BALLYKETT GREEN ENERGY LIMITED

BALLYKETT WIND FARM

CO. CLARE

VOLUME II

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR)

February 2024

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TABLE OF CONTENTS

1 INTRODUCTION

1.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) introduces the proposed Ballykett Wind Farm (the Development) and provides details of the Environmental Impact Assessment (EIA) project team and the structure of the report. It defines the key terms of reference used in the environmental assessment of the Development. The Development is subject to an EIA, under the Environmental Impact Assessment Directive 2011/92/EU[1] as amended by Directive 2014/52/EU[2] (EIA Directive) as it contains 4 wind turbines, and with a total output greater than 5MW.

The EIAR has been prepared by Jennings O'Donovan & Partners Limited, on behalf of Ballykett Green Energy Limited, to accompany the planning application seeking planning permission for the Development. This EIAR assesses the Development as a whole, and all direct and indirect effects, cumulative impacts and interactions, including all relevant ancillary and subsidiary elements of the overall Project.

In addition to the identification, description and assessment of the Project, this EIAR identifies, describes and assesses the Project cumulatively with any other existing, permitted and proposed developments (see **Section 2.2.3 of Chapter 2**). This EIAR has been prepared by competent and qualified experts and includes the conclusions as to the significance of any such environmental effects, to assist the competent authority in undertaking an EIA.

The planning application is also accompanied by a Natura Impact Statement (NIS). This NIS has been prepared to assess whether the development on its own or in combination with other plans or projects is likely to adversely affect the integrity of any European sites, in view of conservation objective and best scientific knowledge under Part XAB of the Planning and Development Act 2000 (as amended).

This chapter is supported by Figures and the following Appendices in **Volume IV:**

- **Appendix 1.1**: Author Qualifications
- **Appendix 1.2**: Cumulative Wind Farms
- **Appendix 1.3**: Scoping Opinion

[1] The European Council Directive 2011/92/EU. Available online at https://eur-lex.europa.eu/eli/dir/2011/92/oj [Accessed 5th November 2023]
[2] The European Council Directive 2014/52/EU. Available online at https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052 [Accessed 5th November 2023

- **Appendix 1.4**: Glossary of Common Acronyms
- **Appendix 1.5**: Community Engagement Report

1.2 KEY DEFINED TERMS

In order to provide clarity in the EIAR, the following defined terms will be used throughout.

Table 1.1: Defined Terms used throughout the EIAR

Term	Definition
Site	Refers to all land that falls within the Proposed Ballykett Wind Farm Site Boundary as shown on Figure 1.1.
Redline Boundary	Refers to the proposed Development planning boundary and includes all the proposed works to be completed as part of the Development. It is shown on the planning drawings accompanying this EIAR.
Baseline	Refers to the existing Project lands and their characteristics.
Development	Refers to all elements of the proposed development as described in the planning application public notices for Ballykett Wind Farm, the details of which are set out within Chapter 2: Project Description. These elements include the wind turbines, all site infrastructure, the Grid Connection Route from the onsite substation to Tullabrack 110kV substation and all works required on the Turbine Delivery Route within the Redline Boundary.
Project	Refers to the Development works within the Redline Planning Boundary, and the works along the Turbine Delivery Route which are outside the redline and landholding boundaries.
Survey Areas	Refers to areas within which surveys are undertaken. These are specifically defined within each technical section.
EIAR Study Areas	Refers to areas which are considered as part of the assessment process. These are specific and defined within each technical section.
Council	Refers to Clare County Council.
Developer	Ballykett Green Energy Limited
EIA Regulations	The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018)

Term	Definition
	transpose the requirements of the 2014 EIA Directive into the Planning and Development Regulations 2001 (As Amended).
EIA Directive	Refers to Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment as amended by Directive 2014/52/EU.
The 2014 EIA Directive	Refers to Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment.
Scoping	Scoping is the process of determining what information should be included in the EIAR and the methodologies that should be used to collect and assess that information.
Electrical Substation	Refers to the on-site substation and control building, including the compound in which it is located.
Met Mast	Refers to proposed permanent Meteorological Mast to be located on site.
Construction Haul Routes	Refers to the proposed routes from local quarries and concrete suppliers to the Site.
Turbine Delivery Route (TDR)	Refers to the proposed Turbine Delivery Route from Foynes Port to the Site.
Grid Connection Route (GCR)	Refers to the proposed route of connecting the proposed Ballykett Wind Farm to the national grid at Tullabrack 110kV ESBN Substation.
Wind Farm Internal Cabling	Refers to the electrical cables and ducting connecting the turbines to the electrical substation
Temporary Construction Compound	Refers to the compound to be developed and used by the appointed contractor(s) for the purposes of constructing the wind farm which will be reinstated when construction is completed.
Turbine Hardstand	Refers to a small, fixed area at the base of each wind turbine used by cranes for erection of turbine structure, hub, nacelles and rotor blades.
Turbine Foundation	Refers to turbine concrete base located under ground level and used to support the turbine structure.
Decommissioning	Refers to the end of the operational life of the wind farm when turbines are dismantled and taken off site for reuse, recycling, or

Term	Definition
	disposal, as appropriate. The turbine foundations will remain in-situ and will be covered with earth and reseeded as appropriate. The turbine hardstands will also be reinstated, and the site roads will be left in-situ. The wind farm internal cabling will be removed while the ducting will remain in-situ. The Electrical Substation will be left in-situ.
Reinstatement	Reinstatement means restoring the habitat to its original state in the areas of the site where infrastructure was developed.

1.3 THE DEVELOPER

The Developer – Ballykett Green Energy Limited, is a subsidiary of Greensource Sustainable Developments Limited (Greensource Ltd.).

Greensource is an innovative Irish renewable energy company based in Adare, Co. Limerick that specialises in the development of renewable energy projects, working with communities from pre-planning to operation, and creating long-lasting local partnerships. Greensource has over ten years development and operational experience. Greensource has a highly skilled and experienced team who are committed to developing projects with successful outcomes for all stakeholders. Working with integrity and care for the local environment, the team has a strong track record, having successfully completed wind energy and other renewable projects in the west of Ireland.

1.4 THE SITE

The Site Redline Boundary area extends to approximately 31.13ha all of which is owned by private third-party landowners. The general area is comprised of agricultural grassland, cutover peatland bog and conifer forestry plantation.

The Site is located 3.5km north-east of Kilrush, Co. Clare, 3km south-west of Cooraclare village, and 7.4km north of the county boundary between Clare and Kerry. The Site is located on relatively level ground, at elevations ranging from 34m AOD in the northern side of the Site, where the site access track is proposed, to 32m AOD towards the middle of the Site. A Site Location Map showing the Redline Boundary is appended as **Figure 1.1** and a map which comprises of all elements of the Project is outlined as **Figure 1.2.**

The Development is located in a rural setting. Housing density in the area is low to medium. There are 146 dwellings within a 2km radius of the proposed turbines, comprising one off houses and farm holdings (**Figure 1.3**). The nearest settlement is Kilrush which is located approximately 3km south of the Site boundary.

A full description of the Development is provided in **Chapter 2: Project Description**.

Based on the feasibility study and constraints mapping, the Site has the potential to accommodate 4 no. 4-5MW wind turbines with an overall blade tip height of 150m. The candidate wind turbines have a rotor diameter of 136m and a hub height of 82m.

Initial Grid Connection feasibility work has been completed for the Development which has identified the preferred route that will connect the Development to the national grid.

This EIAR accompanies the planning application for Development which will be submitted to Clare County Council as the competent planning authority.

1.5 SUMMARY OF PROPOSED DEVELOPMENT DESCRIPTION

Permission is being sought by the Developer for the construction of 4 No. wind turbines, a permanent Met Mast, an Electrical Substation and all ancillary works. Also, it includes localised works along the Turbine Delivery Route and construction of an underground grid connection route to Tullabrack 110kV ESBN Substation.

The Development will include the following main components:

- Erection of 4 no. 4-5MW wind turbines with an overall ground to blade tip height of 150m. The candidate wind turbine will have a rotor diameter of 136m and a hub height of 82m.
- Construction of site access tracks, Turbine Hardstand areas and Turbine Foundations.
- Construction of new site entrance with access onto the adjoining local road network (L6132).
- Construction of one no. Temporary Construction Compound with associated temporary site offices, parking areas and security fencing
- Installation of 1 no. permanent Met Mast of 82m overall height.
- Construction of new internal site access tracks and upgrade of existing site track, to include all associated drainage including new clear span bridge crossing of the Moyasta 27_010 watercourse.
- Development of a site drainage network.
- Construction of 1 no. Electrical Substation.

- 2. no permanent spoil storage areas.
- All Wind Farm Internal Cabling connecting the wind turbines to the Electrical Substation.
- Ancillary forestry felling to facilitate construction of the Development.
- All works associated to facilitate the permanent connection of the wind farm to the national electricity grid comprising a 38kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation and to the existing Tullabrack 110kV ESBN Substation.
- Vertical realignment of an existing crest curve on the L6132 local road in order to prevent grounding of abnormal load vehicles during delivery of turbine components.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

The EIAR assesses the Project which includes the Development as outlined above; it includes improvements and temporary modifications to the existing public road infrastructure to facilitate delivery of abnormal loads and turbine delivery.

Note: There are two additional feasible grid connection routes (GCRs) to the existing Moneypoint 400kV ESBN substation which are discussed in **Chapter 3 Alternatives,** and assessed in detail in **Appendix 3.1**: *Environmental Impact Assessment Report of Grid Options to Moneypoint EBSN Substation*. However, these alternative GCR's are not considered part of the Project as set out in **Table 1.1**.

