed wind farm site).

Please refer to **Section 3.2.1** above and Figure 14-16 in Chapter 14 of the EIAR which outline the locations of existing and proposed wind farm developments in the wider area +in the context of the proposed wind farm development.

3.2.9 NPWS Rare and Protected Species Dataset

An information request was sent by MKO to the NPWS requesting any bird records from the NPWS Rare and Protected Species Database for the hectad encompassing the proposed wind farm site (G03). Data was received on the 31st December 2021. No bird records were included in the dataset received.

3.2.10 National Surveys of Hen Harrier in Ireland

The results of the 2015 National Hen Harrier Survey were consulted by MKO to identify hen harrier breeding sites within the relevant hectad. There were no records of breeding hen harrier in hectad G03 in the 2015 survey. Additionally, there were records of hen harrier wintering in hectad G03, but no records of birds roosting within this hectad. The distribution data is from the 2007-11 Bird Atlas and the roost site locations are sourced from unpublished Irish Winter Hen Harrier Survey data.

3.2.11 Hen Harrier Project

The Hen Harrier Project operates in SPAs designated for hen harrier. The Hen Harrier Project reports were reviewed by MKO for any relevant data on hen harrier within the proposed wind farm site and its hinterland. There are no SPAs designated for hen harrier within or near the proposed wind farm site; therefore, this project was not considered further in the assessment.

3.2.12 Whooper Swan Census - 2020

The results of the 8th International Swan Census were consulted by MKO to identify whooper swan habitat use and distribution within the relevant 10 km hectad (Burke *et al*., 2021). A total population of 973 birds were recorded in county Mayo. No flocks of international or national importance were identified within the county. Three populations of <50 birds and one population of 50-100 birds were recorded within the Blacksod/Broadhaven Bay SPA (located 14.4 km to the west of the proposed wind farm site).

3.2.13 Greenland White-fronted Goose

The 'Bog of Erris' flock of Greenland white-fronted goose was identified by the NPWS DAU as part of pre-application consultation for the proposed wind farm development. This species is known to occur regularly on Bangor Erris Bog, located approximately 20 km south-west of the proposed wind farm site. This area of lowland blanket bog is encompassed within the Bangor Erris Bog NHA (001473). A review of the most recent Greenland White-fronted Goose Study/NPWS census report available on-line from 2021/22 (GWGS/NPWS, 2021) determined that a maximum count of 9 birds was recorded for the autumn and spring census for the Bog of Erris during 2021/22 (same maximum count as 2020/21).

In addition to the above, the 2021/22 Census reported counts for Greenland white-fronted geese at the following locations recorded between October 2021 and March 2022: Lough Conn (between 6 and 41 birds recorded), Carrowmore (between 7 and 26 birds recorded), and Owenduff (8 birds recorded) (GWGS/NPWS, 2021).

3.2.14 Identification of Target Species

The following table (Table 21) outlines those species for which past records exist or which have otherwise been identified as part of the desk-top study and which meet one or more of the target species selection criteria as outlined in Section 2.3, above. Wind farm sensitive species meeting the selection criteria that were not identified as having previously occurred within the relevant hectad during the desk-top study but for which potentially suitable habitat occurs, such as peregrine falcon (*Falco peregrinus*), were also included as target species on a precautionary basis. The conservation status/level of protection afforded to each species is also included.

As outlined above and as set out in SNH (2017), target species typically comprise those species which are afforded a higher level of legislative protection and should be restricted to those likely to be affected by wind farms. Only red-listed species likely to be affected by wind farms have been included as target species, unless the species meets one of the other target species selection criteria as outlined above e.g., Annex I.

Table 21. Identification of target species for the proposed wind farm development

Target Species	Conservation Status[13]	Typical Habitat[14]	Target Species for Site Y/N
Peregrine Falcon (*Falco peregrinus*)	Annex I EU Birds Directive / BoCCI Green-listed/ Wildlife Acts	Breeding Breeds on coastal and inland cliffs. Most birds on the coast breed on the south, west and north coasts, coastal breeding on the east coast is limited by the availability of suitable nesting cliffs. Most inland birds breed on mountain cliffs but will also breed at lower levels. Wintering Resident in Ireland but shows some movement away from its breeding areas in the winter. Can be found on the coast, especially on estuaries where they hunt water birds. Some birds move into cities. Wintering birds may also comprise individuals which have arrived from Britain or even further afield.	Y
Merlin (*Falco columbarius*)	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts/ SCI	Breeding A rare breeding bird in Ireland. Nests on the ground on moorland, mountain and blanket bog. Also nests in woodland and has taken to nesting in forestry plantations adjacent to moorland. Wintering Much more widely distributed in the winter, than in the breeding season. Merlin move away from high ground at this time of the year and can often be seen on the coast, where concentrations of other birds are attractive as prey species	Y

[13] BOCCI 4 (Gilbert, *et al*., 2021)
[14] birdwatchireland.ie

Target Species	Conservation Status[13]	Typical Habitat[14]	Target Species for Site Y/N
Hen Harrier (*Circus cyaneus*)	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts	**Breeding** Breeding birds are confined largely to heather moorland and young forestry plantations, where they nest on the ground. **Wintering** Spends winter in more coastal and lowland areas throughout Ireland hence most easily seen on the coast in the winter months.	Y
Kestrel (*Falco tinnunculus*)	BoCCI Red-listed/Wildlife Acts	**Breeding** A widespread breeder throughout the country. Nests in trees, buildings or in cracks in cliffs. Will use old crows' nests. Found in wide variety of open habitats including coasts, moor land, farmland, wetlands, roadside verges and town parks. **Wintering** Largely resident within breeding territory. Some birds move within the country, especially down from the uplands.	Y
Sparrowhawk (*Accipiter nisus*)	BoCCI Green-listed / Wildlife Acts	**Breeding** Probably the most common bird of prey in Ireland. Widespread in woodland, farmland with woods, larger parks and gardens. **Wintering** Resident in Ireland. Can be seen throughout the country.	Y
Buzzard (*Buteo buteo*)	BoCCI Green-listed/ Wildlife Acts	**Breeding** Widespread breeding species. Nests in trees and sometimes on cliffs, usually with access to open land including farmland, moorland and wetland. **Wintering** Largely resident.	Y
Golden Eagle (*Aquila chrysaetos*)	Annex I EU Birds Directive/ BoCCI Red-listed/ Wildlife Acts	**Breeding** Formerly bred in Ireland and recently re-introduced to County Donegal to re-establish an Irish breeding population. **Wintering** Eagles are generally resident, though young birds may wander during the winter.	Y
Snowy Owl (*Bubo scandiaca*)	Annex I EU Birds Directive/ BoCCI Red-listed/ Wildlife Acts	**Breeding** Does not breed in Ireland. The majority of the European population breeds in Scandinavia and Russia. **Wintering** Rare winter visitor, mainly to western counties such as Mayo. Most often seen roosting during the day on bogs. Some sightings may possibly relate to escaped cage birds, as this species is common in captivity.	Y
Redshank (*Tringa totanus*)	BoCCI Red-listed/ Wildlife Acts/SCI	**Breeding** Nests on the ground in grassy tussocks, in wet, marshy areas and occasionally heather. Breeds	Y

Target Species	Conservation Status[13]	Typical Habitat[14]	Target Species for Site Y/N
		mainly in midlands (especially Shannon Callows) and northern half of the country. **Wintering** Winters all around the coasts of Ireland, Britain and many European countries. Favours mudflats, large estuaries and inlets. Smaller numbers at inland lakes and large rivers.	
Golden Plover (*Pluvialis apricaria*)	Annex I EU Birds Directive/ BoCCI Red-listed/ Wildlife Acts/SCI	**Breeding** Breeds in heather moors, blanket bogs and acidic grasslands. Distribution limited to the uplands of northwestern counties in Ireland. **Wintering** Throughout the winter, are regularly found in large, densely packed flocks, and in a variety of habitats, both coastal and inland. Distribution is widespread in Ireland.	Y
Dunlin (*Calidris alpina*)	Annex I EU Birds Directive/ BoCCI Red-listed /Wildlife Acts/SCI	**Breeding** Nests on the ground in sparse, low vegetation - in Ireland favours machair habitats. **Wintering** Common along all coastal areas - especially on tidal mudflats and estuaries. Very few inland.	Y
Ringed Plover (*Charadrius hiaticula*)	BoCCI Amber-listed/ Wildlife Acts/SCI	**Breeding** Mostly coastal breeding distribution, preferring to nest on exposed wide sandy or shingle beaches. Some breed inland, particularly in the west, where their preferred nesting habitat is on short-grazed pasture beside rivers and lakes. **Wintering** Winter around the entire coastline but are quite sparse along the north and southeast coasts. Mostly recorded along sandy stretches or along the upper shores of estuaries and non-estuarine coastline	Y
Snipe (*Gallinago gallinago*)	BoCCI Red-listed/ Wildlife Acts	**Breeding** Nests on the ground, usually concealed in a grassy tussock, in or near wet or boggy terrain. **Wintering** Highly dispersed distribution in winter. They forage across a variety of wetland and damp habitats. Particularly high concentrations are found on the fringes of lowland lakes.	Y
Curlew (*Numenius arquata*)	BoCCI Red-listed/Wildlife Acts/SCI	**Breeding** Nests on the ground inland in rough pastures, meadows and heather. Not a common breeder but found in most parts of the country. **Wintering** Winters in a wide range of wetland habitats (coastal and inland) and other good feeding areas including damp fields.	Y
Corncrake (*Crex crex*)	Annex I Bird Species/ BoCCI Red-listed/ Wildlife Acts	**Breeding**	Y

Target Species	Conservation Status[13]	Typical Habitat[14]	Target Species for Site Y/N
		Summer visitor. Nests on the ground in tall vegetation. Formerly common. Now confined to areas of difficult terrain where farming practices have not intensified, mainly North Donegal and western parts of Mayo and Connaught.	
Red Grouse (*Lagopus lagopus hibernicus*)	BoCCI Red-listed/ Wildlife Acts	Breeding Nest on the ground. Found on mountains, moorland and lowland blanket bogs and raised bogs, where it is associated with heather, requires it for food, shelter and nesting. As a 'game' species it has benefited from past management of heather moorland. Wintering Resident and sedentary (non-migratory). If snow is on the ground, will move to wind swept ridges and lower ground.	Y
Woodcock (*Scolopax rusticola*)	BoCCI Red-listed / Wildlife Acts	Breeding Nests on the ground in forests and woodland, usually well camouflaged amongst dead leaves and low vegetation. Wintering Wider distribution in winter, occurring in woodland, also scrub and some open areas (bracken and heather-covered hills).	Y
Greenland White-fronted Goose (*Anser albifrons flavirostris*)	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts/SCI	Wintering Scarce winter visitor to Ireland. Highly gregarious. Traditionally occurred in peatland areas, though now mostly seen feeding on intensively managed grasslands.	Y

3.3 Field Survey Results

3.3.1 Target Species

The following target species were recorded during ornithological surveys for the proposed wind farm development conducted between April 2019 and March 2023, inclusive. Target species observations are summarised in the following sub-sections. Annex I species are highlighted in bold.

- **Merlin**
- **Hen Harrier**
- Kestrel
- Sparrowhawk
- Buzzard
- **Peregrine Falcon**
- Woodcock
- Red Grouse
- **Golden Plover**
- **Whooper Swan**
- **Great Northern Diver**
- Snipe

Tabulated summaries of target species VP survey observations, including flight information, are available in **Appendix 4**. VP flight line and activity area mapping for each target species are available in **Appendix 5**.

3.3.1.1 Merlin

All observations of merlin recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 22** below.

Table 22. Summary of merlin survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2020	1	Adult female observed to the west of VP5 in August.	Refer to **Appendix 5**
	Winter 2022/23	1	Adult female observed to the north-east of VP4 in March.	

Incidental Observations

Additionally, there was one incidental record of merlin recorded on 19th February 2020 when an adult was observed to the east of VP5 by a surveyor en route to the VP location.

3.3.1.2 Hen Harrier

All observations of hen harrier recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 23** below.

Table 23. Summary of hen harrier survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2019	1	Adult female observed from VP3 in mid-April.	Refer to **Appendix 4 & 5**
	Winter 2019/20	3	Bird in first year plumage observed to the northwest of VP1 in mid-October. Male in second year plumage observed from VP5 hunting over bog and forestry in late January. A male, presumed the same bird, was observed from VP4 to the northwest of the VP on the same date.	
	Winter 2020/21	1	Male observed to the northeast of VP4 in mid-December.	
	Winter 2021/22	1	Adult male observed west of VP7 in mid-February.	
	Winter 2022/23	2	Adult female observed south of VP6 in late October. Adult male observed northeast of VP1 in late February.	
Hinterland Survey (5 km radius)	Winter 2021/22	1	Three sightings of an adult male (presumed by surveyor to likely comprise two different individuals).	Refer to **Appendix 11**

3.3.1.3 Kestrel

All observations of kestrel recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 24** below.

Table 24. Summary of kestrel survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2019	7	Recorded in April, June, August and September from VP1, VP4, VP5 and VP7.	Refer to **Appendix 4 & 5**
	Winter 2019/20	6	Recorded in October and November from VP1, VP2, VP4, VP5 and VP7.	
	Summer 2020	4	Recorded in July, August and September from VP2, VP3 and VP7.	
	Winter 2020/21	4	Recorded in November (from VP1, VP2 and VP3) and December (VP2).	
	Summer 2021	5	Recorded in May, August and September from VP4 and VP5.	
	Winter 2021/22	6	Recorded in October and November from VP1, VP4, VP5 and VP7.	
	Summer 2022	14	Recorded from all VPs except VP6. Sightings included observations of two kestrels mobbing each other in early August. A juvenile was recorded in mid-September to the southwest of VP4. A juvenile was recorded at the end of September north of VP3.	
	Winter 2022/23	10	Recorded in October and November from all VP's except VP6. There were two records of juvenile birds, both of which were recorded in early November (from VP2 and VP3).	
Transect/ Point Count Surveys	Winter 2019/20	1	November (two birds recorded on Transect A – T1)	Refer to **Appendix 8**
	Summer 2020	1	September (one bird recorded on Transect B – PC1)	
	Winter 2020/21	1	October (one bird recorded on Transect A – PC3)	
	Winter 2022/23	1	November (one bird recorded on Transect A – T5)	

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Breeding Season Walkovers	Summer 2022	2	17th June Walkover A (kestrel hunting) and Walkover B (kestrel hunting).	Refer to **Appendix 10**
Hinterland Survey (5 km)	Winter 2021/22	1	15th November (adult male recorded).	Refer to **Appendix 11**
	Winter 2022/23	1	17th November (one recorded).	

Incidental Observations

Winter 2019/20 There was one incidental sighting of a kestrel in mid-October, observed from VP1 prior to the survey commencing.

Winter 2020/21 There were two incidental records of kestrel recorded (mid-October and mid-November).

3.3.1.4 Sparrowhawk

All observations of sparrowhawk recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 25** below.

Table 25. Summary of sparrowhawk survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2019	11	Recorded in April, June, July, August and September, from all VPs except VP7.	Refer to **Appendix 4 & 5**
	Summer 2020	5	Recorded in August and September from VP3 and VP7.	
	Winter 2020/21	1	Mid-December sighting of a female south of VP3.	
	Summer 2021	2	Recorded in May and July from VP3.	
	Winter 2021/22	3	Recorded in October and March from VP3 and VP5.	
	Summer 2022	4	Recorded in April, August and September from VP2, VP4 and VP7.	
	Winter 2022/23	6	Recorded in November and December from VP1, VP4 and from VP5.	
Transect/ Point Count Surveys	Summer 2019	3	April (presumably same male seen twice during Transect A – T7 & T9), June (male recorded during Transect B – T2), September (two birds recorded during Transect A – PC4).	Refer to **Appendix 8**
	Winter 2019/20	1	October (one bird recorded during Transect A – T10)	
	Winter 2020/21	1	November (one female recorded during Transect B – T2)	
	Summer 2022	4	July (two individuals recorded in area south of river at PC8, including juvenile heard calling from trees, nest site likely close by), September (one bird recorded during Transect A – PC5; female recorded during Transect B soaring over forestry – T4).	
Winter Walkover Surveys	Winter 2022/23	1	18th January Route A (large female flushed from forestry).	Refer to **Appendix 9**
Hinterland Surveys	Winter 2021/22 Winter 2022/23	2	14th January (one male recorded). 1st March (female recorded).	Refer to **Appendix 11**

Incidental Observations

Summer 2020 Sighting of a sparrowhawk in mid-May from area of VP2.

3.3.1.5 Buzzard

All observations of buzzard recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 26** below.