1.6 PLANNING HISTORY

In June 2023 the Developer applied for planning permission (Planning Ref. P23/60219): *"for development, the development is located in the townlands of Ballykett, Tullybrack East and Tullybrack, Kilrush, Co Clare. The Development will consist of the erection of 4 no. wind turbines with an overall ground to blade tip height of 150m with a rotor diameter of 136m and a hub height of 82m. The development will also consist of the construction of crane hardstand areas and turbine foundations, new site entrance onto the L6132, construction of one no. temporary construction compound with associated temporary site offices, parking areas and security fencing, installation of one no. permanent meteorological mast of 82m overall height, construction of new internal site access tracks and upgrade of existing site track, to include all associated drainage including new clear span bridge crossing of the Moyasta River, development of a site drainage network, biodiversity enhancement measures, construction of one no. permanent electrical substation, ancillary forestry felling* *to facilitate construction of the Development, all associated underground electrical and communications cabling connecting the wind turbines to the wind farm substation and to the existing Tullabrack 110kV Substation. This application is seeking a ten year permission and a 35 year operational life from the date of commissioning of the wind farm. The Planning Application is accompanied by an Environmental Impact Assessment (EIAR) and a Natura Impact Assessment (NIS)".*

Clare County Council refused planning permission for the development on 11th August 2023 siting six (6 no.) reasons.

The Developer has prepared a new EIAR, NIS and planning application for the proposed wind farm development in Ballykett, having regard for the reasons set out in the refusal for planning permission by Clare County Council. **Table 1.2** outlines the reason for the planning refusal by Clare County Council and outlines where these have been addressed in this EIAR and NIS. The Developer has also prepared a separate Planning Statement which sets out the response on behalf of Ballykett Green Energy Limited to the reasons for refusal issued by Clare County Council (Planning Ref. P23/60219).

Table 1.2: Outline of reasons for refusal by Clare County Council

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
1	*"Notwithstanding the location of the site on lands identified as 'Acceptable in Principle' for Wind Energy Development as per the Clare County Development Plan 2023 - 2029, the Planning Authority considers that the proposed turbine structures, by reason of their height (tip height of 150m), scale and siting on this low-lying, open and exposed landscape would constitute a prominent feature on the landscape from both local and long-range viewpoints.* *Furthermore taken in conjunction with existing wind turbines in the area, it is considered that the proposed development would give rise to an ad hoc and piecemeal proliferation of wind turbines at this location, which would negatively alter the character of this rural landscape, and would conflict with the guidance contained within the Clare Wind Energy Strategy regarding the capacity of the Kilrush Farmlands (also named Kilmihil Farmlands) Landscape Character Area, Loop Head Landscape Character Area, and Shannon Estuary Farmland Landscape Character Area to accommodate Wind Energy Developments. The proposed development would therefore seriously injure the visual amenities of the area and would be contrary to the proper planning and development of the area."*	The Developer contends that the location and position of the turbines will ensure they are assimilated into the existing landscape, are medium in physical size and will appear almost identical in scale to the existing wind farm developments. The LVIA shows the site of the proposed Wind Farm in Ballykett is located in an area identified as 'Acceptable in Principle' for wind energy development by *Clare County Development Plan 2023-*	Chapter 11 Landscape and Visual Assessment.

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		2029 and associated Clare Wind Energy Strategy. The proposal for four turbines with tip heights of 150m represents a very modest scale wind farm proposal in the current wind energy development environment in Ireland where much larger schemes of turbines with tip heights of between 180m - 200m are much more typical. Also, the proposed location and positioning of these four additional turbines will ensure they are assimilated into the existing landscape which already contains a relatively small number of	

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		wind turbines see EIAR Chapter 11 LVIA -Section 11.4.3 Magnitude of Landscape Effect for further detail.	
2	*"It is an objective of the Clare County Development Plan 2023-2029, as set out under Objective CDP11.47(e) to strike an appropriate balance between facilitating renewable and wind energy related development and protecting the residential amenities of neighbouring properties. Having regard to the scale and height of the turbines as proposed, the location of the site in this open landscape, the existing windfarms in the vicinity of the subject site, and the significant volume of traffic movements required to facilitate the construction process, it is considered that the proposed development would seriously injure the amenities of residential property in the vicinity by reason of noise and disturbance. Furthermore, it is considered that the proposed turbines would be visually overbearing on existing properties and thus depreciate the value of property in the vicinity. The proposed development would therefore be contrary to Objective CDP11.47 of the development plan and be contrary to the proper planning and development of the area."*	The EIAR includes sufficient evidence to show that the proposed development will not significantly impact the amenities of residential property in the vicinity by reason of noise and disturbance or depreciate the value of property in the vicinity. Numerous international studies have concluded that property value variations are not	Chapter 4 Planning Policy Chapter 5 Population and Human Health Chapter 11 Landscape and Visual Assessment Chapter 10 Noise and Vibration Chapter 16 Traffic and Transport Appendix 16.2 Traffic Management Plan

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		attributable to the presence of windfarms. See Chapter 5 Population and Human Health – Section 5.3.7 The assessment of traffic movements for the project shows any disturbance to the local road network and amenities will be temporary. A TMP (Appendix 16.2) has also been prepared for the Project which includes mitigation measures. All information presented in the EIAR is aligned with the requirements outlined in the Clare County	

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		Development Plan 2023-2029 in relation to noise. The noise level for the Project complies with the NRA guideline (2004). Additionally, it demonstrates that the noise related to the Project are significantly lower than the limits in the Noise Directive (Directive 2002/49/EC).	
3	*"The proposed turbine delivery route indicates that delivery vehicles will travel westbound on the L6132 to the wind farm Site entrance from the intersection of this local road with the N68. The turbine delivery route analysis on L6132 shows that enabling works such as verge strengthening and junction modifications will be required on the route to accommodate abnormal load vehicles. The Planning Authority notes that an assessment of this work program has not been included in the Stage 1 Screening report or Natura Impact Statement submitted with the application. Further the grid option*	The Developer notes the feedback from the Planning Authority (above) and accepts that the works along the Turbine Delivery Route (TDR) should have been more clearly addressed in	NIS Construction & Environmental Management Plan (CEMP) Chapter 9: Hydrology and Hydrogeology

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
	connecting the proposed wind farm site to the Moneypoint sub station traverses the Cloon sub-catchment (Cloon [Clare]_SC_010), a designated river for Freshwater Pearl Mussel (S.I 296 of 2009, as amended by S.I 355 of 2018). An assessment on these species has not been included in the Natura Impact Statement. Having regard to these omissions, the Planning Authority considers that there is an inherent risk to the Qualifying Interests of European Sites which have not been adequately address in the Natura Impact Statement. As a result of the foregoing issues, the Planning Authority cannot conclude a finding of no adverse effects on the integrity of the associated European sites, the proposed development would be contrary to Objective CDP15.3 of the County Development Plan and contrary to the proper planning and sustainable development of the area."	the Natura Impact Statement (NIS). A new NIS has been prepared for this planning application which assess the Project as defined in Table 1.1. A Freshwater Pearl Survey was undertaken in October 2023 to provide further data/evidence to support this EIAR. It found "*where the channels were suitable for FPM survey none were found.*" See Appendix 7.1 for detail. Note: The alternative GCR options to	Appendix 7.1 Freshwater Pearl Survey Report

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		Moneypoint substation are not included in the Project as defined in Table 1.2. The EIAR for the GCR options to Moneypoint have been collated into a separate document (see Appendix 3.1). The proposed GCR to Tullabrack has the least number of watercrossings and was selected as the preferred grid route to minimise potential environmental effects.	
4	*"Poulnasherry Bay is a designated shellfish water body under the Quality of Shellfish Water Regulations (S.I 208 of 2008). While water quality impact assessment is undertaken in the submitted EIAR and NIS, specific reference*	Following the Planning Authority's feedback it was decided to remove the two	Chapter 7 Aquatic Ecology

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
	to the current status of the Poulnasherry bay population and potential risks likely to be associated with the development have not been included in the EIAR, with particular reference to dissolved substances (humic acid, sulphates and fugitive hydrocarbons). Under Article 5 of the European Communities Environmental Objectives (Surface Waters) Regulations, 2009, as amended, a public authority, in the performance of its functions, shall not undertake those functions in a manner that knowingly causes or allows deterioration in the chemical or ecological status of a body of surface water. On the basis of the information submitted with the application to date it is considered that the proposed development would present a significant risk of adverse environmental impact on the sensitive natural habitats of the site and of the wider area, constituting an unacceptable risk of pollution of watercourses in the area and seriously injuring the amenities of the area. The proposed development would, therefore, be contrary to the proper planning and sustainable development of the area."	GCR options to Moneypoint from the Project. Therefore, addressing and minimising the potential effects on water quality. The EIAR for the GCR options to Moneypoint have been collated into a separate document (see Appendix 3.1). As outlined in Chapter 7 Aquatic Ecology the Site is located on the Moyasta river, approximately 5km upstream of Poulnasherry Bay. Taking into account the length, size and assimilation capacity of the Moyasta	Chapter 9 Hydrology & Hydrogeology

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		River and Poulnasherry Bay without mitigation in place there would only be a slight to moderate short-term significant effect. However, with mitigation rigorously enforced, as outlined in Chapter 2: Project Description, Appendix 2.1 (i.e., CEMP, SWMP) and Chapter 9: Hydrology and Hydrogeology, it can be concluded there would not be any significant effects on the designated shellfish water body as a result of the proposed wind farm project.	

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
5	*"It is an objective of Clare County Council, under Objective CDP15.12 of the Clare County Development Plan 2023-2023 to inter alia to promote the conservation of biodiversity through the protection of sites of biodiversity importance and wildlife corridors, both within and between the designated site and the wider plan area. Having regard to the species and habitats data submitted with the application, the high level of usage of the site by multiple animals (included bats) and bird species, and the likely impacts of the proposed development on same, the Planning Authority considers that the proposed development would significantly diminish the biodiversity value of the area, would be contrary to Objective CDP15.12 of the Clare County Development Plan 2023-2029 and would be contrary to the proper planning and sustainable development of the area."*	The EIAR and NIS includes sufficient baseline data to determine that the proposed development will not significantly diminish the biodiversity value of the area. The baseline assessment for biodiversity within the proposed wind farm development site and in the surrounding areas (as relevant) was based on extensive surveys by relevant experts and a thorough desk review of available ecological data, carried out between 2020 and 2023. The methods, as detailed in Chapter 6 of	Chapter 6: Biodiversity Chapter 7: Aquatic Ecology NIS Appendix 7.1 Freshwater Pearl Mussel Survey Report (October 2023)

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		EIAR (Section 6.2), followed best practice and standard guidance, for each ecological interest (habitats, bats, birds etc.). Additional surveys were carried including: badger survey (November 2023), bat survey (December 2023) and Freshwater Pearl survey (October 2023) to provide further data/evidence to support this EIAR.	
6	*Having regard to:* *a) the data in bird survey reports (and in particular the data indicating the cutover bog area supports breeding meadow pipit, skylark and wintering snipe), and the consequent potential impact of the temporal and spatial disturbance during construction on the population of Skylark, Snipe and*	The EIAR and NIS includes sufficient baseline data to determine that the proposed development will not significantly impact biodiversity, aquatic	Chapter 6: Biodiversity (Reason No 6 (a) –(c))

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
	Meadow pipit (ground nesting birds) and Kestrel (breeding territory in vicinity of the site), *b) the proximity of the site to the existing wind farms at Tullabrack (6 turbines, 1.52km west of the proposed development site), Moanmore (7 turbines, 1.31km northwest of proposed development site) and other existing and permitted developments in the vicinity of the subject site, the potential 'in combination' effects of the overall disturbance to the bird population, particularly in terms of loss of foraging habitat (and in particular the impact on breeding kestrel in the area),* *c) the location of a Lesser Horseshoe bat roost within 3.5km of the site,* *d) the stated anomaly between the excavated volumes and stone required for construction, using data in Chapter 2 of the submitted EIAR and Chapter 16 (Table 16.12) indicating projected deliveries to the site,* *e) the lack of detail in relation to stone arising on site, and stone required to be imported,* *f) an identified shortfall in required temporary storge area for spoil on site,* *g) the estimated range of 1.6-4.7m peat depth at Turbine 3, which the Planning Authority consider is unacceptably broad, particularly in the context of assessment of stability and dewatering of excavations*	ecology, hydrogeology and hydrogeology and soils and geology. The EIAR has considered all environmental impacts and the proposed mitigation measures will ensure the protection of the environment. In response to the Reason for Refusal 6 (a) the presentation of the results of the various bird surveys undertaken between 2020 and 2022, section 6.3.6 of EIAR presents an evaluation of the bird status within the study area of each species of conservation importance.	EIAR Chapter 16 Traffic and Transport (Reason No.6 (d) and (e)) EIAR Chapter 2 Project Description (Reason No.6 (f)) EIAR Chapter 8 Soils and Geology, Appendix 8.1 – Site Investigations & Stability Risk Assessment and Appendix 8.1 – App B(a) Peat Database (Reason No. 6 (g))

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
	it is considered that the proposed development would pose a serious danger to the environment, potentially causing extensive pollution of waterbodies within and in the vicinity of the site. The Planning Authority is not satisfied therefore that all necessary environmental impacts have been considered and assessed in the EIAR, and therefore the proposed mitigation measures in respect of same would not be considered adequate to ensure the protection of the environment. Therefore, it is considered that the proposed development would present a significant risk of adverse environmental impact on the sensitive natural habitats of the site and of the wider area and would seriously injure the amenities of property in the vicinity. The proposed development would, therefore, be contrary to the proper planning and sustainable development of the area."	In section 6.4.7.2 "Disturbance to birds during construction", the possibility that target species including kestrel could breed within the Site area by the time construction commences, is considered. The mitigation that will be implemented to ensure that breeding target species, including Kestrel, are not disturbed by construction works is described in Chapter 6, Section 6.5.7.1 "Mitigation for birds during construction phase". In response to 6(b)Taking into account the limited	EIAR Chapter 9 Hydrology and Hydrology EIAR Chapter 8 Soils and Geology – Appendix 8.1 – Site Investigations & Stability Risk Assessment and Appendix 8.1 – App B(a) Peat Database

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		amount of cutover raised bog to be lost as a result of permanent works (0.54ha) and the extent of availability of this habitat in the surrounding study area and the wider hinterland landscape, the in combination effect of the overall disturbance to the bird populations, when taken into consideration with other surrounding cumulative projects is evaluated as being not significant. Furthermore, while there appears to be no published reports in Ireland on post-construction monitoring of	

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		bird populations at wind farms, observations by the present author (B. Madden) indicate that passerine bird species, such as meadow pipit and skylark, would generally be present in operational wind farm sites (where suitable habitat exists) and show no displacement effect due to the presence of the turbines. This is in line with published accounts which note that passerine species are generally not affected by wind farm development, e.g. SNH Guidance (2017). In response to 6(c) An additional Bat survey was	

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		undertaken in December 2023, and a new bat report has been included as an Appendix to this EIAR – Appendix 6.2: Bat Survey Report, Ballykett Wind Farm. Prepared by O'Donnell Environmental. (d) Excavation volumes in Chapter 2 and the required stone volumes have been reviewed and updated. (e) Further detail has been provided on the stone volumes expected from the borrow pit and the stone that will be imported. (g) Additional peat probing was undertaken on site in	

No.	Planning Refusal Reason	Developer's Response	Location where Addressed in this EIAR
		November 2023 in areas of the Site that were previously inaccessible. Additional water monitoring was undertaken in November 2023 on the watercourse crossing along the TDR.	

1.7 ENVIRONMENTAL IMPACT ASSESSMENT

1.7.1 Environmental Impact Assessment Requirement and National Legislation

The EIA Directive requires that, before consent is given for certain public and private projects, an assessment of the effects on the environment is undertaken by the relevant competent authority. The EIA Directive has been transposed into Irish legislation, for the purposes of this EIA Development, by the Planning and Development Act 2000, as amended ("the Planning Acts") and the Planning and Development Regulations 2001, as amended ("the Planning Regulations").

Section 171A of the Planning and Development Act 2000 (as amended) defines an Environmental Impact Assessment (EIA) as 'a process —

(a) consisting of —

(i) the preparation of an environmental impact assessment report by the applicant in accordance with this Act and regulations made thereunder,

(ii) the carrying out of consultations in accordance with this Act and regulations made thereunder,

(iii) the examination by the planning authority or the Board, as the case may be, of— (I) the information contained in the environmental impact assessment report, (II) any supplementary information provided, where necessary, by the applicant in accordance with section 172(1D) and (1E), and (III) any relevant information received through the consultations carried out pursuant to subparagraph (ii),

(iv) the reasoned conclusion by the planning authority or the Board, as the case may be, on the significant effects on the environment of the proposed development, taking into account the results of the examination carried out pursuant to subparagraph (iii) and, where appropriate, its own supplementary examination, and

(v) the integration of the reasoned conclusion of the planning authority or the Board, as the case may be, into the decision on the proposed development, and

(b) which includes —

(i) an examination, analysis and evaluation, carried out by the planning authority or the Board, as the case may be, in accordance with this Part and regulations made thereunder, that identifies, describes and assesses, in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of the proposed development on the following: (I) population and human health; (II) biodiversity, with particular attention to species and habitats protected under the Habitats Directive and the Birds Directive; (III) land, soil, water, air and climate; (IV) material assets, cultural heritage and the landscape; (V) the interaction between the factors mentioned in clauses (I) to (IV), and

(ii) as regards the factors mentioned in subparagraph (i)(I) to (V), such examination, analysis and evaluation of the expected direct and indirect significant effects on the environment derived from the vulnerability of the proposed development to risks of major accidents or disasters, or both major accidents and disasters, that are relevant to that development.

Section 172(1)(a)(ii)(I) requires projects of a class specified in Part 2 of Schedule 5 of the Planning Regulations to be subject to an EIA where:
"(I) *such development would exceed any relevant quantity, area or other limit specified in that Part".*

Part 2 of Schedule 5 of the Planning Regulations includes the following classes of an EIA Development:
Class 3(i) *"Installations for the harnessing of wind power for energy production (wind farms) with more than 5 turbines or having a total output greater than 5 megawatts."*
Class 10(dd) *"All private roads which would exceed 2000 metres in length"*
Class 15 *"Any project listed in this Part which does not exceed a quantity, area or other limit specified in this Part in respect of the relevant class of development but which would be likely to have significant effects on the environment, having regard to the criteria set out in Schedule 7".*

It is considered that the Development comes within the scope of Class 3(i) and Class 10(dd) and that it is appropriate to carry out EIA of the Development.

1.7.2 Directive 2014/52/EU

The EIA Directive (2011/92/EU) was amended by the 2014 EIA Directive (2014/52/EU).