Table 26. Summary of buzzard survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2019	4	Recorded in May and September from VP2, VP4 and VP5.	Refer to **Appendix 4 & 5**
	Winter 2019/20	1	Recorded in March from VP1.	
	Summer 2021	5	Recorded between May and August, mainly from VP3 and also from VP2.	
	Summer 2022	11	Recorded in April, June, July and August, from all VPs except VP4. These included an observation of a pair hunting and soaring together before dropping into forestry, recorded northeast of VP1 in mid-June. In early August, two buzzards were recorded in-flight together north of VP5.	
Transect/ Point Count Surveys	Summer 2019	1	June (adult recorded during Transect A – T6)	Refer to **Appendix 8**
	Summer 2020	1	July (one bird recorded during Transect B – T1)	
Hinterland Surveys	Winter 2021/22	1	8th March (one recorded).	Refer to **Appendix 11**

Incidental Observations

Summer 2022 Two incidental records of buzzard on the same date in mid-June prior to the commencement of a survey at VP1. Another mid-June incidental record of buzzard prior to the commencement of a survey at VP6.

3.3.1.6 Peregrine

All observations of peregrine recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 27** below.

Table 27. Summary of peregrine survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2019	1	Recorded in September from VP3.	Refer to **Appendix 4 & 5**
	Winter 2019/20	2	Recorded in October from VP1 and VP6	
	Winter 2020/21	2	Recorded in December from VP2 and in March from VP2.	
	Summer 2021	1	Recorded in August east of VP5.	
	Winter 2021/22	2	Recorded in October and January, both from VP5. The January record comprised a juvenile observed east of VP5.	
	Winter 2022/23	1	Recorded in October, comprising an individual observed to the south-east of VP3 hunting golden plover.	
Hinterland Surveys (5 km)	Winter 2022/23	1	November (one observed on ground).	Refer to **Appendix 11**

For non-core survey data relating to peregrine, please see **Appendix 14**.

3.3.1.7 Woodcock

All observations of woodcock recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 28** below. All sightings of woodcock over this period comprised winter season records only.

Table 28. Summary of woodcock survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Winter 2019/20	1	Recorded in January during VP2.	Refer to **Appendix 4 & 5**
	Winter 2021/22	3	Recorded in mid-December during VP2 and VP3.	
	Winter 2022/23	1	Recorded in mid-February during VP7.	
Transect and Point Count Surveys	Winter 2019/20	6	November (two birds recorded during Transect A – T6 & PC10; two birds recorded during Transect B – T1 & PC5)), December (one bird recorded during Transect B – T2), January (one bird recorded during Transect A – T6)	Refer to **Appendix 8**
	Winter 2020/21	1	October (one bird recorded during Transect B – T4)	
	Winter 2021/22	4	December (two birds recorded during Transect A – T5 & PC8), January (one bird recorded during Transect A – T1; one bird recorded during Transect B – T5)	
	Winter 2022/23	3	November (two birds recorded during Transect A – T1 & T6), February (one bird recorded during Transect A).	
Hinterland Surveys	Winter 2021/22	1	8th March (adult flushed on way to Altderg Lough)	Refer to **Appendix 11**

Incidental Observations

Winter 2019/20 Multiple incidental records of woodcock in mid-November and late March, comprising birds flushed as surveyors traversed the site, including in the vicinity of VP1, VP2 and VP3.

Winter 2021/22 Frequent incidental records of birds being flushed by surveyors, including ten birds flushed on one date in early December in the vicinity of VP1 and VP3 (between access barrier and VP3). Birds also flushed in the vicinity of VP3, VP6 and VP7 on several dates in mid-January and February, including five birds flushed as a surveyor was exiting the site following a VP survey at VP1 in early February.

Multiple birds flushed by surveyors in early to mid-March in the vicinity of VP2, VP3, VP4 and VP6, including four birds flushed from a roadside area adjacent to cattle feeders as the surveyor arrived to site for a survey at VP4, twelve birds flushed as a surveyor travelled to VP2, including seven flushed from the track north-east of the VP, and four birds flushed from the track northeast of VP3.

Winter 2022/23 Multiple incidental sightings of flushed woodcock in October, December and February in the vicinity of VP1, VP2, VP3, VP6 and VP7 as surveyors either entered or left the site, including six records of flushed birds in early December near VP1 and four records of flushed birds in early December near VP3.

3.3.1.8 Red Grouse

All observations of red grouse recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 29** below.

Table 29. Summary of red grouse survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2020	1	Recorded in early May to the north of VP5.	Refer to **Appendix 4 & 5**
	Summer 2022	1	Recorded in early May to the northeast of VP5.	
	Winter 2022/23	4	Recorded in early October and mid-February during VP5 and VP7.	
Winter Walkover Survey	Winter 2019/20	-	Droppings recorded.	Refer to **Appendix 9**
	Winter 2020/21	-	14th & 24th February (droppings recorded).	
	Winter 2021/22	8	10th November Route A (fresh droppings recorded at several locations, also a pair flushed southwest of VP6), Route B (pair flushed southeast of VP7, also one record of droppings). 9th February Route A (male recorded), Route B (one bird observed, and droppings recorded at one location). 14th March Route B (three pairs, plus one female)	
	Winter 2022/23	1	17th February Route A (one bird).	
Breeding Walkover Survey	Summer 2021	2	Including one heard calling in July.	Refer to **Appendix 10**
	Summer 2022	2	17th June Walkover B (same adult male flushed twice). 24th August Walkover B (droppings recorded).	

Incidental Observations

Summer 2019 — Bird heard calling to the east of VP7 in mid-May, droppings recorded during VP6 and VP7 in late May.

Winter 2019/20 — Bird heard calling to the east of VP4 in late November.

Summer 2020 — Bird heard calling to south of VP5 in mid-July and to the south-east of VP4 in late August.

Summer 2021 — Droppings recorded near VP7. Red grouse heard calling to the south-east of VP4 (late May) and to the east of VP5 (mid-July). Red grouse flushed from a track by surveyor en route to VP4.

Winter 2021/22 — Two birds flushed northeast of VP7 in mid-December. Individuals heard calling from south of VP4 and southeast of VP7 (mid-January). Droppings recorded 50 m west of VP7 in mid-January.

Summer 2022 — Bird heard calling to the south of VP7 in mid-April. Red grouse heard calling south of VP4.

Winter 2022/23 — Several records of birds calling to the east and north of VP7 on one date in early December.

3.3.1.9 Golden Plover

All observations of golden plover recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 30** below.

Table 30. Summary of golden plover survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2019	2	Group of 45 birds recorded from VP3 in mid-April - flushed by a female hen harrier. In mid-September, another group of approximately 45 birds recorded from VP6.	Refer to **Appendix 4 & 5**

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
	Winter 2019/20	8	Multiple records of groups, ranging in size from 15 to 80 birds, recorded from VP2, VP4, VP6 and VP7 between mid-October and late March.	
	Summer 2020	1	Group of 40 recorded north of VP6 in late September.	
	Winter 2020/21	9	Two individuals and six records of groups, ranging in size from 13 to 200 birds, recorded from VP1 (200 birds), VP4 (max. 84 birds), VP5, VP6 and VP7, between mid-December and late February.	
	Summer 2021	1	23 birds observed in mid-April to south of VP4.	
	Winter 2021/22	27	Multiple records of groups, ranging in size from 2 to 170 individuals, recorded from all VPs except VP3 between mid-October and late March (groups of in excess of 100 birds recorded from VP4 and VP6).	
	Summer 2022	6	Groups of between 6 and 62 recorded from VP4, VP6 and VP7 between early and mid-April. No further sightings for the remainder of the summer 2022 survey period.	
	Winter 2022/23	10	Multiple records of groups, ranging in size from 12 to 86 birds, recorded from all VPs except VP1 and VP2 (maximum group record of 86 birds during VP6).	
Transect and Point Count Surveys	Winter 2021/22	1	January (one bird heard calling during Transect A – PC3)	Refer to Appendix 8
Winter Walkover Survey	Winter 2020/21	27	14th February (1 birds recorded). 24th February (26 birds recorded).	Refer to Appendix 9
	Winter 2021/22	5	10th November Route A (four flushed northwest of VP6, flock of seven circling overhead northwest of VP6, two heard calling north of VP1), Route B (total 40 birds southeast of VP7). 14th March Route B (11 birds observed).	
	Winter 2022/23	5	17th February Route A (two birds observed). 24th March Route A (one adult flushed, also sightings of two individuals alarm-calling on the ground in separate locations, possibly holding territory) and Route B (four adults on the ground by pools).	
Breeding Walkover Survey	Summer 2021	4	15th July (heard calling and singing to the northwest, at least four birds seen). 28th July (one individual flew over VP7 area).	Refer to Appendix 10
	Summer 2022	7	17th June Walkover A (including an adult alarm calling, a breeding pair close to a nest-site, and three non/failed breeders). 24th August Walkover A (adult flushed from ground).	
Hinterland Surveys	Winter 2021/22	3	14th January (50 birds recorded) 8th March (11 circling bog to south of road, plus 14 on ground).	Refer to Appendix 11
	Summer 2022	1	15th September (1 bird recorded).	
	Winter 2022/23	2	1st March (flock of 45 and flock of 70 recorded).	

Incidental Observations

Summer 2019 Birds heard calling from northwest of VP6 in late May and mid-June, also to the north of VP6 in late August.

Winter 2019/20 Birds heard calling from southwest of VP4, the hilltop above VP6 and the hilltop to the northwest of VP1 in mid-December. Birds calling to north of VP6 in mid-January and west of VP5 in late March.

Summer 2021	One bird heard calling over VP5.
Winter 2021/22	Birds heard calling from VP1, VP4, VP5, VP6
Summer 2022	One heard calling overhead at VP7.
Winter 2022/23	Birds heard calling from VP5, VP6 and VP7 between mid-November and mid-February. Flock of 86 birds on the ground as surveyor made their way into VP4 in November 2022).

3.3.1.10 Whooper Swan

All observations of whooper swan recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 31** below.

Table 31. Summary of whooper swan survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Winter 2021/22	3	Flock of eight on migration east of VP7, flock of six northeast of VP7 and a flock of six southeast of VP2 (all observed on one date in mid-October).	Refer to **Appendix 4 & 5**
	Winter 2022/23	1	Flock of eight observed southwest of VP1 in early December. Travelled east-northeast wards through the south of the site.	

3.3.1.11 Great Northern Diver

All observations of great northern diver recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 32** below.

Table 32. Summary of great northern diver survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Winter 2022/23	1	Two observed flying north-west together during VP5 in early November.	Refer to **Appendix 4 & 5**
Winter Walkover Surveys	Winter 2021/22	1	10th November (one flying north of VP3).	Refer to **Appendix 9**

For non-core survey data relating to great northern diver, please see Appendix 14.

3.3.1.12 Snipe

All observations of snipe recorded during site surveys over the 4-year period April 2019 to March 2023, inclusive, are summarised in **Table 33** below.

Table 33. Summary of snipe survey results

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
Vantage Point Surveys	Summer 2019	6	Recorded from VP4 and VP5 between mid-June and late September, including a male displaying over forestry and clearfell to the northwest of VP4 (18th June).	Refer to **Appendix 4** & **5**
	Winter 2019/20	6	All recorded from VP1 between mid-January and mid-February.	
	Summer 2020	2	Recorded from VP5 (mid-May) and VP6 (late September).	
	Winter 2020/21	5	Recorded from VP1, VP3 and VP6.	

Survey Type	Survey Period	No. of Sightings	Description	Appendix No.
	Summer 2021	2	Recorded from VP4 (late September) and VP5 (mid-April).	
	Winter 2021/22	12	Recorded from VP4, VP6 and VP7, including individual birds and flocks ranging in size from 15-50 (surveyors noted that early winter group records comprised snipe fresh from migration moving through the site).	
	Summer 2022	4	Recorded from VP4 and VP5, including two adult males observed south of VP5 in early May displaying, drumming and holding territory as they circled over bog, and an adult male chipping to the southwest of VP4 in early July.	
	Winter 2022/23	13	Recorded from VP1, VP2, VP4, VP6 and VP7 between early October (including flock of 32 migrating birds) and mid-January.	
Transect/ Point Count Surveys	Summer 2019	1	April (one bird heard chipping during Transect B – to south of PC4)	Refer to **Appendix 8**
	Winter 2019/20	2	January (one bird recorded during Transect A – T5), March (one bird recorded during Transect A – T9)	
	Summer 2020	2	May (one bird recorded during Transect B – T5; two birds recorded during Transect A – T6)	
	Winter 2021/22	1	October (one bird recorded during Transect B – T5)	
Breeding Walkover Surveys	Summer 2021	1	28th July (one flushed).	Refer to **Appendix 10**
	Summer 2022	2	Adult male displaying south of T3 on Transect B. Adult flushed from the track.	
Winter Walkover Survey	Winter 2019/20	6	21st February Route A (three birds) and Route B (three birds).	Refer to **Appendix 9**
	Winter 2020/21	8	Recorded on several occasions.	
	Winter 2021/22	17	10th Nov Route A (six sightings), Route B (two sightings). 9th February Route A (four sightings) 14th March Route A (three sightings), Route B (two sightings)	
	Winter 2022/23	6	18th January Route A (one bird) and Route B (two birds). 17th February Route A (two birds) and Route B (one bird)	
Nocturnal Breeding Surveys	Summer 2019	3	20th June (three snipe heard, including one on Transect A, one on Transect B and one heard drumming at PC4 location on Transect A).	Refer to **Appendix 10**
	Summer 2022	2	22nd June (adult male displaying south of T3, another bird flushed).	
Hinterland Surveys	Winter 2021/22	1	8th March (one flushed from bank of Ballinglen River)	Refer to **Appendix 11**

Incidental Observations

Summer 2019 Snipe heard drumming/chipping/calling east and southeast of VP3, south and southeast of VP5, southeast and southwest of VP7 between mid-May and mid-July.

Winter 2019/20 Snipe flushed by surveyor en route to VP1.

Summer 2020 One heard calling south-west of VP7 in late July.

Summer 2021 Heard chipping/calling west and south of VP4 and south of VP3 between late May and late July. In mid-June, one flushed by a surveyor en route to VP4.

Winter 2021/22 Heard from VP1. Two individuals recorded as surveyor travelled to VP6 in mid-January.

Summer 2022	One heard chipping to the northwest of VP5 at start of June. Also, individuals heard chipping/drumming to the west and north of VP4.
Winter 2022/23	Heard calling on two occasions from VP7.

3.3.2 Secondary Species

The following secondary species were recorded during ornithological surveys conducted in relation to the proposed wind farm development between April 2019 and March 2023, inclusive. Observations of secondary species are summarised as per surveys undertaken in the following sub-sections.

Tabulated summaries of secondary species VP observations, including flight information, are available in **Appendix 4**. VP flight line and activity area maps are available in **Appendix 5**.

3.3.2.1 Grey Heron

Vantage Point Surveys

- Summer 2019, one sighting recorded from VP4 in September.
- Winter 2019/20, one sighting recorded from VP1 in January.
- Summer 2022, total of four sightings, recorded from VP4 and VP5 in May and July.
- Winter 2022/23, one sighting recorded from VP5 in February.

Transect and Point Count Surveys

- Winter 2019/20, one sighting (March)

Hinterland Surveys

- Summer 2019, one bird recorded at Ballycastle Strand in mid-July.

For non-core survey data relating to grey heron, please see **Appendix 14**.

There were no additional observations of grey heron recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.2 Cormorant

Vantage Point Surveys

- Winter 2021/22, one sighting recorded from VP3 in January.
- Summer 2022, one sighting recorded from VP5 in August.

Hinterland Surveys

- Winter 2019/20, one bird recorded in December and two birds recorded in January at Ballycastle Strand

For non-core survey data relating to cormorant, please see **Appendix 14**.

There were no additional observations of cormorant recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.3 Mallard

Vantage Point Surveys

- Summer 2019, two sightings (pairs) recorded from VP5 in April and June.
- Winter 2021/22, one sighting recorded from VP5 in March.
- Winter 2022/23, one sighting recorded from VP1 in March.

Transect and Point Count Surveys

- Summer 2019, one sighting (April)

Hinterland Surveys

Winter 2022/23 November (12 recorded), March (adult male loafing on ponds during survey)

Incidental Observations

Winter 2020/21, one sighting of two individuals recorded from VP4 in February.

Winter 2021/22 Pair flushed out of a quarry by surveyor northeast of VP7.

There were no additional observations of mallard recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.4 Teal

Vantage Point Surveys

- Winter 2022/23, one sighting recorded from VP5 in November.

Hinterland Surveys

Winter 2022/23, November (32 birds recorded), March (adult female loafing on Kileena Lough).

Incidental sightings

Summer 2021, one sighting recorded from north-east of VP3 (pair) in September.