On 1st September 2018, the Minister for Housing, Planning and Local Government published updated guidelines for planning authorities and An Bord Pleanála on carrying out EIAs. The publication of the Guidelines coincides with the coming into operation on 1st September 2018 of the provisions of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018), which were signed by the Minister on 26th July 2018. These Regulations transpose the requirements of Directive 2014/52/EU, amending previous Directive 2011/52/EU, on the assessment of the effects of certain public and private projects on the environment (the EIA Directive) into planning law.

Accordingly, this EIAR complies with the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018). To the extent relevant and necessary, the existing provisions of the Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001, (as amended) insofar as they transpose the EIA Directive, have been complied with. Article 5 of the EIA Directive provides where an EIA is required, the developer shall prepare and submit an Environmental Impact Assessment Report (EIAR). The information to be provided by the developer shall include at least:

(a) *a description of the Development comprising information on the site, design, size and other relevant features of the Development*
(b) *a description of the likely significant effects of the Development on the environment*
(c) *a description of the features of the Development and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment*
(d) *a description of the reasonable alternatives studied by the developer, which are relevant to the Development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the Development on the environment*
(e) *a non-technical summary of the information referred to in points (a) to (d) and*
(f) *any additional information specified in Annex IV relevant to the specific characteristics of a particular Development or type of Development and to the environmental features likely to be affected*

The EIAR provides information on the receiving environment and assesses the likely significant effects of the Development and proposes mitigation measures to avoid or reduce these effects. The function of the EIAR is to provide information to allow the competent authority to reach a reasoned conclusion on the effects of a development and inform subsequent decisions, such as planning. All elements of the Development, (including the Grid Connection and Turbine Delivery Route) have been assessed as part of this EIAR.

1.7.2.1 EIA Definition

Article 1(2)(g) of the 2014 EIA Directive defines EIA as a process consisting of:

"(i) the preparation of an environmental impact assessment report by the developer, as referred to in Article 5(1) and (2)

(ii) the carrying out of consultations as referred to in Article 6 and, where relevant, Article 7

(iii) the examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the developer in accordance with Article 5(3), and any relevant information received through the consultations under Articles 6 and 7

(iv) the reasoned conclusion by the competent authority on the significant effects of the project on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination, and

(v) the integration of the competent authority's reasoned conclusion into any of the decisions referred to in Article 8a".

1.7.2.2 Factors of the Environment

The EIA Directive as amended requires the EIA to identify, describe and assess, in an appropriate manner and in light of each individual case, the direct and indirect significant effects of a project on the following factors:

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under the Habitats and Birds Directives;

(c) land, soil, water, air and climate;

(d) material assets, cultural heritage and the landscape;

(e) the interaction between the factors referred to in points (a) to (d).

The effects referred to above on the factors set out shall include the expected effects deriving from the vulnerability of the Project to risks of major accidents and/or disasters that are relevant to the Project concerned.

Table 1.3: Outline of respective chapters relating to the requirements of the EIA Directive

EIA Directive	Chapter	Title
(a) population and human health	5	Population and Human Health
(b) biodiversity, with particular attention to species and habitats protected under the Habitats and Birds Directives	6 7	Biodiversity Aquatic Ecology

EIA Directive	Chapter	Title
(c) land, soil, water, air and climate	2 6 7 8 9 10 12 13	Project Description Biodiversity Aquatic Ecology Soils and Geology Hydrology and Hydrogeology Noise and Vibration Air Quality and Climate Shadow Flicker
(d) material assets, cultural heritage and the landscape	11 14 15 16	Landscape and Visual Amenity Archaeology and Cultural Heritage Material Assets & Other Issues Traffic Impact Assessment
(e) the interaction between the factors referred to in points (a) to (d)	17	Interactions of the Foregoing

1.7.2.3 Major Accidents and Disasters

A wind farm is not a recognised source of chemical pollution. Should a major accident or natural disaster occur, the potential sources of pollution on Site during both the construction and operational phases are limited. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health include bulk storage of hydrocarbons or chemicals and storage of waste. The Site is not regulated under the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 i.e. SEVESO sites and so there is no potential effect from this source. The closest SEVESO site, at the Moneypoint Generating Station at Killimer, County Clare, is located approximately 6.40km from the Development.

There is limited potential for significant natural disasters to occur at the Site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to peat-slide, flooding and fire. The Site is relatively flat and so the risk of peat slide is negligible. The risk of peat-slide is further addressed in **Chapter 8: Soils and Geology, Appendix 8.1 – Site Investigations & Stability Risk Assessment and Chapter 9: Hydrology and Hydrogeology**.

The closest mapped flood event to the Site is a recurring pluvial flood event, which occurs approximately 3.43km southwest of the southern Redline Boundary along the N67 road and down gradient of the proposed Site. The flood event typically occurs as a result of coastal/estuarine waters in the area, with the road liable to flood after heavy rain in conjunction with high tide. It was assessed that the proposed Development will not exacerbate the pre-existing and recurring pluvial flood event due to an absence of direct pathways between the Site and the identified recurring flood event locations. The risk of flooding is addressed fully in **Chapter 9: Hydrology and Hydrogeology.**

An article in Wind Power Engineering Magazine estimated that 1 in 2,000 wind turbines catch fire each year[3]. Overall, the data shows that wind turbine fires are relatively rare[4]. It is therefore considered that the risk of significant fire occurring, affecting the wind farm and causing the wind farm to have significant environmental effects is limited. As described earlier, there are no significant sources of pollution in the wind farm with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties and infrastructure limits the potential for impacts on human health.

1.7.2.4 Alternatives to the Development

Article 5(1)(d) of the EIA Directive requires that the EIAR includes a description of the reasonable alternatives studied by the Developer, which are relevant to the Development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the Development on the environment.

In addition Annex IV, paragraph 2 provides that the EIAR include "*A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects.".*

This is addressed in **Chapter 3, Alternatives Considered** of this EIAR.

1.7.2.5 National Guidance

The following documents have been complied with in the preparation of this EIAR:

- Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, May 2022)[5]
- The Department of Housing, Planning and Local Government (2018) Circular PL. 05/2018 -Transposition into Planning Law of Directive 2014/52/EU

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[3] https://www.windpowerengineering.com/is-rope-based-descent-emergency-evacuation-at-the-end-of-its-tether/ [Accessed 20/11/23]
[4] https://www.firetrace.com/fire-protection-blog/wind-turbine-fire-statistics [Accessed 20/11/23]
[5] Environmental Protection Agency, (2022). *Guidelines on the information to be contained in Environmental Impact Assessment Reports*. https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf - [Accessed 20/11/23]

- Department of Housing, Planning and Local Government '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*' (August 2018).

1.7.2.6 European Guidance

- Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017).

1.7.2.7 Competent Experts and Quality of the EIAR

Article 5(3) of the EIA Directive states that, in order to ensure the completeness and quality of the EIAR, the Developer shall ensure (a) the EIAR is prepared by competent experts; (b) the competent authority shall ensure that it has, or has access to, sufficient expertise to examine the EIAR, and (c) where necessary, the competent authority shall seek from the Developer any supplementary information, in accordance with Annex IV (the information to be contained in the EIAR), which is directly relevant to reaching a reasoned conclusion on the significant effects of the Project on the environment.

Article 94(e) of the Planning and Development Regulations 2001 (as amended) requires the following information to be provided in an EIAR:

"(e) a list of the experts who contributed to the preparation of the report, identifying for each such expert—

(i) the part or parts of the report which he or she is responsible for or to which he or she contributed,

(ii) his or her competence and experience, including relevant qualifications, if any, in relation to such parts, and

(iii) such additional information in relation to his or her expertise that the person or persons preparing the EIAR consider demonstrates the expert's competence in the preparation of the report and ensures its completeness and quality."

The Developer considers that each of the experts involved in the preparation of this EIAR is competent, having regard to the task he or she has performed, taking account of the scope of the study for which he or she undertook the work, the person(s) possesses sufficient training, experience and knowledge appropriate to the nature of the work. The competencies of the experts involved in the EIAR preparation are outlined in **Appendix 1.1, Author Qualifications and Experience**.

This EIAR has been prepared by Jennings O'Donovan & Partners Limited (JOD), Consulting Engineers, Finisklin Business Park, Sligo, F91 2HH9, on behalf of the Developer. JOD are one of the longest established and most reputable multi-disciplinary engineering consultancies in Ireland. Established in 1950, it has grown to be the largest engineering consultancy in the north-west of Ireland. JOD have been an established presence in the renewable energy wind farm sector since 1998. To date, the company has a portfolio of project involvement extending to over 2,500 MW of power in Ireland and Northern Ireland and is a recognised market leader in the area of wind energy development. This portfolio will equate, when completed, to an investment of €3 billion in the wind energy sector. Additionally, JOD has attained certificates in line with industry standards as follows:

- ISO 9001:2015 – Quality Management System
- ISO 14001:2015 – Environmental Management System
- ISO 45001:2018 – Occupational Health and Safety Management System

Possession of these certificates is, in itself, evidence that JOD, have developed, maintained and implemented systems in quality, safety and environmental related matters and are therefore competent experts.

This Project has been completed in line with JOD's Integrated Management System (IMS) which is based on the current versions of ISO 9001 (Quality Management System), ISO 14001 (Environment Management System) and ISO 45001 (Safety Management System). JOD are fully certified and accredited to ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 for the provision of project management, environmental, civil and structural consulting engineering services.

JOD have developed a Quality Policy Statement, an Environmental Policy Statement and a Safety Health and Welfare Policy Statement. It is a stated objective in our Quality Policy Statement that:
"…*Jennings O'Donovan and Partners Limited is committed to complying with the requirements of the quality management system and to continually improve its effectiveness…".*

JOD staff are degree qualified in their respective specialist fields and have developed their competence through both experience on the job and through training. Each team member has developed the following:

- Sufficient knowledge of the specific tasks to be undertaken and the risks which may arise.