There were no additional observations of teal recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.5 Wigeon

Hinterland Surveys

Winter 2022/23, November (2 birds recorded), March (two adult males loafing on Kileena Lough).

There were no additional observations of wigeon recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.6 Black-headed Gull

Hinterland Surveys

Summer 2021, June (17 birds recorded)

Winter 2021/22, March (one bird recorded).

Winter 2022/23, November (one recorded in field).

For non-core survey data relating to black-headed gull, please see **Appendix 14**.

There were no additional observations of black-headed gull recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.7 Great Black-backed Gull

Vantage Point Surveys

- Summer 2019, one sighting recorded from VP7 in July.
- Winter 2020/21, one sighting of two birds recorded from VP4 in February.
- Summer 2021, one sighting recorded from VP5 in May.
- Winter 2021/22, one sighting recorded from VP5 in March.
- Summer 2022, two sightings recorded from VP5 and VP6 in April (pair) and July.

Hinterland Surveys

Winter 2021/22, March (pair recorded)

Winter 2022/23, March (one recorded)

For non-core survey data relating to great black-backed gull, please see **Appendix 14**.

There were no additional observations of great black-backed gull recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.8 Lesser Black-backed Gull

Vantage Point Surveys

- Summer 2019, total of three sightings recorded from VP4 and VP7 in June.

Hinterland Surveys

Summer 2021, June (six birds recorded)

For non-core survey data relating to lesser black-backed gull, please see **Appendix 14**.

There were no additional observations of lesser black-backed gull recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.9 Herring Gull

Hinterland Surveys

Summer 2021, June (14 birds recorded)

Winter 2021/22, January (34 birds recorded feeding in fields), March (16 birds recorded)

Summer 2022, September (1 bird recorded)

Winter 2022/23, November (1 bird recorded), March (5 birds recorded).

For non-core survey data relating to herring gull, please see **Appendix 14**.

There were no additional observations of herring gull recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.10 Common Gull

Hinterland Surveys

Winter 2021/22, January (30 birds feeding in fields with herring gulls), March (one recorded).

Winter 2022/23, November (10 birds feeding in fields).

For non-core survey data relating to common gull, please see **Appendix 14**.

There were no additional observations of common gull recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.11 Iceland Gull

Vantage Point Surveys

- Winter 2020/21, one sighting recorded from VP6 in March.

For non-core survey data relating to Iceland gull, please see **Appendix 14**.

There were no additional observations of Iceland gull recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.12 Gannet

Hinterland Surveys

Summer 2022, September (3 birds recorded).

There were no additional observations of gannet recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.3.2.13 Jack Snipe

Winter Walkover Surveys

Winter 2022/23, March (one bird flushed from Route B).

Hinterland Surveys

Winter 2022/23, March (one bird flushed).

Incidental sightings

Winter 2021/22, two sightings (likely same bird flushed twice) recorded while surveyor was leaving VP4 in January.

Winter 2022/23, one sighting recorded from VP3 in November flushed while surveyor en route to VP location.

There were no additional observations of jack snipe recorded during any of the other surveys carried out during the 4-year survey period from April 2019 to March 2023, inclusive.

3.4 Evaluation of Conservation Importance of Populations of Key Species

The conservation importance of the populations of key species which have been identified within the ZOI is evaluated with regard to national species population estimates and mean county population data, where available for certain species.

3.4.1 Merlin

Merlin is listed under Annex I of the EU Birds Directive and is amber listed in Ireland (Gilbert *et al*., 2021). To date there has been no systematic national survey undertaken for merlin. As per the latest NPWS Article 12 reporting, the national breeding population of merlin is estimated to be between 200 and 400 pairs. This NPWS Article 12 breeding population estimate is based largely on expert opinion (Hardy *et al*., 2009).

Merlin was recorded on three occasions over the course of the 4-year survey period. These records included two sightings of merlin during VP surveys (comprising one breeding season and one winter season record, both of which occurred in/within a 500 m radius of the proposed wind farm site. There was also one incidental record of an adult bird (recorded February 2020).

No merlin breeding activity was recorded during any of the surveys undertaken within the study area over the 4-year survey period; however, it is acknowledged that targeted breeding raptor surveys in-line with best practice guidance were not completed (see **Section 2.9.4.2**) and therefore a precautionary approach is taken with regard to results.

On this basis, the merlin population recorded has been assigned a conservation importance rating of **Local Importance (Higher Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.2 Hen Harrier

Hen harrier is listed under Annex I of the EU Birds Directive and is amber listed in Ireland (Gilbert *et al*., 2021).

There was a total of eight sightings of hen harrier during VP surveys over the course of the 4-year survey period, comprising one breeding season and seven winter season records. There were also two sightings of males on one date during a winter hinterland survey.

<u>Wintering</u>

Of the seven winter season records, all observations occurred in/within a 500 m radius of the proposed wind farm site during the survey period. Both male and female birds were recorded, including adults and birds in both first- and second-year plumage. No hen harrier winter roosts were identified within a 2 km radius of the proposed wind farm site.

As per the latest NPWS Article 12 reporting, the estimated national wintering population of hen harrier in Ireland is 269-349 individuals (1% of this population equates to 2-3 birds). On a precautionary basis, therefore, the individuals recorded during the winter season surveys at the proposed wind farm site are taken to form part of a wintering population of **National/International importance**, as per NRA (2009).

<u>Breeding</u>

A review of the most recent national survey of breeding hen harrier in Ireland (Ruddock *et al*., 2016) determined that the national breeding population is estimated to comprise between 108-157 pairs. Therefore, the presence of one breeding pair would be taken to comprise a population of National/International importance.

There was one summer season record of hen harrier, comprising a female recorded in mid-April 2019 (occurred within the east of the site). This comprises the only summer season observation of hen harrier recorded over the course of the 4-year bird survey period.

On the basis of the surveys undertaken within the study area over the 4-year survey period; it is considered that the proposed wind farm site and the surrounding area does not support breeding hen harrier; however, it is acknowledged that targeted breeding raptor surveys in-line with best practice guidance were not completed (see Section 2.9.4.2) and therefore a precautionary approach is taken with regard to results.

On this basis, the population recorded has been assigned a conservation importance rating of Local Importance (Higher Value) on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.3 Kestrel

Kestrel is not listed on Annex I of the EU Birds Directive. However, kestrel is red listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al*., 2021). As per the latest NPWS Article 12 reporting, the national breeding population of kestrel is estimated to be between 12,100 and 21,200 individuals.

There was a total of 56 sightings of kestrel during VP surveys over the course of the 4-year survey period, comprising 30 breeding season and 26 winter season records. Of these, 45 flight paths were recorded in/within a 500 m radius of the proposed wind farm site. There were an additional eight records of kestrel during distribution and abundance surveys and three incidental records.

Juvenile birds were recorded during VP surveys in September 2022 indicating that at least one pair of kestrels may have bred in the area; however, it is acknowledged that targeted breeding raptor surveys in-line with best practice guidance were not completed (see Section 2.9.4.2) and therefore a precautionary approach is taken with regard to results.

On this basis, the population recorded has been assigned a conservation importance rating of Local Importance (Higher Value) on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.4 Sparrowhawk

Sparrowhawk is not listed on Annex I of the EU Birds Directive and is green listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al*., 2021). As per the latest NPWS Article 12 reporting, the national breeding population of sparrowhawk is estimated to be between 9,100 and 14,830 individuals.

There was a total of 32 sightings of sparrowhawk during VP surveys over the course of the 4-year survey period, comprising 22 breeding season and ten winter season records. Of these, all but one flight path occurred in/within a 500 m radius of the proposed wind farm site. There were an additional 12 records of sparrowhawk during distribution and abundance surveys and one incidental record.

In July 2022, a juvenile(s) was heard calling from trees during a transect with the nest site considered by the surveyor to be located close by. This indicates that at least one pair of sparrowhawk bred in the area; however, it is acknowledged that targeted breeding raptor surveys in-line with best practice guidance were not completed (see Section 2.9.4.2) and therefore a precautionary approach is taken with regard to results.

On this basis, the population recorded has been assigned a conservation importance rating of Local Importance (Higher Value) on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.5 Buzzard

Buzzard is not listed on Annex I of the EU Birds Directive and is green listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al.*, 2021). As per the latest NPWS Article 12 reporting, the national breeding population of buzzard is estimated to be 1,500 pairs.

There was a total of 21 sightings of buzzard during VP surveys over the course of the 4-year survey period, comprising 20 breeding season and one winter season record. Of these, 17 flights occurred in/within a 500 m radius of the proposed wind farm site. There were an additional three records of buzzard during distribution and abundance surveys (transects and a hinterland survey) and three incidental records.

In mid-June 2022, a pair was observed in-flight together before dropping into forestry northeast of VP1 indicating that a pair may have possibly bred within the site; however, it is acknowledged that targeted breeding raptor surveys in-line with best practice guidance were not completed (see **Section 2.9.4.2**) and therefore a precautionary approach is taken with regard to results.

On this basis, the population recorded has been assigned a conservation importance rating of **Local Importance (Higher Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.6 Peregrine

Peregrine is listed on Annex I of the EU Birds Directive and is green listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al*., 2021). As per the latest NPWS Article 12 reporting, the national breeding population of peregrine is estimated to be 515 pairs.

There was a total of nine sightings of peregrine during VP surveys over the course of the 4-year survey period, comprising two breeding season and seven winter season records. Of these, all but one flight path occurred in/within a 500 m radius of the proposed wind farm site. There was one additional record of peregrine recorded during a winter hinterland survey.

It is acknowledged that targeted breeding raptor surveys in-line with best practice guidance were not completed (see **Section 2.9.4.2**) and therefore a precautionary approach is taken with regard to results. On this basis, the population recorded has been assigned a conservation importance rating of **Local Importance (Higher Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.7 Woodcock

Woodcock is not listed on Annex I of the EU Birds Directive but is red listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al*., 2021). A review of the latest NPWS Article 12 reporting determined that due to the uncertainty that exists between the ratio of calling males (recommended reporting unit) to breeding pairs, no reliable population estimate for breeding woodcock is available. However, a population estimate of 2,500 – 9,999 pairs may still be relevant.

There was a total of five sightings of woodcock during VP surveys over the course of the 4-year survey period, all of which comprised winter season records and occurred in/within a 500 m radius of the proposed wind farm site. There were twelve additional records of woodcock recorded during distribution and abundance surveys (winter transects and winter hinterland surveys) and 27 incidental records.

All sightings were made during the winter survey periods. Woodcock was not observed during any of the breeding season woodcock surveys or other breeding season surveys undertaken during the 2019, 2020, 2021 or 2022 breeding seasons.

However, it is acknowledged in **Section 2.9.4.3** above that there were survey limitations with regard to breeding woodcock. Taking a precautionary approach, the population recorded has been assigned a conservation importance rating of **Local Importance (Higher Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.8 Red Grouse

Red grouse is not listed on Annex I of the EU Birds Directive but is red listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al*., 2021). As per the latest NPWS Article 12 reporting, the national breeding population of red grouse is estimated to be between 1,708 and 2,116 pairs.

There was a total of seven sightings of red grouse during VP surveys over the course of the 4-year survey period, comprising two breeding season and five winter season records, all of which occurred in/within a 500 m radius of the proposed wind farm site. There were 13 additional records of red grouse recorded during the winter and breeding walkover surveys undertaken, and 15 incidental records, including birds heard calling on multiple occasions, as well as records of red grouse droppings.

Taking a precautionary approach, the population recorded has been assigned a conservation importance rating of **Local Importance (Higher Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.9 Golden Plover

Golden plover is listed on Annex I of the EU Birds Directive and is red listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al*., 2021).

<u>Wintering</u>

A review of '*Estimates of waterbird numbers wintering in Ireland, 2011/12 – 2015/16*' (Burke *et al*., 2018) determined that the national wintering population of golden plover is estimated at 80,707 birds (ROI). As per NRA (2009), a regularly occurring population of 807 golden plover would be required for classification as National/International importance. Based on the size of the largest flock of golden plover recorded during the winter periods, this wintering population does not meet the criteria for a population of either National/International importance.

In order to estimate the county population of golden plover, a review of I-WeBS site data for the county was undertaken in January 2023. It is acknowledged that I-WeBS counts underestimate the numbers of certain species (e.g., golden plover) as these species regularly forage away from wetland sites (Burke *et al*., 2018). The following mean counts have been recorded for golden plover at I-WeBS sites within the county over the most recent 5-year count period (2016/17 to 2020/21):

- Balla Wetlands: 41
- Ballybackagh: 150
- Ballyglass Wetlands: 6
- Ballyhaunis Lakes: 59
- Blacksod & Tullaghan Bays: 506
- Clew Bay: 139
- Killala Bay: 186

- Lough Cullin: 117
- Lough Mask: 19
- Mullet West: 7
- South Mayo Coast: 187
- Termoncarragh & Annagh Marsh: 302

Based on the above count data for the period 2016/17 to 2020/21, the estimated total mean wintering population for the county is 1,719 individuals. Therefore, a regularly occurring population of 17 individuals (1% of the county population) would be considered to be of County importance.

There was a total of 54 VP survey records for golden plover over the course of the winter survey periods. A total of 36 flight paths were recorded in/within a 500 m radius of the proposed wind farm site. The largest flock recorded over each winter season comprised the following:

- Winter 2019/20: 80 birds observed from VP6 in January and 80 birds recorded from VP4 in late March 2020.
- Winter 2020/21: 200 birds observed from VP1 in February 2021
- Winter 2021/22: 170 birds observed from VP6 in December 2021
- Winter 2022/23: 86 birds observed from VP6 in October

These flocks are considered to be of **County importance** given the numbers that were recorded. Three of these flocks occurred in/within a 500 m radius of the proposed wind farm site.

There were 43 additional records of golden plover recorded during transects, winter walkover surveys and hinterland surveys and 18 incidental winter records.

<u>Breeding</u>

As per the latest NPWS Article 12 reporting, the national breeding population of golden plover is estimated to be between 134 and 156 pairs. Therefore, a regularly occurring population of 1 pair (1% of the national population) would be considered to be of National/International importance.

There were 10 sightings of golden plover during VPs over the course of the summer survey periods. Of these, nine flight paths were recorded in/within a 500 m radius of the proposed wind farm site. All VP records occurred at either the start or the end of the summer survey seasons (mid-April or late September records).

There were 12 additional records of golden plover recorded during transects and breeding walkover surveys and two incidental breeding season records. During breeding walkover surveys, golden plover were heard calling outside and to the north-west of the proposed wind farm site boundary (July 2021), while in June 2022 an adult alarm calling, and a breeding pair considered close to a nest-site, were also recorded. It is acknowledged in **Section 2.9.4.1** above that there were survey limitations with regard to breeding waders, including golden plover.

The individuals recorded during the breeding walkover surveys are taken to form part of a breeding population of **National/International importance**, as per NRA (2009).

3.4.10 Whooper Swan

Whooper swan is listed on Annex I of the EU Birds Directive and is amber listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al*., 2021). Whooper swan is a winter visitor to Ireland occurring from October to April.

There was a total of four sightings of whooper swan during VP surveys over the course of the 4-year survey period, all of which comprised winter season records. All records were of birds believed to be on migration/commuting. Three of the flight paths recorded occurred in/within a 500 m radius of the proposed wind farm site.

There were no other sightings of whooper swan in the vicinity of the proposed wind farm site over the course of the bird survey period. Results indicate that the site does not support a wintering population of whooper swan.

The population recorded has been assigned a conservation importance rating of **Local Importance (Lower Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.11 Great Northern Diver

Great northern diver is listed on Annex I of the EU Birds Directive and is amber listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al.*, 2021). Great northern diver is not a breeding species in Ireland. The closest breeding population is located in Iceland. This species occurs along the Irish coastline between September and April.

There was one sighting of great northern diver during VP surveys over the course of the 4-year survey period, comprising a winter season record. This flight path was recorded in/within a 500 m radius of the proposed wind farm site. There was one additional record of great northern diver recorded during winter walkover surveys (individual travelling west through the northern part of the proposed wind farm site, recorded in November 2021).

A total of two flights by great Northern diver were recorded. These individuals are considered to have been birds commuting towards the coastline. There were no other sightings of this species in the vicinity of the proposed wind farm site over the course of the bird survey period and the site does not encompass suitable habitat for wintering great northern diver. The proposed wind farm site is not considered to be of ecological importance for this species.

The population recorded has been assigned a conservation importance rating of **Local Importance (Lower Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.4.12 Snipe

Snipe is not listed on Annex I of the EU Birds Directive but is red listed as per the most recent assessment of species conservation status in Ireland (Gilbert *et al.*, 2021).

<u>Wintering</u>

A review of the latest NPWS Article 12 reporting and Burke *et al.*, (2018) determined that a national wintering population estimate is not available for snipe. Burke *et al.*, (2018) references the elusive nature of snipe and certain other species as the reasoning for exclusion from the waterbird population analysis carried out.

In order to estimate the county population of snipe, a review of I-WeBS site data for the county was undertaken in January 2023. The following mean counts have been recorded for snipe over the most recent five-year count period available (2016/17 to 2020/21):

- Ballybackagh: 1
- Ballyhaunis Lakes: 4
- Blacksod & Tullaghan Bays: 11
- Castlebar Lakes/Islandeady Chain: 1
- Clew Bay: 4

- Killala Bay: 1
- Lough Mask: 17
- South Mayo Coast: 2
- Termoncarragh & Annagh Marsh: 65
- Wetland near Drumcarrabaun (Belcarra/Ballyglass Road): 1

Based on the above count data for the period 2016/17 to 2020/21, the estimated total mean wintering population for the county is 107 individuals. As per Burke *et al*., (2018), the county population estimate of wintering snipe, as per I-WeBS data available, likely comprises a considerable under-estimate. However, on the basis of available I-WeBS data, a regularly occurring population of one individual (1% of the county population) would be considered to be of County importance.

There were 34 VP observations of snipe over the course of the winter survey periods, all of which occurred in/within a 500 m radius of the proposed wind farm site. There were an additional 40 observations of snipe recorded during transects and winter walkover surveys and eight incidental records.

Taking a precautionary approach, the winter population recorded has been assigned a conservation importance rating of **County Importance** on the basis of a resident/regularly occurring population assessed to be important at the county level.

<u>Breeding</u>

As per the latest NPWS Article 12 reporting, the national breeding population of snipe is estimated at 4,275 pairs. Therefore, a regularly occurring population of 42 pairs (1% of the national population) would be considered to be of national importance.

There were 14 observations of snipe during the breeding season VP surveys, including 11 flight paths recorded in/within a 500 m radius of the proposed wind farm site. Snipe were also heard calling/drumming/chipping on occasion during VP surveys. There were an additional 11 observations of snipe recorded during transects, breeding walkover surveys and nocturnal breeding surveys and seven incidental breeding season records. It is acknowledged in **Section 2.9.4.1** above that there were survey limitations with regard to breeding waders, including snipe.

Taking a precautionary approach, the population recorded has been assigned a conservation importance rating of **Local Importance (Higher Value)** on the basis of a resident/regularly occurring population assessed to be important at the local level.

3.5 Identification of Important Ecological Features (IEFs)

The following table (**Table 34**) presents the rationale for either the inclusion or exclusion of target species as IEFs based on criteria set out in **Section 2.6**. The likely significance of the project on target species that are included as IEFs is considered further in **Section 4.**

Table 34. Identification of IEFs

Species	Conservation Status[15]	NRA Evaluation (NRA, 2009)	IEF (Yes/No)	Rationale for Inclusion/Exclusion
Merlin	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts/ SCI	**Local Importance (Higher Value)**	**Yes**	Merlin was recorded on three occasions during surveys over the course of the overall 4-year survey period. Two flight paths occurred in/within 500 m of the proposed wind farm site. No merlin breeding activity was recorded within the study area over the course of the bird surveys. Further assessment is required in relation to merlin.
Hen Harrier	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts	Wintering National/International importance	**Yes**	Hen harrier was recorded on ten occasions during surveys over the course of the overall 4-year survey period. One breeding season flight path was recorded in/within 500 m of the proposed wind farm site. No hen harrier breeding activity/breeding population was identified within the vicinity of the proposed wind farm site during the surveys undertaken. Seven winter season flight paths were recorded in/within 500 m of the proposed wind farm. No hen harrier winter roosts were identified within 2 km of the proposed wind farm site. Further assessment is required in relation to hen harrier.
Kestrel	BoCCI Red-listed/ Wildlife Acts	Local Importance (Higher Value)	**Yes**	Kestrel was recorded on 64 occasions during surveys over the course of the overall 4-year survey period. Of these, 45 flight paths occurred in/within 500 m of the proposed wind farm site. Kestrels were observed in both breeding and non-breeding seasons within the survey period. One pair of kestrels is estimated to have bred in the area over the course of the survey period. Further assessment is required in relation to kestrel.
Sparrowhawk	BoCCI Green-listed / Wildlife Acts	Local Importance (Higher Value)	**Yes**	Sparrowhawk was recorded on 44 occasions during surveys over the course of the overall 4-year survey period. Of these, 31 flight paths occurred in/within 500 m of the proposed wind farm site. Sparrowhawk was observed in both the breeding and non-breeding seasons. Evidence of sparrowhawk breeding in the area was recorded.

[15] Wildlife Act, 1976 (irishstatutebook.ie)

Species	Conservation Status[15]	NRA Evaluation (NRA, 2009)	IEF (Yes/No)	Rationale for Inclusion/Exclusion
				Further assessment is required in relation to sparrowhawk.
Buzzard	BoCCI Green-listed/ Wildlife Acts	Local Importance (Higher Value)	Yes	Buzzard was recorded on 24 occasions during surveys over the course of the overall 4-year survey period. Of these observations, 17 flight paths occurred in/within 500 m of the proposed wind farm site. Buzzard was observed in both the breeding and non-breeding seasons. A pair possibly bred within the proposed wind farm site. Further assessment is required in relation to buzzard.
Peregrine	Annex I EU Birds Directive / BoCCI Green-listed/ Wildlife Acts	Local Importance (Higher Value)	Yes	Peregrine was recorded on 10 occasions during surveys over the course of the overall 4-year survey period. Of these observations, eight flight paths occurred in/within 500 m of the proposed wind farm site. Peregrine was observed in both the breeding and non-breeding seasons. Further assessment is required in relation to peregrine.
Golden Eagle	Annex I EU Birds Directive/ BoCCI Red-listed/ Wildlife Acts	N/a	No	Golden eagle was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of golden eagle.
Snowy Owl	Annex I EU Birds Directive/ BoCCI Red-listed/ Wildlife Acts	N/a	No	Snowy owl was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of snowy owl.
Woodcock	BoCCI Red-listed / Wildlife Acts	Local Importance (Higher Value)	Yes	Woodcock was recorded on 17 occasions during surveys over the course of the overall 4-year survey period. Of these observations, five flight paths occurred in/within 500 m of the proposed wind farm site. All sightings were made during the winter seasons. Woodcock was not recorded during any of the breeding season surveys undertaken. Further assessment is required in relation to woodcock.
Red Grouse	BoCCI Red-listed / Wildlife Acts	Local Importance (Higher Value)	Yes	Red grouse was recorded on 20 occasions during surveys over the course of the overall 4-year survey period. Of these observations, seven flight paths occurred in/within 500 m of the proposed wind farm site. Red grouse were recorded in both breeding and non-breeding seasons within the survey period. Red grouse were recorded during breeding walkover surveys, including multiple records of birds heard calling/recording of droppings. Further assessment is required in relation to red grouse.

Species	Conservation Status[15]	NRA Evaluation (NRA, 2009)	IEF (Yes/No)	Rationale for Inclusion/Exclusion
Golden Plover	Annex I EU Birds Directive/ BoCCI Red-listed/ Wildlife Acts/ SCI	Wintering County Importance Breeding National/ International importance	**Yes**	Golden plover was recorded on 97 occasions during surveys over the course of the overall winter survey period. Of these observations, 36 flight paths occurred in/within 500 m of the proposed wind farm site. Flocks >50 birds were recorded on several occasions (max. 200 birds recorded at one time). These flocks are considered to be of County importance with regard to the wintering population. Golden plover was recorded on 22 occasions during surveys over the course of the overall summer survey period. Of these observations, nine flight paths occurred in/within 500 m of the proposed wind farm site. During breeding walkover surveys golden plover were heard calling (Summer 2021), while in June 2022 an adult alarm calling, and a breeding pair considered close to a nest-site, were recorded. The individuals recorded during the breeding walkover surveys are therefore taken to form part of a breeding population of National/International importance. Further assessment is required in relation to golden plover.
Whooper Swan	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts	Locally important (lower value)	**No**	There was a total of four sightings of whooper swan during VP surveys over the course of the overall 4-year survey period, all of which comprised winter season records. All records were of birds believed to be on migration/commuting. Results indicate that the proposed wind farm site does not support a wintering population of whooper swan.
Great Northern Diver	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts/ SCI	Locally important (lower value)	**No**	There was one sighting of great northern diver during VP surveys over the course of the overall 4-year survey period, comprising a winter season record, and one additional record recorded during a winter walkover survey. There were no other sightings of this species in the vicinity of the proposed wind farm site over the course of the bird survey period. The site does not encompass suitable habitat for wintering great northern diver Results indicate that the proposed wind farm site does not support a wintering population of great northern diver.
Snipe	BoCCI Red-listed/ Wildlife Acts	Wintering County importance Breeding Local Importance (Higher Value)	**Yes**	Snipe was recorded on 74 occasions during surveys over the winter survey period. Of these observations, 34 flight paths were recorded in/within 500 m of the proposed wind farm site. The winter population recorded has been assigned a conservation importance rating of County Importance. Snipe was recorded on 25 occasions during surveys over the summer survey period. Of these observations, 11 flight paths occurred in/within 500 m of the proposed

Species	Conservation Status[15]	NRA Evaluation (NRA, 2009)	IEF (Yes/No)	Rationale for Inclusion/Exclusion
				wind farm site. Snipe were heard calling/drumming/chipping on occasion and were recorded during breeding walkover surveys. Further assessment is required in relation to snipe.
Dunlin	Annex I EU Birds Directive/ BoCCI Red-listed /Wildlife Acts/SCI	N/a	No	Dunlin was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of dunlin.
Ringed plover	BoCCI Amber-listed/ Wildlife Acts/SCI	N/a	No	Ringed plover was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of ringed plover.
Curlew	BoCCI Red-listed/Wildlife Acts/SCI	N/a	No	Curlew was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of curlew.
Redshank	BoCCI Red-listed/ Wildlife Acts/SCI	N/a	No	Redshank was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of redshank.
Corncrake	Annex I Bird Species/ BoCCI Red-listed/ Wildlife Acts	N/a	No	Corncrake was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of corncrake.
Greenland white-fronted goose	Annex I EU Birds Directive/ BoCCI Amber-listed/ Wildlife Acts/SCI	N/a	No	Greenland white-fronted goose was not recorded at any stage over the course of the overall 4-year survey period. Results indicate that the proposed wind farm site does not support a population of Greenland white-fronted goose.

3.5.1 Sensitivity of Bird Species Selected as IEF

The determination of the sensitivity of bird species selected as IEF in the previous section follows the guidance set out in Percival (2003) for assigning sensitivity. The criteria are outlined in **Section 2.6.1** above. Consideration of the information contained in **Table 34** above indicates two 'Very High' sensitivity species have been recorded, one 'High' sensitivity species has been recorded, four 'Medium' sensitivity species have been recorded and three 'Low' sensitivity species have been recorded (see **Table 35** below).

Table 35. Sensitivity of bird species selected as IEFs

	Very High Sensitivity	High Sensitivity	Medium Sensitivity	Low Sensitivity
Species	Merlin (Annex I)	Hen Harrier (Annex I)	Kestrel (red list)	Peregrine (green list)
	Golden Plover (Annex I)		Woodcock (red list)	Buzzard (green list)
			Red Grouse (red list)	Sparrowhawk (green list)
			Snipe (red list)	

4. Likely Significant Effects

4.1 Do-Nothing Effect

Without the Proposed Development proceeding, it is expected that the existing main land-uses on the proposed wind farm site, namely commercial forestry, will continue. Mature stands will be clear-felled in due course and the areas then replanted.

Overall, the diversity of birds within the site would be expected to remain fairly similar as at present. However, for periods the populations of some bird species would be expected to increase when substantial areas are clear-felled and replanted (until closed canopy stage). For the periods when open canopy forest exists, birds of prey such as hen harrier and kestrel could be expected to forage over the young trees.

4.2 Construction Phase Potential Effects

4.2.1 Habitat Loss

The permanent total loss of habitat to facilitate the construction of the Proposed Development is 117.3 Ha, along with an estimated 1.3 km of hedgerow to be removed. This comprises almost entirely conifer plantation (116 Ha), which includes some clear-felled areas.

While some of the bird species which are identified as IEFs can utilise conifer plantation, and especially the open canopy phase (see **Table 36** below), none is dependent on this (non-native) habitat for breeding and/or wintering requirements. Of the species listed in **Table 36** only sparrowhawk, buzzard and kestrel were considered likely to have bred within the conifer plantation in at least one of the survey years. All of the listed raptor species may hunt or forage within or alongside the plantations. The wintering woodcock population in Ireland largely comprises immigrants from Scandinavia and Russia (Crowe, 2005) and birds will readily roost within the margins of conifer plantations, as well as other woodland types and scrub. All of the listed species in **Table 36** below would be expected to continue to utilise the remaining area of plantation (approx. 1,040 Ha) within the proposed wind farm development site after the wind farm is constructed. Also, it is noted that conifer plantation is a widespread habitat in the local area and throughout north County Mayo and is not a habitat of conservation importance.

Table 36. Bird species listed as Important Ecological Features which may utilise conifer plantation

Species	Use of Conifer Plantation
Merlin	May nest in conifer trees at edge of plantation (adjoining open bog) and hunt over clear-fell & open canopy forest. With two records during vantage point surveys (August 2020 & March 2023) and one incidental record (February 2020), merlin was not considered to breed within proposed wind farm development site.
Hen Harrier	May forage over clear-fell and open canopy forest, and along forest edges. Seven winter records within 500 m of proposed wind farm development site during study, though no evidence of a winter roost within a 2 km distance of proposed wind farm development site. With only one record in the breeding season and taking into account that County Mayo is outside of the known hen harrier breeding range (Ruddock *et al*. 2016), breeding within at least 500 m of the proposed wind farm development area not considered likely.
Kestrel	May nest in conifer trees and hunt over open canopy forest and clear-fell, as well as along forest edge and tracks. Recorded regularly within the proposed wind farm development area during summer and winter. Juveniles in August & September 2022 indicates breeding took place locally.
Sparrowhawk	Breeds and hunts in woodland, including conifer plantation. Recorded regularly within the proposed wind farm development area during baseline surveys, with breeding confirmed in July 2022.
Buzzard	May nest in mature conifer trees and hunt over open canopy forest and clear-fell, as well as along forest edge and tracks. Recorded regularly within the proposed wind farm development area during summer and winter. Some evidence of breeding occurring within the proposed wind farm development area in 2022.
Woodcock	Often occurs along woodland edges and forest tracks. Recorded within the proposed wind farm development area during winter only.

The proposed wind farm development will also result in the loss of 1.1 Ha of peatland habitat to facilitate two of the required borrow pits (one in south and one in north of site). These are both located on degraded bog and heath, with the southern site partly covered with conifer trees. Other than perhaps meadow pipits, these relatively small areas of peatland habitat would not be expected to support any breeding species of conservation importance. Also, the loss will be off set through the Biodiversity Management and Enhancement Plan (**Appendix 6.4 of the EIAR**), which aims to restore approximately 40 ha of peatland habitat through conifer removal and drain blocking. The BMEP involves the removal of self-seeded conifers from an area of approximately 40 Ha in the northern sector of the site. The area will be located a substantial distance from the turbines (closest distance 650 m to north) and bird species likely to utilise the restored bog, such as kestrel and golden plover, will not be displaced due to the presence of turbines or will not be at an increased risk of collision with turbines.

The Proposed Development requires the removal of approximately 1.3 km of hedgerow along the local road in Ballyglass which forms part of the Turbine Delivery Route and along which the grid connection cable will be laid. This hedging is of low stature and dominated by gorse, willow, hawthorn and brambles (see Section 6.6.1.5 of Chapter 6 of the EIAR). The hedge is limited in its potential for breeding birds, though is likely to support species such as wren, robin, dunnock and blue tit. The hedge would also provide some feeding potential for various passerine species.

It is noted that a hedgerow, using similar species, will be replanted approximately 2 m back from the edge of the existing road when the works are complete.

Notwithstanding the survey limitations relating especially to raptors and waders (including breeding woodcock) (see Section 2.9 of this report), the following points are noted:

(i) habitat loss involves mainly commercial conifer plantation (a non-native commercial habitat), along with a small area of degraded bog/heath, and a stretch of 1.3 km of roadside hedgerow (which will be replanted on completion of works),

(ii) it is expected that all bird species associated with the conifer and bog habitats will still retain a presence on site during and after construction,

(iii) the loss of degraded bog/heath will be offset by the restoration of up to 40 Ha of peatland habitat through a Biodiversity Management and Enhancement Plan,

On this basis, it is considered that the significance of the effect on birds due to the loss of habitat to facilitate the Proposed Development is an adverse effect of Slight Significance and of long-term duration.