- Sufficient experience and ability to carry out their duties in relation to the project and to take appropriate actions required under the EIA Directive.

Specialist consultancies have been employed to complete some of the EIAR chapters. Each chapter of the EIAR includes a statement of authority regarding the competency of the author and relevant qualifications.

1.8 NEED FOR THE DEVELOPMENT

At a European and national regulatory and policy level, the need for the Development is clear.

Under Directive 2009/28/EC on the promotion of the use of energy from renewable sources (the RED Directive), Ireland committed to produce at least 16% of all energy consumed by 2020 from renewable sources. This was to be met by 40% from renewable electricity, 12% from renewable heat and 10% from the renewable transport sector.

The Climate Action Plan 2023

The Climate Action Plan 2023 provides a detailed plan to achieve a 51% reduction in CO_2 emissions by 2030 and net zero by 2050.

In relation to electricity generation, there is a commitment to increase the reliance on renewable energy sources to facilitate a 75% reduction in CO_2 emissions from the electricity generation sector by 2030. This requires increasing the target of on-shore wind energy to 9 GW in line with the National Climate Action Plan 2023 commitments.

The contribution of the Development to the de-carbonisation of the Irish electricity network will contribute positively to an issue of strategic social importance and highlights the need to remove barriers to the development of renewables, including onshore wind, such as streamlining regulation and encouraging reinforcement of the grid to facilitate greater renewables penetration. The significance of the action plan is underlined by the Irish government's declaration of a Climate Emergency in 2019.

The Renewable Energy Directive 2018

The Promotion of the use of energy from renewable sources (recast) Directive 2018/2001/EU entered into force in December 2018 and was transposed into Irish law in September 2020 by the European Union (Renewable Energy) Regulations 2020. The regulations set the parameters for the establishment of future Renewable Electricity

Support Schemes (RESS), and build on the existing regime, which was created by the European Union (Renewable Energy) Regulations 2014 (as amended) (the "2014 Regulations"). The ambition of increased electricity from renewable sources will be significantly ramped up.

Ireland is facing significant challenges in efforts to meet these targets, alongside its commitment to transition to a low carbon economy by 2050. Ireland did not meet its 2020 target for renewable energy and is falling behind in the longer-term movement away from fossil fuels.

The Development is critical to helping Ireland address these challenges as well as addressing the country's over-dependence on unsustainable imported fossil fuels. The need for the Development is driven by the following factors:

- A requirement to diversify Ireland's energy sources, to achieve national renewable energy targets;
- Avoid significant fines from the EU (the Promotion of the use of energy from renewable sources (recast) Directive 2018/2001/EU);
- A legal commitment under the Kyoto protocol to the United Nations Framework Convention on Climate Change (UNFCCC) from Ireland to limit greenhouse gas emissions;
- A requirement to increase Ireland's national energy security as set out in the Energy White Paper 'Ireland's Transition to a Low Carbon Energy Future 2015-2030' ;
- Provision of cost-effective power production for Ireland which would deliver local benefits;
- Increase energy price stability in Ireland by reducing an over-reliance on imported gas and exposure to international market price and supply fluctuations.

The Development will also offer opportunities such as:

- Provision of clean energy whilst minimising environmental impacts;
- Contributing to renewable energy targets which will continue to drive down the overall cost of energy with benefits to the Irish consumer.

The Project will create additional jobs and will encourage continued investment in the renewable industry in Ireland. Wind Energy Ireland (WEI), Ireland's largest renewable energy organisation, in its annual Wind Energy Report for 2022 noted that Ireland's wind energy share of electricity demand in 2022 was 34% compared to 30% in 2021.

The total installed capacity of the Republic of Ireland's wind farms is now 4,375 MW[6]; this is approximately enough to power 2.2 million Irish homes annually.

Chapter 4 of the EIAR relates to the Planning Policy Context and presents a full description of the international and national renewable energy policy context for the Development. **Chapter 5** addresses Climate Change, including Ireland's current status with regard to meeting greenhouse gas emission reduction targets.

1.8.1 Public Consultation

1.8.1.1 Informing the Public and Local Residents

The public were informed about the project via a newsletter which was issued in 2022. This newsletter outlined who Greensource are, project proposals, project schedule, community benefit, the proposed EIA process and studies to be undertaken, answers to frequently asked questions and contacts for further information requests and questions. The Community Engagement Report is attached as **Appendix 1.5**. There is also the Ballykett Green Energy website where updates on the project are posted.

1.8.2 Community Benefit and Community Involvement

Ballykett Green Energy Limited will set up a community benefit fund which will allocate funds from the wind farm to community groups in the area should the wind farm be granted planning and be successful under the Government's RESS support programme.

If consented, the proposed Ballykett Wind Farm will require an approximate investment of circa €33 million and will provide sustainable, low carbon energy generation infrastructure to meet Ireland's growing demand. The Development benefits to the local community would include significant investment in local infrastructure and electrical systems, local job creation, and a contribution of approximately €9.5million[7] in Clare County Council rates over the project lifetime of 35 years.

If consented the proposed Ballykett Wind Farm will also provide a community fund calculated in accordance with the Renewable Electricity Support Scheme (RESS) Terms and Conditions at €2 per MWh of electricity produced by the project. This is to be made available to the local community for the duration of the RESS (15 years). The average capacity factor of wind energy projects in Ireland is 28.3% (SEAI, 2019). Assuming this

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[6] https://windenergyireland.com/images/files/20221026windenergyirelandoireachtasmembersbriefing.pdf [Accessed on the 20/11/2023].
[7] Estimated €8,000 per mega watt installed for 35 year project lifespan

efficiency, and a capacity of c.20MW, the community benefit fund would amount to an average of €99,163 per annum. The actual fund will vary around this average from year to year, depending on each year's wind conditions. Wind resource monitoring undertaken in the Study Area indicate that Ballykett Wind Farm could be capable of achieving an above average capacity factor, and therefore contribute towards a larger community fund.

Up to 50% of the fund will be distributed to near neighbours of the wind farm (within 1km). 40% of the fund, amounting to approximately €39,600 per year in this example, will be allocated to not-for-profit community enterprises, with an emphasis on low carbon initiatives. The fund will be directed towards local clubs, societies and other initiatives. It is envisaged that the communities nearest the Development will benefit most from any community fund. The community benefit fund will be managed by a fund committee comprised of local residents, the Developer and a fund administrator. The Developer and the administrator will also be members of the fund committee, to ensure that all funding applications meet the fund's eligibility criteria.

1.8.2.1 Information to be Included in a Decision to Grant

Article 8a (1) of the EIA Directive states:

"The decision to grant development consent shall incorporate at least the following information:

(a) the reasoned conclusion referred to in Article 1(2)(g)(iv);

(b) any environmental conditions attached to the decision, a description of any features of the project and/or measures envisaged to avoid, prevent or reduce and, if possible, offset significant adverse effects on the environment as well as, where appropriate, monitoring measures".

To assist the planning authority with this requirement, the EIAR includes a summary of all proposed mitigation and monitoring measures outlined within the technical assessments at the end of each chapter.

1.9 EIAR STRUCTURE

This EIAR uses the grouped structure method to describe the existing environment, the potential impacts of the Development thereon and the proposed mitigation measures. Background information relating to the Development, scoping and consultation undertaken and a description of the Development are presented in separate sections. The grouped format sections describe the impacts of the Development in terms of human beings, biodiversity, soils and geology, hydrology and hydrogeology, air and climate, noise and vibration, landscape and visual, shadow flicker, cultural heritage, material assets and traffic and transportation, together with the Interactions of the foregoing. Please note that the Irish Transverse Mercator (ITM) coordinate system is used in the EIAR document for precise geographical referencing of the Development.

The layout of this EIAR is arranged in four volumes, I-IV.

Volume I: This volume includes the opening **Non-Technical Summary (NTS)**. It is a condensed and easily comprehensible version of the EIAR document. The NTS is presented in a similar format to the main EIAR document and comprises descriptions of the Development, the receiving environment, impacts, mitigation measures and interactions presented in a grouped format. It is a standalone document.

Volume II: This volume contains the main text of the **Environmental Impact Assessment Report (EIAR)**. The EIAR is presented using the grouped structure method and describes the existing environment, the potential impacts of the Development thereon and the proposed mitigation measures. Background information relating to the Development, scoping and consultation undertaken and a description of the Development are presented in separate chapters.

The chapters in this **Volume II: EIAR** are as follows:

- Chapter 1: Introduction
- Chapter 2: Project Description
- Chapter 3: Alternatives Considered
- Chapter 4: Planning Policy
- Chapter 5: Population and Human Health
- Chapter 6: Biodiversity
- Chapter 7: Aquatic Ecology
- Chapter 8: Soils and Geology
- Chapter 9: Hydrology and Hydrogeology
- Chapter 10: Noise and Vibration
- Chapter 11: Landscape and Visual Assessment
- Chapter 12: Air Quality and Climate
- Chapter 13: Shadow Flicker and EMI
- Chapter 14: Archaeology and Cultural Heritage
- Chapter 15: Material Assets

- Chapter 16: Traffic and Transport
- Chapter 17: Interactions of the Foregoing

Volume III: EIAR Figures and Drawings

The Figures and Drawings referred to in each chapter of the EIAR are compiled separately in Volume III. Figures are numbered sequentially for each chapter in which they are principally referred.

Volume IV: Appendices

The appendices referred to in each chapter of the EIAR are compiled separately in Volume IV. They are also numbered sequentially for each chapter in which they are principally referred.

1.10 EIAR PREPARATION

1.10.1 Introduction

JOD had overall responsibility for the coordination of the EIAR with input from other independent specialist consultants where necessary. The competency of JOD has been outlined in Section 1.6.2.7. **Table 1.4** provides details of the contributors of each aspect of the EIAR. Further details on the qualifications of each lead author can be found in **Appendix 1.1** and in the Statement of Authority in each individual technical assessment chapter.

Table 1.4: EIAR Preparation Details

EIAR Chapter	Contributor & Qualifications
1: Introduction	Ms. Sarah Moore, BSc., MSc, Senior Environmental Consultant, Jennings O'Donovan & Partners Limited
2: Project Description	Ms. Sarah Moore, BSc., MSc, Senior Environmental Consultant, Jennings O'Donovan & Partners Limited
3: Alternatives Considered	Ms. Sarah Moore, BSc., MSc, Senior Environmental Consultant, Jennings O'Donovan & Partners Limited Ms Shirley Bradley, BSc., Environmental Consultant, Jennings O'Donovan & Partners Limited
4: Planning Policy	Ms. Breena Coyle, BA, MSc MRTPI HD Planning and Environmental Planning Law, Senior Planner, Jennings O'Donovan & Partners Limited Ms. Sarah Jones, BSc., Environmental Consultant, Jennings O'Donovan & Partners Limited
5: Population and Human Health	Ms. Sarah Moore, BSc., MSc, Senior Environmental Consultant, Jennings O'Donovan & Partners Limited Mr. Darren Timlin, BSc., Environmental Consultant, Jennings O'Donovan & Partners Limited

EIAR Chapter	Contributor & Qualifications
6: Biodiversity	Mr. Brian Madden, MSc., BSc., CIEEM, Director, Biosphere Environmental Services
7 Aquatic Ecology	Dr. Brendan O'Connor, Ph.D., B.Sc., MCIEEM, Managing Director, Aquafact Dr. Edward McCormack, Ph.D., BSc, Principal Ecologist, Aquafact Ms. Aisling Hearty, M.Sc., Senior Ecologist, Aquafact
8: Soils and Geology	Mr. Sven Klinkenbergh, BSc., P.G.Dip., Principal Environmental Consultant, RSK Dr. Jayne Stephens, BSc, PhD, Environmental Consultant, RSK
9: Hydrology and Hydrogeology	Mr. Sven Klinkenbergh, BSc., P.G.Dip., Principal Environmental Consultant, RSK Dr. Jayne Stephens, BSc, PhD, Environmental Consultant, RSK
10: Noise and Vibration	Mr. Brendan O Reilly and Mr. Shane Carr, MPhil., Director, Irwin Carr Consulting
11: Landscape and Visual Assessment	Mr. Richard Barker, MLA, PGD, BA, MILI, Director, Macro Works Limited Mr. Jamie Bell, Macro Works Limited
12: Air Quality and Climate	Mr. David Kiely, BSc., MSc., Director, Jennings O'Donovan & Partners Limited Ms. Sarah Moore, BSc., MSc, Senior Environmental Consultant, Jennings O'Donovan & Partners Limited
13. Shadow Flicker & EMI	Mr. David Kiely, BSc., MSc., Director, Jennings O'Donovan & Partners Limited Ms. Aileen Byrne, BA, H.Dip., Environmental Consultant, Jennings O'Donovan & Partners Limited
14: Archaeology and Cultural Heritage	Mr. Tony Cummins, BA., MA., Senior Archaeologist, John Cronin & Associates
15: Material Assets	Ms. Sarah Moore, BSc., MSc, Senior Environmental Consultant, Jennings O'Donovan & Partners Limited Mr. Darren Timlin, BSc., Environmental Consultant, Jennings O'Donovan & Partners Limited Mr. Kevin Hayes, B.Eng., M.Eng., Founding Director and Engineering Contracts Manager, Ai Bridges Limited Mr. Patrick Tinney, B.Eng. Electronics, B.Eng. Computer and IT Systems, Commucations Engineer, Ai Bridges Limited
16: Traffic & Transport	Mr. David Kiely, BSc., MSc., Director, Jennings O'Donovan & Partners Limited Mr. John Doogan, NC., NDip. CEng. (HND), Senior Roads Technician, Jennings O'Donovan & Partners Limited
17: Interactions of the Foregoing	Mr. David Kiely, BSc., MSc., Director, Jennings O'Donovan & Partners Limited Ms. Sarah Moore, BSc., MSc, Senior Environmental Consultant, Jennings O'Donovan & Partners Limited

1.10.2 Chapter Structure

Each technical assessment included in the EIAR has followed the same general format:

- Assessment Methodology and Significance Criteria: A description of the methods used in baseline surveys and in the assessment of the significance of effects
- Baseline Description: A description of the Site's existing baseline, based on the results of surveys and desk information and consultations
- Assessment of Potential Environmental Effects: A description of how the baseline environment could potentially be affected for the Project including a summary of the measures taken during the design of the Project to minimise effects
- Mitigation Measures and Residual Effects - A description of measures recommended that will be implemented to reduce and/or off-set potential negative effects and a summary of the assessed level of significance of the effects of the Development and/or the Project after mitigation measures have been implemented
- Cumulative Effects: A description identifying the potential for effects of the Project to combine with those from other existing, pending and/or permitted developments to affect resources
- Statement of Significance of effects.

The significance of effects resulting from the Development will be determined through consideration of a combination of the sensitivity of the receiving environment and the predicted level of change from the baseline state. Environmental sensitivity can be categorised by several aspects including factors such as; the transformation of natural landscapes, the protection afforded to, and presence of, European sites, rare or endangered species, land use and fisheries.

Sensitivity of classification of the receiving environment can vary between the different technical areas of assessment e.g., ecology, hydrology, population and human health and visual. In general, this EIAR largely follows the principles and terminology of the 2022, EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' in relation to the identification of significant effects. Where a technical assessment has adopted an alternative to this process, such as following technical guidance bespoke to that topic, such assessment criteria are made clear in that chapter. **Table 1.5** highlights the general framework for the assessment of significance of effects.

Table 1.5: Impact Classification Terminology (EPA Guidelines, 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 significantly alters most of 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 & 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

Impact Characteristic	Term	Description
	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 a day
	Temporary	Effects lasting less than a year
	Short-term	Effects lasting one to seven years
	Medium-term	Effects lasting seven to fifteen years
	Long-term	Effects lasting fifteen to sixty years
	Permanent	Effect lasting over sixty 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)
Type	Indirect	Impacts 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 significant 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	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

1.10.3 Significance Criteria

The significance of the potential effects of the Development have been classified by taking into account the sensitivity of receptors and the magnitude of the potential effects on them, combined with the likelihood of an impact occurring as defined in **Table 1.6**.

Table 1.6: Rating of Significant Environmental Impacts (EPA Guidelines, 2022)

Description of Impact Character/Magnitude/Duration/Probability/Consequences					
Magnitude of Significance /Sensitivity		Negligible	**Low**	**Medium**	**High**
	Extremely High	Not Significant	Profound/ Very Significant	Profound	Profound
	Very High	Not Significant	Moderate	Significant	Profound/ Very Significant
	High	Not Significant	Slight	Significant/ Moderate	Very Significant
	Medium	Not Significant/ Imperceptible	Slight	Moderate	Significant/ Moderate
	Low	Imperceptible	Slight/ Not Significant	Slight	Slight/ Moderate
	Negligible	Imperceptible	Imperceptible	Imperceptible	Imperceptible

1.10.3.1 Mitigation Measures and Residual Effects

There are three established strategies for impact mitigation - avoidance, reduction and remedy. The efficacy of each is directly dependent on the stage in the design process at which environmental considerations are taken into account, (i.e., impact avoidance can only be considered at the earliest stage, while remedy may be the only option available for projects where avoidance and reduction were not possible).

The EIA coordinator has engaged with stakeholders, which has provided the benefit of developing and refining mitigation through an iterative process rather than 'adding on' such measures at the end of the Project. Mitigation measures have been prioritised and embedded into the design phase of the Project to avoid, reduce and offset any significant adverse effects. These are referred to within this EIAR as 'embedded mitigation'.

Relevant mitigation measures are discussed within each technical chapter of this EIAR. **Chapter 17: Interactions of the Foregoing** provides a summary of mitigation measures for all technical assessments.

1.10.3.2 Cumulative Effects

The assessment has considered 'cumulative effects'; these are effects that result from increasing changes caused by past, present or those which are reasonably foreseeable together with the Development. Consideration has been given to the combined cumulative effects of several developments that may, on an individual basis, be insignificant, but which cumulatively may give rise to a significant effect.

1.10.3.3 Statement of Significance of Effects

The statement of significance outlines the conclusion of each technical assessment in order to provide a final overall conclusion as to the significance of the Development under the terms of the EIA Directive.

1.11 SCOPING AND CONSULTATION

The scoping and consultation process was carried out in accordance with the EIA Directive and in accordance with the Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA, 2022).

The 2014 EIA Directive Circular (PL 05/2018) notes that:

"It is a requirement of the EIA process to consult with statutory consultees and to take into account any submissions made by these consultees. Such submissions may contain expert specialist opinions on topics to be assessed in the EIA process…".