4.2.2 Disturbance to Birds

The construction phase for the proposed wind farm development is anticipated to last between 18 and 24 months. In this period, on-site activities, including tree felling, civil works and turbine erection works, have potential to cause disturbance effects on birds of conservation importance in adjoining and nearby areas.

Scottish Natural Heritage (2016) write "Different bird species have different tolerance levels to disturbance. Even within species, disturbance distance can vary according to time of year or geographical location. Some sensitive species may be disturbed by activity as much as 750 m away." SNH had published "*A review of disturbance distances in selected bird species*" prepared by Ruddock and Whitfield (2007). This review included 26 'priority' species and was based largely on expert opinion. The 2007 guidance note was replaced in 2022 by "*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 review included 65 bird species.

Detailed consideration of potential for disturbance is given to the species identified as IEFs at the Proposed Development site (see Table 34 above).

It is noted that passerine species, including meadow pipit (Red-listed) are not perceived as being prone to disturbance from wind farm construction (SNH 2017) and indeed Pearce Higgins *et al*. (2012) found that densities of skylarks and stonechats increased on wind farms during the construction phase.

Hen Harrier

There was no hen harrier breeding activity recorded within the study area in any of the bird surveys (a female recorded on-site in April 2019 was not showing breeding behaviour). Breeding hen harriers were not recorded in County Mayo in the 2010 or 2015 National Hen Harrier Surveys (Ruddock *et al*. 2016).

Wintering hen harriers were recorded within the study area on seven occasions (including two records of the same bird sighted 6 minutes apart). Birds were observed flying and/or hunting over bog and forestry. However, there was no evidence of winter roosts from the various baseline surveys (though specific survey for winter roosts was not carried out as part of baseline surveys, see Section 2.4 of this report), or from the literature review, within at least a 2 km radius of the wind farm site.

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 birds and non-breeding birds.

While construction works at the site for the proposed wind farm development will take place in an area where hen harriers have been recorded in winter, the potential for disturbance is considered low as the birds were only hunting in the area and not associated with any apparent winter roost. Hunting birds are still likely to pass through areas of the site away from the main construction works area. On the basis that there was no evidence of a winter roost within the proposed wind farm development area, the effect on wintering hen harrier is rated as 'Not Significant'.

Sparrowhawk

The habitat in the study area, i.e., conifer plantation, is suitable for supporting breeding sparrowhawk. The species was recorded in the study area regularly during the various baseline surveys and breeding was considered to have taken place in 2022 (juvenile heard calling).

Sparrowhawk was not considered in the NatureScot (2022) review of disturbance distances in birds or in the review of 'safe working distances' for forestry workers to sensitive bird species by Currie and Elliot (1997). In the absence of such information, a buffer zone of 100-200 m is suggested for breeding birds (as for buzzard, a tree-nesting species, and kestrel, a tree and cliff/crag nesting species, in the NatureScot review).

At the site for the proposed wind farm development, construction works will take place in an area that supported a nesting pair of sparrowhawk at least in the 2022 season. It is considered that the construction of the wind farm would likely have a potential disturbance effect on breeding birds within a distance of up to 200 m from the construction area – this is rated as an 'Adverse Significant Effect' of Short-term duration. Pre-construction surveys will be carried out in suitable breeding habitat within and around the site and, as required, mitigation will be implemented to reduce the significance of this potential effect on breeding sparrowhawks (see **Section 5.5**, below).

It is considered unlikely that construction works would have effects on birds in the proposed wind farm development site outside of the breeding season – significance of potential effect rated as 'Not significant'.

Buzzard

The habitat in the study area, i.e., conifer plantation, is suitable for supporting breeding buzzard. The species was recorded in the study area regularly during the various summer baseline surveys and breeding was considered to have taken place within the site in 2022 (pair dropping into forestry in mid-June). There was only one record in a winter period (27th March 2020), though buzzard would be well into breeding behaviour by then.

Buzzard is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'low/medium sensitivity' to disturbance, with a buffer zone of 100-200 m suggested for both breeding and non-breeding birds.

At the site for the proposed wind farm development, construction works will take place in an area that probably supported a nesting pair of buzzard at least in the 2022 season. It is considered that the construction of the wind farm would likely have a potential disturbance effect on breeding birds within a distance of up to 200 m from the construction area – this is rated as an 'Adverse Significant Effect' of Short-term duration. Pre-construction surveys will be carried out in suitable breeding habitat within and around the site and, as required, mitigation will be implemented to reduce the significance of this potential effect on breeding buzzard (see **Section 5.2**, below).

It is considered unlikely that construction works would have effects on birds within the proposed wind farm site outside of the breeding season when the species is scarce – significance of potential effect rated as 'Not significant'.

Peregrine

Peregrine was recorded over the site and the 500 m buffer zone on nine occasions during vantage point watches. All sightings were between August and March and involved birds flying and/or hunting. There are no known breeding territories within at least a 2 km distance of the wind farm site.

Peregrine 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 500-750 m suggested for breeding birds and 200 m for non-breeding birds.

As peregrine is at most an occasional visitor to the site area and almost entirely outside of the breeding season (one March record), it is considered that construction works are unlikely to deter birds from flying over the area and possibly hunting prey items such as woodpigeon. Typically, peregrine would land on open ground such as bog, rather than within afforested areas to pluck prey items. For peregrine, potential disturbance effect is rated as 'Not Significant'.

Merlin

The habitats in the study area, i.e., bog and conifer plantation, are suitable for supporting breeding merlin. While there was no evidence of merlin breeding in the study area, specific surveys for breeding merlin were not undertaken (see Section 2.9.4.2). As there were three records on bog to the south-east of the redline boundary but within the 500 m buffer zone (19th February 2020, 27th August 2020 & 29th March 2023), local breeding is a possibility. It is noted that 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).

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 suggested for breeding birds. For disturbance by forestry operations, Currie & Elliot (1997) gave a distance range of 200 - 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 surveys will take place in all suitable breeding habitat which adjoins the site to a distance of at least 500 m and as required, mitigation will be implemented during the breeding season (March-August) to reduce the significance of this potential effect on breeding birds (see Section 5.2, below).

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 'Not significant'.

Kestrel

The habitats in the study area, i.e., bog and conifer plantation, are suitable for supporting breeding kestrel. Kestrel was recorded regularly during the surveys, with breeding expected to have occurred within the site at least in the 2022 season. Kestrel was also observed regularly outside of the breeding season.

Kestrel is considered in the NatureScot (2022) review of disturbance distances in birds. The species is rated as of 'low/medium sensitivity' to disturbance, with a buffer zone of 100 - 200 m suggested for breeding birds and 50 m for non-breeding birds.

At the site for the proposed wind farm development, construction works will take place in areas that could support a tree nesting pair of kestrel, as well as within areas suitable for hunting. It is considered that the construction of the wind farm would likely have a potential disturbance effect on breeding birds within a distance of up to 200 m from the construction area – this is rated as an 'Adverse Significant Effect' of Short-term duration. Due to the high conservation status of kestrel, pre-construction surveys will be carried out in all suitable breeding habitat within the site to a 200 m distance of the construction works area and as required, mitigation will be implemented during the breeding season (March-August) to reduce the significance of this potential effect on breeding birds (see **Section 5.2**, below).

It is considered unlikely that construction works would have significant effects on birds within the site outside of the breeding season – significance of potential effect rated as 'Not significant'.

Red grouse

Bog habitat suitable for supporting red grouse occurs to the east, southeast, west and northwest of the site for the wind farm, along with small areas of bog within the redline boundary (in northeast and northwest). The species was recorded on several of the vantage point watches and regularly on the walkover surveys in winter and summer.

Red grouse is not considered in the NatureScot (2022) review of disturbance distances in birds. However, 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 proposed wind farm development, construction works will take place within a distance of up to 500 m from open bog suitable for red grouse for the following turbines: T02, T03, T04, T014, T017, T018, T019, T020, T021 & T022.

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 up to 500 m from the where works will take place – this is rated as an 'Adverse Significant Effect' of Short-term duration. Due to the high conservation status of red grouse, pre-construction surveys will be carried out in all suitable breeding habitat which adjoins the site to a distance of at least 500 m from where works will take place and as required, mitigation will be implemented during the breeding season (March-August) to reduce the significance of this potential effect on breeding birds (see **Section 5.2**).

Golden plover

Bog habitat suitable for supporting breeding golden plover occurs to the northwest and southeast of the redline boundary, with birds showing breeding behaviour recorded during both vantage point and walkover surveys. Further bog habitat to the east has potential to support breeding, though there was no evidence of birds present during the surveys.

Golden plover was also recorded associating with the bogs during the migration and winter periods, with flocks flying over the site and adjoining open bogs. Flock size varied from small numbers (<10) to up to 200 birds.

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.

At the site for the proposed wind farm development, construction works will take place within a distance of up to 500 m from open bog suitable for breeding golden plover for the following turbines; T02, T03, T04, T014, T017, T018, T019, T020, T021 & T022.

From the above analysis, it is considered that the construction of the wind farm is likely to have a potential disturbance effect on breeding golden plover within a distance of 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 golden plover, pre-construction surveys will be carried out in all suitable breeding habitat within a distance of 500 m from where works will take place and as required, mitigation will be implemented during the breeding season (March-August) to reduce the significance of this potential effect on breeding birds (see **Section 5.2**, below).

It is considered unlikely that construction works would have significant effects 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 area of habitat – significance of potential effect rated as 'Not significant'.

Snipe

Bog habitat suitable for supporting breeding snipe occurs within the site (displaying bird over clearfell in eastern sector in June 2019) and on the bog which adjoins the site to the southeast (breeding behaviour recorded each summer season). While there is extensive bog to the northwest of the site, there was no evidence of breeding snipe here during any of the baseline surveys.

Snipe was also recorded regularly associating with the bogs during the migration and winter periods, with most records from the bog areas adjoining the redline boundary. Numbers in winter were typically single birds but numbers of up to 50 birds in October (mostly from bog in northern sector of study area) indicated local migration.

Snipe was not considered in the NatureScot (2022) review of disturbance distances in birds. However, Pearce-Higgins *et al*. (2012) identified snipe as one of the species showing a reduction (53%) in densities on wind farms during construction. Critically, the authors also found that snipe population densities did not recover after the construction period, with habitat within 400 m of turbines being used less than expected.

At the site for the proposed wind farm development, construction works will take place within a distance of up to 400 m from open bog which provides habitat suitable for snipe, as well as close to clear-fell where a displaying bird was recorded during baseline surveys (though as the replant grows, it will become less suitable as potential nesting habitat).

From the above analysis, it is considered that the construction of the wind farm is likely to have a potential disturbance effect on breeding snipe within a distance of up to 400 m from the works area – this is rated as an 'Adverse Significant Effect' of Short-term duration. Due to the high conservation status of snipe, pre-construction surveys will be carried out in all suitable breeding habitat within the proposed wind farm site, as well as suitable habitat which adjoins the site to a distance of up to 400 m from where works will take place. As required, mitigation will be implemented during the breeding season (March-August) to reduce the significance of this potential effect on breeding birds (see **Section 5.2**, below).

It is considered unlikely that construction works would have effects on snipe outside of the breeding season as wintering birds are more mobile than breeding birds and are active mainly during darkness – significance of potential effect rated as 'Not significant'.

Woodcock

Woodcock was regularly recorded within the site, and mainly within the northern sector, during the winter periods. Most of the records were incidental, with birds flushed as surveyors traversed the site. Most records were in December, indicating winter influxes. There were no observations of breeding birds on any of the surveys. However, survey limitations were associated with the assessment for breeding woodcock (see **Section 2.9.4.3**) and the assumption is made that breeding within the proposed wind farm site is possible.

During winter, woodcock roost in small area of cover within woodland during the day and fly to (mainly) pasture to feed during darkness. Woodcock is a highly elusive bird and during winter is usually detected only by flushing. At Glenora, the birds from the proposed wind farm development site presumably fly to pasture lands to the east to feed.

Woodcock was not considered in the NatureScot (2022) review of disturbance distances in birds.

It is considered that at the site for the proposed wind farm development, construction works would only disturb birds should the works take place very close to a roosting individual and then the bird would likely fly to another area of woodland away from the works.

It is considered unlikely that construction works would have significant disturbance effects on wintering birds within the proposed wind farm development site – significance of potential effect rated as 'Not significant'.

Construction works including tree felling have the potential to cause disturbance to breeding birds should they take place close to a breeding territory. A distance of 100-200 m from the work zone is suggested as the disturbance zone – this is rated as an 'Adverse Significant Effect' of Short-term duration. Due to the high conservation status of woodcock and the absence of a focused breeding survey (see Section 2.9), pre-construction survey will be carried out in all suitable breeding habitat within the proposed wind farm site to a distance of up to 200 m from where works will take place. As required, mitigation will be implemented during the breeding season (March-August) to reduce the significance of this potential effect on breeding birds (see Section 5.2 below).

4.2.3 Disturbance/Destruction of Active Nests

Disturbance to, or destruction of, active nests during construction activities could contravene Section 22 of the Wildlife Acts 1976 to 2022 as amended.

Best practice will be followed to minimise disturbance of active nests by the clearing of vegetation from work areas outside of the bird breeding season (March-August inclusive).

However, should ground still need to be cleared during the restricted period, mitigation will be implemented to minimise the significance of the effect on nesting birds (see Section 5.6, below).

4.3 Operational Phase

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

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

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

Potential disturbance as a result of the wind farm on birds in hinterland sites is also considered.

4.3.1 Displacement

Displacement of birds from otherwise suitable habitat due to 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 because 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 are negligible for the most part. In a review of potential displacement effects on upland breeding bird densities at twelve wind farm sites in Britain, Pearce-Higgins *et al*. (2009) reported that seven of the twelve species studied exhibited significantly lower frequencies of occurrence close to the turbines.

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

Hen harrier

While there was no evidence of hen harrier breeding in the study area, or indeed anywhere in north County Mayo (Ruddock *et al*. 2016), the species has a presence during winter within the study area (recorded on seven occasions during the four winters), with birds observed flying and/or hunting over bog and forestry. However, there was no evidence of winter roosts from the various baseline surveys (though specific survey for winter roosts was not carried out), or from the literature review, within at least a 2 km radius of the wind farm site. From the baseline survey data, it can be concluded that hen harrier is an occasional winter visitor at the Proposed Development site.

In the review of upland raptors and wind farms, Madders and Whitfield (2006) tentatively rated foraging hen harriers as having a 'low-medium' sensitivity to displacement, though all studies appear to have been in the breeding season. Pearce-Higgins *et al*. (2009) cited a predicted reduction in flight activity of 52.5% within 500 m of the turbine array for breeding birds.

As hen harrier is at most an occasional visitor to the site during winter, it is expected that hunting birds would still pass through the area when the turbines are in operation and that the potential for disturbance is low. Notwithstanding the absence of specific survey for hen harrier within the proposed wind farm development site and the surrounding area (to distance of 2 km), - this effect is rated potentially as an adverse effect of Slight Significance and of long-term duration.

Sparrowhawk

The baseline surveys showed that sparrowhawk is regular at the proposed wind farm site, with breeding considered to have taken place within the site in 2022.

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 at low height 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 Proposed Development site - significance of potential effect rated as 'Not significant'.

Buzzard

The baseline surveys showed that buzzard is regular at the proposed wind farm site, with breeding likely to have taken place within the site in 2022.

In the review of upland raptors and wind farms, Madders and Whitfield (2006) tentatively rated foraging buzzards as having a 'low-medium' sensitivity to displacement. Pearce-Higgins *et al.* (2009) cited a predicted reduction in flight activity of 41.4% within 500 m of the turbine array for breeding birds.

As buzzard is a regular species in the area proposed for the wind farm at Glenora, it is expected that the species could show some signs of displacement around the turbines at the Proposed Development site. It is likely that any displacement effect would be highest in the early period of operation, with some degree of habituation occurring over time (Pearce-Higgins *et al*. (2012). Significance of potential effect is rated as 'Slight' and of short to medium-term duration.

Merlin

The habitats in the study area, i.e., bog and conifer plantation, are potentially suitable for supporting breeding merlin. While there was no evidence of merlin breeding in the study area, there were three records on bog to the south-east of the redline boundary but within the 500 m buffer zone (19th February 2020, 27th August 2020 & 29th March 2023), which may indicate local breeding.

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 breeding and/or hunting habitats in the vicinity of turbines at the Proposed Development site - significance of potential effect rated as 'Not significant'.

Kestrel

Kestrel was recorded regularly during the surveys, with breeding possibly occurring within the study area in the 2022 season. Kestrel was also observed regularly outside of the breeding season.

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 potential displacement effect is rated as of Slight Significance and of long-term duration.

Red grouse

Habitat suitable for supporting red grouse occurs to the east, southeast, west and northwest of the site for the wind farm, along with small areas of bog within the redline boundary (in northeast and northwest).