A scoping exercise was carried out in September 2022. **Table 1.7** documents individuals and organisations that have been consulted as part of the EIA process. The purpose of this consultation process was to provide a focus for the EIA by identifying the key issues of relevance. As such, the consultation process informs the various organisations of the Development, thereby providing an opportunity to submit comments and to offer information relevant to the preparation of this EIAR. Responses can be found in **Volume IV, Appendix 1.3: Scoping Opinion.**

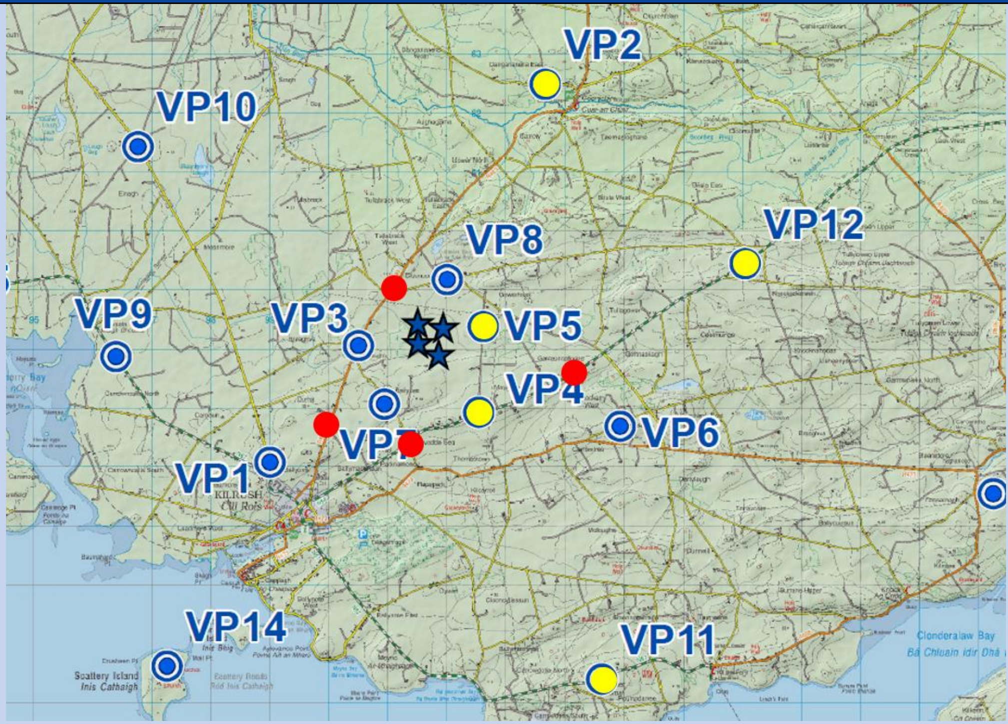
Table 1.7: Scoping Responses Received on The Project

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Kerry County Council	Email response received on 11/11/22. It is recommended that the following be taken into consideration as part of the visual and landscape impact assessment of the project and the selected viewpoint locations amended, if deemed appropriate: - • The visually sensitive landscape & views / prospects outlined in the Kerry CDP 2022-2028 (volume 4) • The Beale Strand and Carrigafoyle Castle Wild Atlantic Way Discovery Points.	N/A	Items raised have been addressed within Chapter: 4, 11

Clare County Council Planning	Pre-Planning Meeting 21/09/2022.
	
	The main points from the meeting on 21st September 2022 were as follows:
	• The key viewpoints CCC would like to see for further consideration/discussions are VP2, VP5, VP4, VP12 and VP11 (Ballykett VP Map).
	    ○ VP2 ad VP5 close to the site/
	    ○ VP4 and VP12 will be important as views on N68
	    ○ VP11 good to get view of wider context with both wind farms and Tullabrack Wind Farm
	    ○ Macro Works to develop draft photomontages for these.
	• Will be important to consider views from proposed West Clare Greenway to be developed in the future
	• Hydrology needs to be assessed.
	• Main issue for CCC is the principle of turbines in the area i.e. zoning of the area in the CDP as 'Open to Consideration' which is third priority.
	• Proximity to Moneypoint is a positive as is Ireland's only grid 'Motorway' and Tullabrack substation needs upgrades to accept the wind farms.
	
	In addition to the VP's indicated in your email (below in yellow) I would suggest that the 4 areas in red also be considered. With regard to the route of the greenway please contact Grainne Reddan greddan@clarecoco.ie (Senior Executive Engineer in Project Management Office) on same.
	
	Email response received 20/12/22.
	
	The Planning Authority advises that the following information is considered in the preparation of the EIAR.
		All items considered during the design process.	Items raised have been addressed within Chapters: 6, 7, 8, 9, 10 11, 12, 13, 14, 15, 16,

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Water Quality The aquifer vulnerability within the site ranges from Moderate to Extreme. The proposal site accommodates a number of watercourses (and associated designated flood risk areas) which flow in a generally westerly direction towards Moyasta and the Shannon Estuary. As such the EIAR should take into consideration the potential for impacts on water quality both within the site and its wider environs. All stages of the development should be considered in compiling information regarding the interactions of the development with surface water and groundwater. Impacts on downstream receptors shall be identified. **Noise & Vibration** Acoustics and vibration should be considered in relation to noise and vibration arising from the proposed development. Noise should be assessed in the context of site preparation, ongoing operation and any restoration required. Baseline readings at all noise-sensitive locations (e.g., houses, schools etc.) should be obtained. The noise reports should also provide an assessment of the potential impacts on sensitive receptors arising from the activities associated with the proposed borrow pit(s). **Habitat Protection** The EIAR must fully assess the impact of the proposal on habitats (i.e., raised bog and conifer plantation) within and surrounding/connected to the site. **Adjacent Land Uses & Sensitive Receptors** With respect to the proximity to sensitive receptors (e.g., from shadow flicker, noise etc) the EIAR should take into account permitted dwellings and other sensitive developments that may not as yet be constructed. **Visual Amenities** The visual impact of the windfarm must be assessed, with particular emphasis on views towards the site from the N68 national road to the south, the N67 national road and the R483 regional road to the west, the local roads to the south west, east and north of the site, settlements in the area, historical or tourist related features in the area, and from potential views from designated scenic routes (as per the Clare County Development Plan 2017-2023 (as varied). Finally, intervisibility between the proposed wind farm and existing wind farm developments from these views should also be assessed. Photomontages that are to be provided with the application should be in the context of clear skies. The viewpoint locations as appended to the EIA Scoping documents are considered to provide adequate representation of the views available towards the site. However, please be advised that subject to the carrying out of the site inspection at planning application stage additional viewpoint locations may be requested by the Planning Authority.		

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Cumulative Impacts The cumulative impact of the proposed development and the current wind farms in the wider area must be assessed in all assessment chapters contained within the EIAR. **Grid Connection** Details on the location and design of the proposed grid connection(s) to be included and adequately assessed within the EIAR. **Ground Conditions** A peat stability assessment and landslide susceptibility modelling are recommended on any areas within the site which may have significant level changes. The model should show areas at risk of landslide based on peat depth, slope, altitude, aspect and curvature. **Major Accidents** The EIAR must include the expected effects from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project. **Traffic and Transportation** Traffic management information relating to the proposed number, composition, routes etc for traffic associated with the construction, operational and decommissioning phase of the development is required. **Cultural Heritage** Full assessment of the potential for direct and indirect impacts on the cultural heritage assets of the area to be adequately assessed within the EIAR. Road **Conclusion** The information set out within this response is provided in good faith and a full assessment of all of the issues would be carried out by the Planning Authority of Clare County Council at planning application stage. You are advised that the Planning Authority is available to provide further feedback on the EIAR scoping process on request.		
Clare County Council Roads	Email received 28/09/2022. '*Apologies for the delayed response, I was on annual leave until today. Looking at the scope I do not have any particular comments to make. It may be worth looking at the Road Design response for planning reference P20-658 as a typical response for a windfarm. Regards, Eoghan Kelly*'. A follow up email received 28/10/2022 following the pre-planning meeting confirming the Viewpoints to be considered.	N/A	Item raised has been addressed in Chapter 16

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
			
Clare County Council Environ	Email received 13/09/2022.'*This goes to our Planning Section planoff@clarecoco.ie. Regard, Adrian Rahill Clerical Officer*	N/A	N/A
Minister for Housing, Planning, Local Government and Heritage **DAU**	Email received: 12/09/2022: **Our Ref: G Pre 00240/2022** (Please quote in all related correspondence) *A Chara, I acknowledge receipt of your recent consultation.* *Please note Development Applications Unit (DAU) is the coordinating unit for the Department of Housing, Local Government and Heritage, coordinating responses/submission from National Parks and Wildlife Service, National Monuments Service, Architectural Heritage and Underwater Archaeology Unit.* *All Correspondence to be issued to and from DAU. In the event of observations, you will receive a co-ordinated heritage-related response by email from Development Applications Unit (DAU). The normal target turnaround for pre-planning and other general consultations is six weeks from date of receipt. In relation to general consultations from public bodies under the European*	N/A	N/A

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 to 2011, the Department endeavours to meet deadline dates, where requested. *Email received 27/10/2023 with letter attachment. Some of the main observations/recommendations are as follows:*		
	Nature Conservation *The Department is concerned that it appears from the supplied details and the EIA Scoping report that it is not intended to assess the proposed grid connection in the EIA. As the grid connection is required for the wind farm project both the turbine and grid connection proposals need to be assessed together in terms of both EIA/EIS and NIS/AA process to avoid project splitting the grid connection effects aspects of the project from the wind farm effects aspects of the project within the assessment process.*	All items considered during the design process.	Item raised addressed in Chapters 1 and 2.
	Guidance on EIAR *You are advised to consult the European Commission's (2017) Environmental Impact Assessment: Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)'. Any surveys and assessments should be based on a full details of the overall project, noting all lands that will be required. For a detailed list of potential considerations, see the 'Review checklist', and specifically 'Section 1 – Description of the project', in this guidance. Note also that if compensatory afforestation is required on other lands, which appears may be the case here, the likely significant effects of that integral element of the development should be assessed in the main project EIAR.* *In addition to guidance listed in Appendix 1, the following should be taken into account in planning and designing a windfarm and in completing the assessments. Please note the 2020 updates of the Guidance documents:* • *Guidance document on wind energy developments and EU nature legislation (European Commission, 2020)* • *Draft Revised Wind Energy Development Guidelines (DoHLGH, 2020), particularly the requirements in relation to assessing ground conditions/geology (section 5.3* • *Landslides in Ireland (GSI, 2006).* *In considering a windfarm in this area, the Clare Wind Energy Strategy and its associated appropriate assessment and SEA Environmental Report should be checked for any mitigation that applies in this type of situation, given the proximity and potential for negative effects of this proposal on protected sites of national and international importance for nature conservation.*		Item raised addressed in Chapters 1 and 4.
	Project planning and design *It should be remembered that a key element of EIA is the avoidance or reduction of negative effects on the environment. EIA is an iterative process and the information gathered through assessments or surveys should be used to guide the planning and design of the windfarm so that sensitive ecological or hydrological areas are avoided, and negative impacts are minimised insofar as is possible. The size, layout and design of proposed development should be informed by a constraints-type study and the compilation of an environmental constraints map that*		Item raised addressed in Chapters 1,3, 4 and 6.