At the site for the proposed wind farm development, some of the turbines will be located 500 m or less from open bog suitable for breeding and/or feeding red grouse, namely T02, T03, T04, T014, T017, T018, T019, T020, T021 & T022.

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 within wind farms. 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 dry tracks within the Derrybrien Wind Farm, Co. Galway.

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

Golden plover

Bog habitat suitable for supporting breeding golden plover occurs to the northwest and southeast of the redline boundary, with birds showing breeding behaviour recorded during both vantage point and walkover surveys. Further bog habitat to the east has potential to support breeding, though there was no evidence of birds present during the surveys.

Golden plover was also recorded associating with the bogs during the migration and winter periods, with flocks flying over the site and adjoining open bogs. Flock size varied from small numbers (<10) to up to 200 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 200 m. However, in further review, Pearce-Higgins *et al*. (2012) found little evidence for consistent population declines in golden plover populations at wind farms sites. They note that populations may become habituated to operational wind farms, which is supported by the lack of decline in golden plover abundance at an upland wind farm over a 3-year period of operation (Douglas *et al*. 2011).

At the site for the proposed wind farm development, several of the turbines (namely T02, T03, T04) will be within a distance of 200 m from open bog suitable for breeding golden plover.

From the above and considering the high conservation status of golden plover, the significance of a potential displacement effect on golden plover during the breeding season is rated as a 'Slight adverse effect'.

It is considered unlikely that the presence of the wind farm would have a significant adverse effect on golden plover landing on the local bogs 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 location – significance of potential effect rated as 'Not significant'.

Snipe

Bog habitat suitable for supporting breeding snipe occurs within the site (displaying bird over clearfell in eastern sector in June 2019) and on the bog which adjoins the site to the southeast (breeding behaviour recorded each summer season). While there is extensive bog to the northwest of the site, there was no evidence of breeding snipe here during any of the baseline surveys.

Snipe was also recorded regularly associating with the bogs during the migration and winter periods, with most records from the bog areas adjoining the redline boundary. Numbers in winter were typically single birds but numbers of up to 50 birds in October (mostly from bog in northern sector of study area) indicated local migration.

Pearce-Higgins *et al*. (2009, 2012) found that avoidance of suitable habitat by breeding snipe extended to 400 m from the turbines and that the predicted reduction in breeding density within 500 m of the turbine array was 47.5%.

At the site for the proposed wind farm development, some of the turbines will be located within a distance of up to 500 m from open bog suitable for breeding and/or feeding snipe (T02, T03, T04, T014, T017, T018, T019, T020, T021, T022).

From the above and considering the high conservation status of snipe, the significance of a potential displacement effect on snipe during the breeding season is rated as a 'Slight' adverse effect.

It is considered unlikely that the presence of the wind farm would have adverse effects on snipe utilising the local bog 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 rated as 'Not significant'.

4.3.2 Potential Barrier Effect due to Turbines

The potential impact of lines or groups 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.

Considering the following:

- The proposed wind farm development site has not been identified as being along a regular migration route for birds, such as wetland species (swans, geese etc.) or birds of prey. While there were four records of whooper swan passing over the study site during the baseline winter surveys, three of these were of small parties (6-8 birds) over the course of approximately one hour on 15th October 2021 and flying south or southwest, which suggests the birds had just arrived in from the sea. The other record was on 6th December 2022 and involved a party of eight birds flying eastwards across the site. There were no records of any geese species passing over the site.
- The proposed wind farm development site has not been identified as being located along a daily or seasonal commuting route between feeding and roost sites used by local birds such as gull species or waterfowl species.
- The proposed wind farm development site is not in proximity to any other operational or permitted wind farm, with the nearest sites located over 5 km to the south-west (see Figure 14-16 in Chapter 14 of the EIAR).

It is considered that the proposed wind farm development would not cause any barrier effects to the movement of bird species either on migration or involved in local movements such as between feeding and roost sites.

4.3.3 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, Watson *et al*. 2018, Diffendorfer *et al*. 2021). 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. It is generally considered that passerine species are less susceptible to collision with turbines (SNH 2017).

Collision risk is calculated using a mathematical model to predict the number of birds that may be killed by collision with moving wind turbine rotor blades. The modelling method used in this collision risk calculation is known as the Band Model (Band *et al.* 2007) (see **Appendix 15** for full details). Two stages are involved in the Band Model. First, the number of bird transits through the air space swept by the rotor blades of the wind turbines per year is estimated. Then the collision risk for a bird passing through the rotor blades is calculated using a mathematical formula. The product of these provides a theoretical annual collision mortality rate. Finally, a bird avoidance rate is applied to the collision mortality rate to account for birds attempting to avoid collision. This final collision mortality rate informs the assessment of impacts of the wind farm development on key ornithological receptors (KORs) in the EIAR.

At the proposed wind farm development site, the collision risk assessment is based on Vantage Point surveys undertaken at the site from April 2019 to March 2023 inclusive.

The key ornithological receptors recorded within the potential collision height during surveys were:

- Hen harrier
- Sparrowhawk
- Buzzard
- Merlin
- Kestrel

- Peregrine
- Golden plover
- Snipe

Whooper swan, whilst not identified as a KOR at the proposed wind farm development site due to the scarcity of records, is included as it is a species at high risk of collision.

It is acknowledged that the predicted number of transits, and hence predicted rate of collision, for snipe may be largely underestimated, as flight activity for this species is largely crepuscular in nature (during twilight) while the VP survey sample predominantly consists of hours during daylight period when visibility is not an issue. It is assumed that waterbirds (including snipe) are active for 25% of the night along with daylight hours (as per SNH guidance) and this is accounted for in the model.

For the above species, a summary of the estimated number of collisions over the lifetime (35 years) of the wind farm is given in **Table 37** below (full details are given in **Appendix 15**).

Table 37. Summary of estimated number of collisions for key ornithological receptors.

Species	Estimated Collisions over the Lifetime of Wind Farm	Estimated Collisions per Year	One Bird Collision
Hen harrier	0.45 birds	0.013	78 years
Sparrowhawk	3.36 birds	0.096	10 years
Buzzard	12.26 birds	0.35	3 years
Merlin	0.16 birds	0.005	220 years
Kestrel	77.92 birds	2.226	<1 year
Peregrine	0.89 birds	0.026	39 years
Golden plover	367 birds	10.491	<1 year
Snipe	7.29 birds	0.208	5 years
Whooper swan	1.91 birds	0.054	18 years

For three species, hen harrier, merlin and peregrine (all Annex I listed), the predicted collision risk is less than 1 bird over the 35-year life of the wind farm, an effect which is effectively not measurable ('Not Significant').

For whooper swan (Annex 1), the predicted collision rate over the 35-year life of the wind farm is 1.91 birds, a rate which is considered 'Not Significant' in terms of the national population (19,111 All-Ireland population in 2020, Burke *et al*. 2021).

For sparrowhawk (Green-list), the predicted collision rate over the 35-year life of the wind farm is 3.36 birds, a rate which is considered 'Not Significant' in terms of the estimated national population (between 9,100 and 14,830 individuals – see **Section 3.4.4**, above) and the favourable conservation status of the species.

The remaining four species listed in **Table 37** above have somewhat higher predicted collision risks and are considered further in terms of the conservation status of each.

Snipe

For snipe (Red-list), the predicted collision rate over the 35-year life of the wind farm is 7.29 birds or 1 bird every 5 years (calculated from both winter and summer baseline data). While these rates are negligible in terms of the national breeding population of snipe (estimated at 4,275 pairs – see **Section 3.4.12**), it is noted that vantage point surveys are not an effective method of recording flight activity for this species and hence the collision risk may be under-estimated. Considering the high conservation status (Red list) of the species due to the severe short-term and long-term declines in the national breeding population (Gilbert *et al*. 2021), the significance of collision risk is rated as a 'Long-term Slight Adverse' effect.

Buzzard

For buzzard (Green-list), the predicted collision rate over the 35-year life of the wind farm is 12.26 birds. The size of the bird and its tendency to fly relatively low and within the potential collision risk zone makes buzzard prone to collision. Watson *et al*. (2018) identify *Buteo* species, including *Buteo buteo*, as showing high risk of collision globally. In Ireland, however, buzzard has a favourable conservation status, which limits the potential for ecologically significant effects to result at the population level. However, on a precautionary basis, the significance of collision risk is rated as a 'Long-term Slight Adverse' effect.

Kestrel

For kestrel (Red-list), the predicted collision rate over the 35-year life of the wind farm is 77.92 birds or 2.22 per year. 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, Diffendorfer *et al*. 2021, Hotker *et al*. 2006, Hotker 2008, Lucas *et al*. 2008, Marques *et al.* 2014, Watson *et al.* 2018). This may be partly due to the hovering behaviour of the species, as 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.

While the predicted collision rate is low in the context of the estimated national population of 13,500 birds (Lewis *et al.* 2019), considering the high conservation status of the species and the known susceptibility of the genus to collision, the significance of collision risk is rated as a 'Long-term Moderate Adverse' effect. Mitigation will be implemented to lessen this risk (see **Section 5.3.1**).

Golden plover

Golden plover (Annex I & Red list) is a winter and passage visitor to the site, with breeding also occurring on the bogs which adjoin the site. All the flightlines, however, considered for collision risk modelling refer to winter and passage birds. The predicted collision rate over the 35-year life of the wind farm is 367 birds or 10.49 birds per year.

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.

There appears to be relatively few instances in the literature of golden plover casualties due to collision with turbines. 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.

4.3.4 Potential Impacts on Birds from Maintenance Activities

On-site activities during the operational phase of the wind farm will include turbine servicing, the maintenance and periodic upgrading of access tracks and drains, and substation inspection and maintenance.

Maintenance works at the turbines and the wind farm substation, which typically involve small crews of 2-3 personnel working within the turbines or substation compound, would not be expected to have any impacts on local bird populations either within the site or in bog areas adjoining the site.

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 breeding or foraging behaviour of birds within the site or in adjoining areas.

4.3.5 Potential Impacts on Birds in Hinterland Sites

The hinterland surveys in winter and summer covered a wide area at distances of up to 5 km from the redline boundary of the site. Also included was an area of cutover bog located approximately 1.5 km to the north of the site.

The results of these surveys (as described in **Appendix 11**) recorded a wide range of bird species, including cliff nesting seabirds and waterbird species such as wigeon and teal (at Killeena Lough). Effects as a result of the Proposed Development on any of the species recorded more than 2 km from the site would not be expected, i.e., area outside of zone of influence (NatureScott 2017). The surveys did not record any concentrations of wintering birds of conservation importance, such as swans, geese or other waterbirds, within a 2 km distance of the site. Similarly, no locations for breeding species of conservation importance were recorded close to the site.

Based on the hinterland surveys, it is concluded that the operation of the wind farm project does not have potential to have significant effects on any of bird species associated with the surrounding hinterland area.

4.4 Decommissioning Phase

The wind turbines proposed as part of the proposed wind farm development are expected to have a lifespan of approximately 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of turbines, subject to planning permission being obtained, or the Proposed Development will be decommissioned. The onsite substation will remain in place as it will be under the ownership of the ESB and will form a permanent part of the national electricity grid. A description of the decommissioning process is presented in the Decommissioning Plan included in Appendix 4-7 of the EIAR.

During the decommissioning works there is a risk of disturbance, and possible displacement, to sensitive breeding species within and adjoining the site, including red grouse, kestrel, golden plover and snipe. Such disturbance effects would be potentially of similar significance, but shorter duration, as described in **Section 4.2.2,** above (Disturbance to birds), and would depend on the distribution of species at the time. The same mitigation measures will be implemented as prescribed for during the construction phase (see **Section 5.2**, below) to ensure that disturbance to these species, as well as any other species which may have a high conservation status present at the time of decommissioning, is minimised.

4.5 Designated Sites for Birds

4.5.1 European sites

The desktop study (Section 3.2 of this report) identified six Special Protection Areas (SPAs) within a 20 km radius of the site for the Proposed Development. These are (and see Table 16 of this report):

- Killala Bay/Moy Estuary SPA (code 004036)
- Illanmaster SPA (code 004074)
- Owenduff/Nephin Complex SPA (code 004048)
- Blacksod/Broadhaven Bay SPA (code 004037)
- Carrowmore Lake SPA (004052)
- Lough Conn and Lough Cullin SPA (code 004228)

Of these, it can be stated with certainty that the proposed wind farm development site does not have habitats which could support the breeding, feeding and/or roosting requirements of the Special Conservation Interests (see Table 16) of Illanmaster SPA, Carrowmore Lake SPA, Blacksod/Broadhaven Bay SPA and Lough Conn and Lough Cullin SPA. Also, the baseline bird surveys did not identify flight paths over the wind farm site by any of the SCIs for these four sites. It is also noted that there is no hydrological connectivity between the proposed wind farm development site and any of these four listed SPA sites.

The Killala Bay/Moy Estuary SPA, located at a distance of 10.2 km from the proposed wind farm development site, has golden plover as a SCI (SPA has habitat for non-breeding birds). Whilst wintering/passage golden plover at times occur in the area of the proposed wind farm development site, due to the distance from the SPA it is highly unlikely that these birds commute between the two locations.

While the proposed development site has hydrological connectivity with the Killala Bay/Moy Estuary SPA, with mitigation in place, it is concluded that there is no risk of adverse effects on water quality of the SPA as a result of any phase (construction, operation, decommissioning) of the project (see the NIS for full details).

The Owenduff/Nephin SPA, which is located approximately 13.4 km from the proposed wind farm development site, has merlin and golden plover as SCIs. As the foraging distances of these species (merlin: within 5 km; golden plover: within core range of 3 km and maximum range of 11 km – SNH 2016) are less than the distance between the two locations, it can be concluded that it is highly unlikely that any records at the proposed wind farm development site of merlin and/or golden plover are connected with the populations within the SPA.

It is concluded that the Proposed Development is not expected to have any significant effects on the SCIs of any Special Protection Area.

In addition to the above listed SPAs, the Glenamoy Bog Complex SAC (code 000500) occurs approximately 150 m north of the proposed wind farm development site. The site synopsis notes the occurrence of breeding populations of merlin and golden plover within the site. While there was no evidence of merlin breeding within the proposed wind farm development site, the three records of merlin from within the 500 m buffer zone could be associated with the population within the SAC. Some of the observations of golden plover during the summer baseline surveys are likely to be associated with the breeding population of the SAC.

However, as the nearest turbines to the SAC are at a distance of over 500 m, it is concluded that the proposed wind farm development does not have potential to have disturbance effects on breeding merlin and golden plover within the SAC during either the construction, operational and/or decommissioning phases.

4.5.2 National sites

Two NHAs adjoin the site, as follows (with listed species of conservation importance from site synopses):

- Inagh Bog NHA (code 002391) – adjoins western boundary of site, with breeding populations of golden plover and red grouse;
- Ummerantarry Bog NHA – adjoins southern boundary of site, with breeding populations of golden plover (with baseline surveys confirming red grouse also present).

The following turbines are within distances of 500 m from Inagh Bog: T02 (125 m), T03 (160 m) & T04 (110 m)

The following turbines are within distances of 500 m from Ummerantarry Bog: T14 (approx. 350 m), T17 (285 m) & T19 (340 m)

Potential for disturbance to golden plover and red grouse at distances of up to 500 m exists from construction work disturbance and to a lesser extent decommissioning disturbance (as discussed in Section 4.2.2 Disturbance to birds).

Such disturbance is rated as an 'Adverse Significant Effect' of Short-term duration. Pre-construction surveys will be carried out in all suitable breeding habitat for these species within a distance of at least 500 m from the works area and as required, mitigation will be implemented during the breeding season (March-August) to reduce the significance of this potential effect on breeding birds.

During the operational phase, it is considered that golden plover could be displaced from suitable breeding habitat within a distance of 200 m from turbines (as discussed in Section 4.3.1). Hence, breeding golden plover within the Inagh Bog NHA could be affected – this is rated as a 'Slight adverse' effect. With time, some habituation to the presence of turbines is likely (Pearce-Higgins *et al.* 2012).

From the available information, there is no evidence of a displacement effect for red grouse due to the presence of turbines.

4.6 Cumulative Effects

Section 6.8 of the EIAR considers Cumulative Impacts. Under Section 6.8.2 'Assessment of Projects', all wind farms within the same catchment of the Proposed Development were considered (details given in Table 6.20), as follows:

Bellacorick Wind Farm – existing wind farm located approximately 10 km from Proposed Development site

Oweninny Wind Farm – comprising, Phase 1 (in operation located approximately 7 km from Proposed Development, Phase 2 (in operation) comprising 31 turbines located approximately 10 km from Proposed Development, Phase 3 in planning (ABP 316178) comprising 18 turbines located approximately 8 km from Proposed Development,

Sheskin (ABO) Wind Farm – in construction, comprising eight turbines located approximately 7 km from Proposed Development,

Sheskin South Wind Farm – in planning (ABP 315933), comprising 21 no. turbines located approximately 9 km from Proposed Development,

Killala Community Wind Farm – existing wind farm comprising 6 no. turbines located approximately 14 km from Proposed Development site

Kilsallagh Wind Farm – pre-application consultation (ABP 312282), comprising 13 no. turbines located approximately 16 km from Proposed Development, Tirawley Wind Farm – pre-application consultation (ABP 315864), comprising 31 no. turbines located approximately 8 km from Proposed Development (details not known).

Six of the above projects (Bellacorick, Oweninny (x3), Sheskin (x2)) form a substantial cluster of turbines (if all built) to the southwest of the Proposed Development, varying in distance from approximately 7 km to 13 km from the Proposed Development site. These wind farms are mainly on cutaway bog and conifer plantation, with designated sites comprising blanket bog and other Annex I habitats in the surrounding areas. Between this cluster of wind farms and the Proposed Development site the land use comprises almost entirely peatland habitats (much of which is designated) and commercial forestry.

The Oweninny sites, including the Bellacorick Wind Farm, comprise an area of approximately 5,000 ha and support a range of bird species of conservation importance, including breeding teal, red grouse, golden plover, dunlin, snipe, common sandpiper and common gull. Merlin is occasional on site and may breed. The Phase 3 area supports a winter hen harrier roost, with up to 6 birds recorded at times. However, hen harriers were rarely recorded foraging on site. Whooper swan is occasional during winter. The EIS for the Oweninny project (Phases 1 & 2) recommended mitigation to avoid or minimise disturbance to breeding birds during the Phase 1 and Phase 2 construction periods. With the various mitigation measures, it was considered that the Phase 1 and Phase 2 projects would not have any significant residual effects on breeding birds.

The two Sheskin sites are largely in conifer plantation, though species such as kestrel and sparrowhawk occur within the area.

The Killala Community Wind Farm is close to the town of Killala and is not within an area of importance for birds.

Following analyses of the detailed baseline surveys undertaken for the proposed wind farm development, and the identification of mitigation as required to minimise or avoid potential effects on bird species, it is considered that the risk of collision to wintering and/or migrating golden plover as a result of the proposed development (rated as a long-term adverse effect of moderate significance) may contribute to a cumulative effect when considered with risk to this species associated with other wind farms in the area. While collision risk modelling was not carried out for the Oweninny Phase 1 and Phase 2 Wind Farms, golden plover does occur within the site during winter, albeit in relatively small numbers (source: EIAR 2013) and may be prone to collision with turbines. For the Oweninny Phase 3 project, the estimated figure for collision risk is 5.29 collisions per year (source: EIAR 2023). Golden plovers were not recorded within the risk zone around turbines at the proposed Sheskin South Wind Farm site (source EIAR; 2023).

For all other bird species associated with the proposed wind farm development, it is concluded that, with appropriate mitigation in place, there will be no significant cumulative effect when the proposed wind farm development is considered in combination with other wind energy projects.

The proposed development occurs within a general area where important bird species, such as merlin, red grouse and golden plover, are associated with peatland habitats and especially blanket bog. However, the proposed development is primarily located within forestry habitat, a non-native habitat of relatively low biodiversity value. While further afforestation may result in the loss of (non-designated) peatland habitat, the proposed development will not contribute to a cumulative loss of such habitat and indeed the project will enhance an area of degraded peatland through the Biodiversity Management and Enhancement Plan. The BMEP involves the removal of self-seeded conifers from an area of 40 ha in the northern sector of the site. The area will be located a substantial distance from the turbines (closest distance 650 m) and bird species likely to utilise the restored bog, such as kestrel and golden plover, will not be at an increased risk of collision with turbines.

5. Mitigation and Monitoring

This section describes measures which will be in place to mitigate potential or predicted adverse effects associated with the Proposed Development on avian receptors. Such effects have been addressed in two ways:

- Design of the Proposed Development
- Management of the development phases

5.1 Mitigation by Design

The Proposed Development has been deliberately designed to avoid open bog habitats within the site and specifically areas of unplanted blanket bog in the north-west and north-east sectors of the site.

5.2 Mitigation during Construction

5.2.1 Species identified as IEFs

The present study has identified potential significant disturbance effects on various breeding species which are listed as Important Ecological Features as a result of the construction works (see **Section 4.2.2**). These species are sparrowhawk, buzzard, merlin, kestrel, red grouse, golden plover, and snipe (woodcock, while not recorded, is included as focused baseline survey was not carried out). Best available evidence has been reviewed (see **Section 4.2.2**) and it is suggested that these species could be disturbed by works, including tree felling, up to and including the at the following distances:

Sparrowhawk	200 m
Buzzard	200 m
Merlin	500 m
Kestrel	200 m
Red Grouse	500 m
Golden Plover	500 m
Snipe	400 m
Woodcock	100 - 200 m

Should any of these species be recorded breeding within the given distances of the works area (as established through confirmatory surveys before and/or during construction – see **Sections 5.6** & **5.7**), a buffer zone (using above distances) will 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, which will apply from March to August (inclusive), will ensure that the works will not have significant adverse effects on the identified IEFs.

5.2.2 Other bird species

A range of passerine bird species breed within the site, including meadow pipit (Red-listed). As noted, (**Section 4.2.3**), disturbance to, or destruction of, active nests during construction activities could contravene Section 22 of the Wildlife Acts 1976 to 2021. Clearance of trees and ground vegetation will take place outside of the bird breeding season (1st March – 31st August) to minimise the possibility of disturbance and destruction to occupied bird nests during the construction phase.

However, it is possible that some ground may still need to be cleared of vegetation during the breeding season or that previously cleared ground will have developed colonising vegetation (such as brambles) which could attract nesting birds such as wren. Such these occurrences arise, the following protocol will be followed:

- The area will be surveyed by a qualified ecologist with ornithological experience 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 to prevent disturbance to the nest, the ecologist will evaluate the situation in the context of the conservation status of the species and the stage of breeding, i.e. nest with eggs, nest with young chicks, nest with large young near fledging stage, and will advise on the best approach in the context of the Wildlife Acts. In such cases, the local representative of NPWS will be consulted.

5.3 Mitigation during Operation

5.3.1 Control of vegetation at turbine locations

Areas of forest around turbines which are cleared of trees will be managed to prevent establishment of scrub and rank vegetation which would encourage small mammals and birds and attract species such as kestrel to hunt near the turbines and increase risk of collision. This maintenance will be carried out on an annual basis by mowing or strimming. The managed areas around turbines which will be implemented as mitigation for bats will suffice for birds as well. 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 80 m from the turbine base (Pescador *et al*. 2019).

5.4 Mitigation during Decommissioning

As the decommissioning works will involve works similar to those involved at construction stage, these could result in similar effects on birds. Hence, the mitigation that will be undertaken during construction will also be applied during the decommissioning phase (taking into account changes in bird populations and distributions that may have occurred locally during the operational life of the project).

5.5 Pre-construction / Construction Phase Monitoring for Sensitive Species

During the breeding season (March-August) bird monitoring surveys within the proposed wind farm development site will take place to a distance of up to 1 km from the proposed wind farm development site.

The purpose of the surveys is to confirm the locations of breeding territories prior to construction to ensure that mitigation is successfully implemented (see **Section 5.2**) to avoid disturbance effects on breeding activities as a result of the works.

The survey for breeding birds on the adjoining bog to the west and southeast will follow methodology of Brown and Shepherd (1993) and will take place in the April to July period (4 visits) in the season before works, including tree felling, commence. This schedule will provide guidance to the contractor on where restrictive zones are likely to be required.

As noted in **Section 2.9.4** (Breeding Season Distribution and Abundance Surveys), targeted surveys for breeding raptors were not undertaken within the Proposed Development site or within a 2 km radius of the site. Owing to the high conservation status of merlin, and noting the difficulties associated with survey for breeding merlin (as highlighted by Lusby *et al.* 2011), particular focus will be placed on locating possible territories within a distance of at least 1 km of the works area. The survey, which will take place in the period April to July, prior to any works on site commencing including tree felling, will comprise a combination of traditional search methods (after Hardey *et al*. 2009) and vantage point watches focused on suitable habitat within 1 km maximum of the vantage point location (see Lusby *et al*. 2011). The merlin survey will be undertaken by field workers with experience of surveying birds of prey.

Survey limitations were also identified with establishing the status of breeding woodcock on site (see **Section 2.9.4.3)**. A full survey for breeding woodcock, following Gilbert *et al.* (1998), will be undertaken in the breeding season prior to any works, including tree felling, commencing on site.

5.6 Construction Phase Monitoring for Breeding Birds On-site

Any ground clearance of habitat during the period March to August that could support breeding birds will be walked to establish the presence of breeding birds (mainly passerines). This will be done by an ornithologist up to 10 days before the clearance works take place. If 10 days elapse without the clearing commencing, a further survey will take place. The focus will be on the area to be cleared but zones up to 100 m (approximately) around the area will also be included. Should a breeding territory be identified, the surveyor will attempt to establish the phase of building, e.g., nest building, incubating, feeding young, and will advise the contractor accordingly on measures to be followed (see **Section 5.2**).

5.7 Post-construction Monitoring for Birds

The objectives of post-construction bird monitoring are:

- To record usage of the site and adjoining areas by birds and their interaction with the operating turbines;
- To monitor short-term and long-term effects on bird populations which had been identified in the baseline surveys as of conservation importance.

The monitoring programme will comprise the following:

5.7.1 Flight activity surveys

Flight activity surveys will be undertaken using the Vantage Point method (Scottish Natural Heritage 2017). The purpose of the surveys is to determine if the presence of the turbines is causing species such as hen harrier, kestrel and buzzard to avoid the site area. This will use the same Vantage Points as used for the baseline EIAR surveys so that a valid comparison can be made between the two periods. The surveys will be undertaken monthly in Years 1, 2, 3, 5, 10 and 15 of the lifetime of the project (in accordance with Scottish Natural Heritage Guidance 2009).

5.7.2 Distribution and abundance surveys within site

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 EIAR surveys which will allow a comparison of data to be made for each monitoring year. However, transects may be extended to include sections alongside turbines. Surveys will be undertaken during summer and winter and will be in the same monitoring years as the vantage point surveys.

5.7.3 Distribution and abundance surveys on bog

The baseline walkover survey that was carried out on the bog to west/northwest and northeast of site (for EIAR), and which will be repeated at pre-construction stage, will be repeated again post-construction. This will provide long-term population data for the important breeding species associated with the blanket bog, including golden plover. It is proposed that surveys will be carried out in the same years as the other bird monitoring surveys and will comprise three visits in the period April-July. Method will follow Brown and Shepherd (1993).

5.7.4 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 Bernardino 2012, Reed 2011, Mathews 2013). A trained dog under the control of a handler will be used

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. These tests would be repeated should there be a need to use different search dogs between years.

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

Should a significant number of casualties be recorded at one or more turbines, the data will be analysed for trends including species, age of birds, season, and weather preceding the finds. Depending on the analysis, a recommendation could be made to the wind farm operator to curtail the operation of a turbine(s) during a likely high-risk period for an identified species. For example, in the case of raptors (birds of prey), a high-risk period would be when recently fledged young are engaged in practice flights and still returning to the nest site.

6. Residual Impacts

With mitigation measures as prescribed in this report implemented in full, and specifically construction phase mitigation to minimise disturbance to breeding bird species of conservation importance, as well as measures to minimise risk of collision to species such as kestrel during the operation phase, it is considered that the significance of the predicted effects on birds as a result of the Proposed Development will range from 'Imperceptible' to 'Moderate' significance.

At this site, the effect on birds from loss of habitat is rated as of Slight Significance. The loss of 1.1 Ha of peatland habitat to facilitate two of the required borrow pits will be off set through the Biodiversity Management and Enhancement Plan, which aims to restore approximately 40 Ha of peatland habitat through conifer removal and drain blocking. The implementation of the BMEP will result in a positive effect for birds.

The construction phase of the project has potential to result in disturbance to breeding birds within a distance of up to 500 m of the works boundary. This could have significant adverse effects (albeit of short-term duration) on species of conservation importance such as red grouse, merlin, golden plover and snipe. With mitigation in place (as recommended following pre-construction survey), comprising the use of work restrictive zones around identified breeding areas, the development is not expected to have any significant residual effects 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. For breeding buzzard, golden plover and snipe, the effect is rated as a 'Slight adverse' effect. However, it is noted that there is evidence that populations of species such as golden plover may become habituated to operational wind farms (Douglas *et al*. 2011).

During the operational phase of the project, birds will be at some risk of collision with turbines, with snipe, buzzard kestrel and golden plover (winter/passage populations) identified as the species at most risk. For snipe and buzzard, the significance of the risk is rated as a 'Slight adverse' effect of long-term duration, while for kestrel and golden plover the significance of the risk is rated as a 'Moderate adverse' effect of long-term duration. For kestrel, mitigation will be implemented to discourage birds from hunting close to turbines and the significance of the effect can be reduced to slight.

The baseline surveys did not identify any regular migration routes or local movements of wetland bird species through the site. The proposed development is not expected to have any residual effect on migrating species or bird populations associated with sites in the hinterland.

The Proposed Development is not expected to have any residual effects on the Special Conservation Interests of any Special Protection Area (as detailed in the Natura Impact Statement).

The breeding golden plover population associated with the Inagh Bog NHA could be displaced from suitable breeding habitat within a distance of 200 m from turbines during the operational phase - this is rated as a 'Slight adverse' effect. With time, some habituation to the presence of turbines is likely.

7. Conclusion

The following is concluded with regard to the Proposed Development, noting the survey limitations as described in Section 2.9, and taking into account mitigation and monitoring as described in Section 5:

- The effect on birds due to habitat loss during the construction phase of the proposed wind farm development is rated as an adverse effect of Slight Significance. The implementation of the BMEP, which will restore an area of degraded bog, is likely to result in a positive effect for birds.
- No significant effects are predicted on birds due to disturbance during the construction or decommissioning phases of the proposed wind farm development.
- A slight adverse effect for breeding buzzard, golden plover and snipe is predicted during the operational phase due to possible displacement or avoidance of suitable habitat as a result of the presence of turbines.
- The Proposed Development is predicted to result in collision casualties for snipe, buzzard and kestrel (rated as 'Slight adverse' effect of long-term duration) and wintering golden plover (rated as a 'Moderate adverse' effect of long-term duration).
- The Proposed Development is not expected to have any adverse effect on migrating species or bird populations associated with sites in the hinterland.
- The Proposed Development is not expected to have any residual effects on the Special Conservation Interests of any Special Protection Area (as detailed in the Natura Impact Statement).
- The breeding golden plover population associated with the Inagh Bog NHA could be displaced from suitable breeding habitat within up to 200 m from turbines during the operational phase - this is rated as a 'Slight adverse' effect.
- The Proposed Development will not result in significant cumulative impacts on birds, in combination with land management, other wind farms or other projects, proposed, existing or permitted in the area.

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APPENDIX 5

CUMULATIVE IMPACT ASSESSMENT

1. ASSESSMENT OF CUMULATIVE EFFECTS

1.1 Plans

The following development plans have been reviewed and taken into consideration as part of this assessment:

- Mayo County Development Plan 2022-2028
- National Biodiversity Action Plan 2017-2021
- The Regional Planning Guidelines for the West 2010-2022

The review focused on policies and objectives that relate to Natura 2000 sites and natural heritage. Policies and objectives relating to sustainable land use were also reviewed

Table 8.1 Review of plans

Plans	Key Policies/Issues/Objectives Directly Related To European Sites, Biodiversity and Sustainable Development In The Zone of Influence	Assessment of development compliance with policy
Mayo County Development Plan 2022-2028	**Biodiversity, Designated and Non-Designated Site Policies** **NEP 1** To support the protection, conservation and enhancement of the natural heritage and biodiversity of County Mayo, including the protection of the integrity of European sites, that form part of the Natura 2000 network, the protection of Natural Heritage Areas, proposed Natural Heritage Areas Ramsar Sites, Nature Reserves and Wild Fowl Sanctuaries (and other designated sites including any future designations). **NEP 2** To protect and enhance the county's natural heritage and biodiversity by supporting the implementation of the National Biodiversity Action Plan 2017-2021, the National Pollination Plan 2015-2020 and County Mayo Biodiversity Plan 2015- 2020 and any future editions, in partnership with relevant stakeholders, subject to available resources. **NEP 4** To conserve and enhance the county's biodiversity and ecological connectivity, identified areas of local biodiversity importance (Local Biodiversity Areas) in the towns and villages in Mayo. **NEO 11** To ensure that the impact of development within or adjacent to national designated sites, Natural Heritage Areas, Ramsar Sites and Nature Reserves likely to result in significant adverse effects on the designated site is assessed by requiring the submission of an Ecological Impact Assessment report (EcIA), Environmental Report (ER), an Environmental Impact Assessment Report (EIAR), if deemed necessary, and/ or a Natura Impact Assessment (NIS), if deemed necessary, prepared by a suitably qualified professional, which should accompany planning applications.	The Development Plan was comprehensively reviewed, with particular reference to Policies and Objectives that relate to the biodiversity, protected species and designated sites. The proposed development has been designed in order to avoid peatland habitats and the Biodiversity Management Plan includes for the improvement of existing and the creation of new peatland habitat. The proposed development is located outside of any Designated sites, as described in Section 5. No potential for negative cumulative impacts when considered in conjunction with the current proposal were identified. No developments or projects identified within the Development Plan were found to occur in the wider area surrounding the proposed development.

Plans	Key Policies/Issues/Objectives Directly Related To European Sites, Biodiversity and Sustainable Development In The Zone of Influence	Assessment of development compliance with policy
	NEO 14 To protect and enhance the ecological network throughout the county to improve the ecological coherence of the Natura 2000 network in accordance with Article 10 of the Habitats Directive **Peatland Policies** **NEP 9** To enhance the county's natural heritage and biodiversity through supporting the protection and restoration of peatlands in County Mayo, where appropriate, in order to transition towards a low-carbon and circular economy. **NEP 10** To recognise the role of peatlands as carbon sinks to combat climate change and ensure that peatland areas, including those designated or proposed for designation (pNHA, NHA or SAC), are conserved for their ecological, climate regulation, archaeological, cultural, and educational significance. **NEO 18** As part of the implementation of Climate Ready Mayo, Climate Adaption Strategy, to develop and implement a Peatland Management Strategy for County Mayo that will: **a.** To identify damaged Peatlands in the county and those at risk from climate change and becoming carbon emitters. **b.** To initiate conservation and management of Mayo's peatlands, particularly those sites nominated for designation as Special Areas of Conservation and Natural Heritage Areas, to preserve the habitat and their unique ecosystems, managing flood risk and other environmental benefits. **Renewable Energy Policies**	

Plans	Key Policies/Issues/Objectives Directly Related To European Sites, Biodiversity and Sustainable Development In The Zone of Influence	Assessment of development compliance with policy
	REP 1 To support Ireland's renewable energy commitments outlined in national policy by facilitating the development and exploitation of a range of renewable energy sources at suitable locations within the county, where such development does not have a negative impact on the surrounding environment (including water quality), landscape, biodiversity or local amenities to ensure the long-term sustainable growth of the county. **REP 3** To actively encourage and support the sustainable development, renewal and maintenance of energy generation infrastructure in order to maintain a secure energy supply, while protecting the landscape, archaeological and built heritage and having regard to the provisions of the Habitats Directive. **REP 7** To promote the harnessing of wind energy to contribute toward decarbonising County Mayo, including new emerging by-product markets	
National Biodiversity Action Plan 2017-2021	**Objective 4: Conserve and restore biodiversity and ecosystem services in the wider countryside.** • Action 4.2.1. Continue to protect, enhance and monitor the ecological status of water during the second cycle of the Water Framework Directive (2015- 2021) including reducing risks to water quality and utilising ecological expertise in decision-making, and in analysis of cumulative effects. **Objective 6: Expand and improve management of protected areas and species** Target 6.2: Sufficiency, coherence, connectivity, and resilience of the protected areas network substantially enhanced by 2020.	The National Biodiversity Action Plan was comprehensively reviewed, with particular reference to Policies and Objectives that relate to the biodiversity, protected species and designated sites. There will be no deterioration of water quality as a result of the proposed development. The proposed development has been designed in order to avoid any potential fragmentation of habitats or commuting corridors. No potential for negative cumulative impacts when considered in conjunction with the current proposal were identified.

Plans	Key Policies/Issues/Objectives Directly Related To European Sites, Biodiversity and Sustainable Development In The Zone of Influence	Assessment of development compliance with policy
The Regional Planning Guidelines for the West 2010-2022	**EAP13:** To support the protection of Natural Heritage Areas, Special Protection Areas, Special Areas of Conservation, Nature Reserves, Ramsar Sites (Wetlands), Wildfowl Sanctuaries, National Parks, Nature Reserves and the biodiversity designated under the Habitats Directive, Birds Directive, Wildlife Act, Flora Protection Order and other designated or future designated sites. **EAO18:** Support the achievement of favourable conservation status of Annex I habitats, Annex II species, Annex I bird species and other regularly occurring migratory bird species and their habitats in the region.	The proposed development will not result in significant effects on habitat and features of ecological importance. The proposed development has been designed to avoid and minimise impacts on sensitive habitats and species. No potential for negative cumulative impacts when considered in conjunction with the current proposal were identified

1.2 Other Projects

Assessment material for this in-combination impact assessment was compiled on the relevant developments within the vicinity of the Proposed Development and was verified on the 18/09/2023. The material was gathered through a search of relevant online Planning Registers, reviews of relevant documents, planning application details and planning drawings, and served to identify past and future projects, their activities, and their environmental impacts. All relevant projects were considered in relation to the potential for in-combination effects.

All relevant data was reviewed (e.g. individual EISs/EIARs, layouts, drawings etc.) for all relevant projects. These are listed below.

Other Developments
The review of planning register for Mayo County Council documented relevant general development planning applications in the vicinity of proposed development site and the grid connection route, most of which relate to the provision and/or alteration of one-off rural housing and agriculture-related structures.

Replacement of Forestry

The replacement of forestry, felled as part of the proposed development, may occur on any lands, within the state, benefitting from Forest Service Technical Approval[1] for afforestation, should the Proposed Development receive planning permission. Under the Forestry Regulations 2017, all applications for licences for afforestation require the prior written approval (technical approval) of the Minister for Agriculture, Food and the Marine.

The requirements for afforestation licencing are set out in the Forestry Regulations 2017 - this includes consideration of Environmental Impact Assessment and Appropriate Assessment as set out in parts 7 and 8 of the Regulations, respectively. Further detail is set out in the Environmental Requirements for Afforestation (DAFM, 2016)[2]. This ensures that afforestation takes place in a way that complies with environmental legislation and enhances the contribution new woodlands and forests can make to the environment and to the provision of ecosystem services, such as water protection and landscape enhancement.

The typical environmental effects of afforestation include potential effects on biodiversity, soils and geology, hydrology and hydrogeology, cultural heritage, landscape and visual, and air and climate.

The applicant is seeking a ten-year planning permission which incorporates time to secure a grid connection agreement, a route to market (RESS or equivalent Power Purchase Agreement), select the preferred equipment suppliers and put the necessary capital funding in place to allow construction and delivery to commence. Thus, the identification of forestry replacement lands at this stage is seen as premature. If a licence for afforestation was obtained prior to seeking and/or obtaining planning permission, it is highly likely that any licencing approvals sought from the Forest Service would have expired before it could be taken up due to the time required for the planning processes and post-planning delivery preparations. The Forest Service Afforestation Licences expire after 3 years from when they are consented.

Furthermore, as mentioned above, the key environmental issues relating to afforestation include water, biodiversity, archaeology, and landscape. Each is subject to regular updates in terms of best practice, guidelines, standards and national policies. Delaying the identification of alternative afforestation lands until such time as they are required enables identification of optimum lands available (from an environmental perspective) for afforestation at that time.

[1] All proposed forestry developments where the area involved is greater than 0.1 hectare must receive the prior written approval of the Forest Service. The application for approval is known as Pre-Planting Approval – Form 1.

[2] https://www.gov.ie/en/publication/642e6-forestry/#environmental-requirements

For the purposes of this project, the applicant commits that the location of any replanting (alternative afforestation) associated with the project will be greater than 10km from the wind farm site and also outside any potential hydrological pathways of connectivity (i.e. outside the catchment within which the proposed project is located) with the proposed project. On this basis, it is reasonable to conclude that there will be no more than imperceptible in-combination cumulative effects associated with the replanting. Therefore, forestry replanting is not considered further in the impact assessment chapters of this EIAR.

In addition, the applicant commits to not commencing the project until both a felling and afforestation licence(s) is in place and, therefore, this ensures the afforested lands are identified, assessed and licenced appropriately by the relevant consenting authority.

Further details in relation to the consideration forestry replanting is included in Appendix 2-4 of this EIAR.

Forestry Practices

The majority of the lands within the site and the surrounding area are planted with commercial forestry. The management and felling of this surrounding commercial forestry was also considered in this assessment.

Other Wind Turbines

There are a number of permitted and operation windfarm developments permitted within a 20-kilometre radius of the proposed development site, which are detailed in the table below.

1.2.1 Projects considered in the Cumulative Impact Assessment

Relevant planning history of potential cumulative wind energy projects are considered to be those within c. 20km of the Proposed Development, those that have not been listed previously. These are set out in the table below. Other wind energy applications not listed below have either expired or were lodged prior to 2013.

Table 1-1. Applications Within 5km of the Proposed Wind Farm

Pl. Ref	Description	Decision
Bellacorick Wind Farm		
20834 (ABP 311157)	10-year permission to develop an electricity service, entailing the laying of approximately 10.4 kilometres of 38kv underground cable from the granted Sheskin wind farm to connect the wind farm to the national grid at the existing Bellacorick 110kv ESB station. the proposed grid connection will be installed along existing private tracks, the public roadway and a short section of private agricultural land	Granted by ABP 31/08/2022 subject to 7 conditions.
Mayo CC Ref: 19457	Amendments to existing planning permission PL5/825 for 8 turbines with an overall max height of 150m, amendments to include - an increase in the overall maximum height of the turbines from 150m to 176m (turbines 1-3) and from 150m to 165m (turbines 4-8) comprising a tower 95-120m high to which three blades of 55-70m length will be attached. An increase in the maximum height of the permanent met mast from 100m to 120m. an increase in the diameter of the foundation base from 22m to 26m. An amendment to condition no 46 to revise the community benefit payment to 2 euro//MWH to be consistent with government guidance set out under the renewable electricity support scheme. the red line boundary and all other aspects of the permitted development will remain unchanged.	Granted by MCC 28/01/2020 subject to 51 conditions.
Oweninny Wind Farm		
ABP: PA0029	Proposed Oweninny Wind Farm and associated works, Bellacorick,	Granted by ABP 02/06/2016 subject to 20 conditions
ABP: 307261	Section 146B Planning application for amendments to An Bord Pleanála case reference PA0029 for Oweninny Wind Farm	Alter decision - Not a material Alteration (No EIS) (27/07/2020)
ABP: 309375	Pre-App Consultation - Oweninny Wind Farm Phase 3. Between 10 and 20 wind turbines (including tower sections, nacelle, hub, rotor blades) with an approximate capacity of 90 MW and a maximum blade tip height of 200 metres.	Determined it is an SID – 04/04/2022
ABP: 316178	Proposed development of Oweninny Wind Farm Phase 3 consisting of 18 wind turbines.	Decision due by 29/09/2023
Killala Community Wind Farm		

17619	10 Year planning permission for 5 turbine wind farm. Proposed Development will be located in the townlands of Magherabrack, Mullafarry, Tawnaghmore Lower, Meelick and Tawnaghmore Upper, Killala approx. 1.3km south of Killala. development is an updated application to the consented 6 turbine wind farm p09/780. proposal is for a wind energy development comprising 5 electricity generating wind turbines, each with a rotor diameter not exceeding 103.2m a hub height not exceeding 73.5m and a blade tip height of not exceeding 126m. the development will include a meteorological mast not exceed 82m in height, internal underground electrical cabling, a substation building, an external underground grid connection cable and ducting to the existing 110kv Tawnaghmore substation, associated grid substation works, associated site access roads and ancillary site works including upgrades to existing site access, a temporary construction compound and haulage route works. the max output capacity of the wind farm will be up to 18mw and has an intended operation life of 25 years	Granted by MCC 15/02/2018 subject to 19 conditions
19260	25 Year permission for a single electricity generating wind turbine with an overall maximum height of up to 125m. The development will also consist of a turbine hardstand, access track of c.394m, internal cable trench of c.1,775m and ancillary site works. The planning application is accompanied by a Natura Impact Statement	Granted by MCC 15/10/2019 subject to 12 conditions
Dooleg More Single Turbine		
20467	Single wind turbine generator and 20kV grid connection to Bellacorick 110kV substation	Granted by MCC 25/03/2021 subject to 15 conditions
Bunnahowen Wind Farm		
18873	Permission to modify the existing permission, p08/1997, to erect three (3) 1mw turbines, control house and ancillary associated works	Granted by MCC 10/03/2019 subject to 6 conditions
Kilsallagh Wind Farm		
ABP: 312282	Proposed Kilsallagh Wind Farm consisting of 13 wind turbines and ancillary equipment including 110kV substation infrastructure.	Pre-App consultation request lodged 21/12/2021
Sheskin South Wind Farm		
ABP: 315933	Proposed development of 21 no. wind turbines and all associated works.	Lodged on 28th February 2023
Tirawley Wind Farm		
ABP: 315864	Construction of up to 31 wind turbines (Tirawley Wind Farm), a permanent 110kV substation, 110kV underground	Pre-App consultation request lodged 21/02/2023

	cable and grid connection to the existing 110kV substation at Tawnaghmore Co. Mayo.	
Keerglen Wind Farm		
Not yet lodged	Proposed Keerglen Wind Farm consisting of approximately 14 No. wind turbines and all other associated works.	Project is still in the design process.

Consented ABO Sheskin Wind Farm

ABO Wind Ireland Ltd. lodged a planning application under Pl Ref. 15/825 to the Planning Authority on the 21st December 2015 for 8 no. wind turbines with an overall blade tip height of up to 150m and ancillary site development works. Within the lodged application documentation, ABO emphasised the development's proximity to the larger Oweninny Wind Farm and the site's predominantly Tier 1 designation in arguing that ABO Sheskin Wind Farm should be read in conjunction with Oweninny rather than as a separate visually obstructive development. The applicant also emphasised the use of varying turbine heights between the two wind farm in order to compliment the surrounding topography.

The Planning Authority (MCC) did not raise any concerns with regard to potentially significant effects on landscape and visual amenity arising from the Proposed Development nor did they issue any further queries on these matters within the Request for Further Information (RFI) on the project. The RFI (dated 22nd February 2016) comprised 16 no. queries predominantly relating to lodged Natura Impact Statement and its assessment methodology. These issues were adequately resolved by ABO within their RFI response, which included an amended NIS, and have been reviewed by the EIA Project Team in order to identify any items of relevance in the context of the Sheskin South project. The Planning Authority ultimately granted permission for the development on the 7th of December 2016 without appeal proceedings.

ABO lodged a second application on ABO Sheskin Wind Farm (Pl Ref. 19/457) to the Planning Authority on the 12th June 2019 for amendments to the extant permission (Pl Ref . 15/825), including an increase in the overall maximum height of the turbines from 150m to 176m (turbines 1-3) and from 150m to 165m (turbines 4-8) and increases in height of the permanent met mast from 100m to 120m. Within their assessment of the proposal, the Authority highlights that, while it is reasonable to optimise wind energy infrastructure in Tier 1 and Tier 2 areas, this development should not be detrimental to the visual amenity of the wider area. In this context, the Authority concluded,

> *"The increased visual impact arising from the increases in turbine heights at 165m and 176m is considered to be relatively indiscernible, and as such, there are no concerns in relation to landscape protection particularly in light of the permitted development on site."*

The Planning Authority granted permission for the development on the 28th January 2020, which was not subject to any subsequent appeal proceedings.

ABO most recently lodged an application to Mayo County Council under PL Ref. 20/834 on the 10th November 2020 in relation to the ABO Sheskin Wind Farm's proposed national grid connection comprising c. 10.4km of 38 kV underground cable from the consented wind farm to the 110 kV Bellacorick substation. The underground cable route corridor encompasses private track, the public roadway (L52926 and N59) and a short section of private agricultural land. Currently, the application is subject to an appeal (ABP: 311157).

Where the potential for the proposed development to result in adverse effects on European Sites on its own was identified, there was potential for it to contribute to in combination effects when considered in combination with other plans and projects. Following the implementation of the best practice measures outlined in Sections 3 and 5 of this report, in the 'Water' Chapter of the EIAR accompanying this application (Appendix 3) and in the

CEMP (Appendix 2), all potential impact pathways have been blocked. There is therefore no potential for the proposed development to contribute to any in-combination impact on EU Designated Sites when considered in combination with other plans and projects.

1.2.2 Conclusion of Cumulative Assessment

In the review of the projects that was undertaken, no connection, that could potentially result in additional or cumulative impacts was identified. Neither was there any potential for different (new) impacts resulting from the combination of the various projects and plans in association with the proposed development.