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	identifies and avoids, insofar as is possible and using appropriate separation distances, all nature conservation sites, other sensitive ecological and hydrological features, deep or intact peat deposits, and areas of wet and/or active bog, pool systems and flushes. *The National Biodiversity Action Plan 2017- 2021 aims to conserve and restore Ireland's biodiversity. A key objectives of the plan is to achieve; no net contribution to biodiversity loss arising from development projects occurring within the lifetime of the plan. Accordingly, the EIAR should outline how this project would avoid a net loss of biodiversity and include relevant mitigation and or compensatory measures where necessary.*		
	Project Components *In general, the EIAR should include sufficient project details so that the full nature and extent of the likely significant effects are clear and assessed fully in relation to, among other things, road design and construction methodology; site drainage details, including settlement ponds; temporary and permanent storage or disposal areas for peat and other materials or wastes arising; extraction sites/borrow pits; and any modifications to roads, bridges or culverts along the entire length of haul routes. Volumes of surplus material arising and of fill required should be calculated. Full assessment should also take place within the EIAR and NIS of the grid connection.* *There are concerns regarding the potential loss and/or degradation of raised bog, cutover bog or other peatland habitats arising from the overall wind farm proposal (both regarding the wind farm site itself and the grid connection works), such habitats could also include potential Annex I habitat under the EU Habitats Directive for which the Department has reporting obligations under Article 17 of the Directive to the European Commission on details of losses and degradation.* *Detailed consideration should be given to the potential amount of peat / soil excavated stored, and disposed/recovered. A detailed plan for the safe storage, disposal an rehabilitation of excavated or disturbed peat /soil would have to form part of the EIAR.* *A detailed site drainage map would be required and should show all existing watercourses, drainage ditches, flushes, lakes or ponds; new drainage ditches; all outfall points to watercourses or lakes; and all settlement ponds.* *The associated impacts of quarrying or extraction should be included among the considerations at the earliest stages of project planning and design, and should be assessed fully in the EIAR. Reinstatement or restoration plans would be required for any quarries or borrow pits on-site and should be included in the EIAR. Any tree felling of forested sites should be included as an intrinsic element of the overall development, the impacts and implications of which should be assessed fully in the EIAR.* *The extent of tree felling should be mapped, and the future use and management of all cleared areas should be specified. The impacts of tree felling on wildlife, habitats and surface waters*		Item raised addressed in all EIAR Chapter 6, 7,8 and 9, the CEMP and NIS

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	(e.g. water quality) should be assessed fully, including the risk of Phosphate mobilisation from peat soils as a result of tree clearance and ground disturbance. *Any losses of biodiversity habitat associated with this proposed development (including access roads and cabling etc.) such as woodland, scrub, hedgerows and other habitats should be mitigated for. In addition, Annex 1 habitats which occur outside the Natura 2000 network are important in terms of biodiversity conservation. The presence of any Annex I habitats outside the network should be given due consideration as part of the consideration of biodiversity matters generally for the proposed development. The loss of Annex 1 habitats outside SACs should be avoided. It should be noted in this regard that the site contains potential annexed habitat such as the peatland types listed above.*		
	Ecological Data and Surveys (Ornithology) *Surveys for all species should cover bird usage and facilitate assessment of potential collision risk, habitat loss, barrier effect and displacement for these species and should be based around the daily and seasonal activity patterns of the species being surveyed. In section 7.1 of the Report collision is specified but barrier and displacement effects impacts are also a concern for bird species, this is expanded on in the Harrier section below but it should be noted that the issues raised there also apply to other relevant species (Golden Plover, Snipe etc). Survey work should cover year-round site use and should cover a minimum of two years to allow for an accurate determination of site usage. Specific Target species for this site include Annex I (Birds Directive) species such as Hen Harrier, Merlin, Golden Plover and Peregrine Falcon, and red listed Birds of Conservation Concern (BoCCI) such as kestrel, snipe, woodcock, meadow pipit and red grouse. A population of the amber listed species Skylark occur on site as well as potentially suitable habitat for Dipper (as well as identified amber species such as Cormorant and Herring Gull). Hinterland surveys should include breeding raptor surveys, including roost watches, surveys for nocturnal species (for example woodcock, red listed and known from the literature to be impacted on by wind farms) and other species-specific surveys as appropriate. Potential significant effects on the aforementioned target species requiring assessment include collision effects, displacement effects, barrier effects, direct and indirect habitat loss and degradation, in combination effects, cumulative impact effects etc. In combination effects and cumulative impacts assessments must include those arising from the other wind farms in the population areas (as well as from the adjacent windfarms), with data required in terms of best scientific evidence of, for example, the area of displacement/foraging loss through these developments (or others). It should be noted that this point is also applicable in terms of seminatural habitat loss.* *Vantage point surveys should be done in a manner that ensures sufficient data is collected to allow an assessment of the importance of all the flight paths into, out of and between sites and assess migratory movements. Consequently, the Department recommends that a visibility analysis of topography and vegetation is used in the selection of vantage points for*		Items raised addressed in Chapter 6.

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	ornithological surveys. Technological solutions should also be considered in conjunction with VPs surveys to ensure sufficient data is compiled for assessment. *Results for species need to be referenced back to the overall populations and their dynamics as, in some cases even a small risk to a population of a species could be considered significant. When completing impact assessment for birds, assessment and monitoring results from nearby windfarms must be considered. Cumulative impact on birds from all windfarms in the area needs to be assessed and the data from surrounding sites needs to be considered in the assessment.*		
	Ecological Data and Surveys (Hen Harrier) *In addition to potential reduction of habitat suitability by the construction and/or operation of a wind energy development habitat connectivity, fragmentation, barrier effects, collision risk and foraging efficiency would be important considerations also. Foraging behaviour of breeding pairs may be influenced by habitat changes at distances conceivably up to 5-10km from extant turbines. In terms of displacement effects from upland wind farms in Hen Harriers Pearce-Higgins et al. (2009b) provide evidence of significant Hen Harrier avoidance of apparently suitable habitat within 250m of turbines, with a predicted 53% reduction of Hen Harrier flight activity within 500m of turbines, assuming that modelled habitat usage is proportional to breeding density (see Pearce et al 2009). The vast majority of the proposed development site is comprised of potentially suitable Hen Harrier foraging habitat (including as stated bog habitat which is of particularly high value for the species) and the displacement effects of the wind farm will result in the loss of the majority of the large potential foraging resource for Hen Harrier.* *In combination effects and cumulative impacts assessments for the other wind farms in the population area would be required, with data required in terms of best scientific evidence of the area of displacement/foraging loss through these developments (or others) in terms of overall habitat availability for the population.* *As well as the breeding season data and assessment winter data is required also.* *The Department highlights and emphasises that specific calculations of area of available foraging habitat in the overall area is required. A quantitative measurement of the availability of this habitat in the wider surroundings is required when considering cumulative loss of this habitat as a consequence of other developments. It should also be noted that as individual EIAR's for other nearby windfarm projects based their conclusions on the basis of similar habitats being available in the wider area these conclusions would no longer be valid/up to date (regardless of whether they were correct at the time) due to the subsequent loss of such 'similar habitats' due to subsequent windfarm developments etc.* *It should be noted that some of the forested area within the project area contains potentially suitable nesting habitat for hen harriers.*		Items raised addressed in Chapter 6.
	Ecological Data and Surveys (Bats) *Bat roosts may be present in trees, buildings and bridges. Bat species are protected under the Wildlife Act, 1976 to 2018, and are subject to a regime of strict protection pursuant to the*		Items raised addressed in Chapter 6 and Appendix 6.2.

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	requirements of the Habitats Directive (92/43/EEC) as transposed in Irish law in Regulation 51 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended). Therefore, damage/disturbance to any such roosts must be avoided in the first instance. While the Minister may grant a derogation licence under Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011-2015, a licence can only be granted once a number of strict criteria have been met (see Regulation 54). An assessment of the impact of the proposed wind farm on bat species should be carried out noting recent guidance available, "Bat and Onshore Wind Turbines: Survey, Assessment and Mitigation, 2019" published jointly by Scottish Natural Heritage and Bat Conservation Trust and other stakeholders. Any proposed bat friendly lighting should be proven to be effective and follow up-to-date guidance. *Windfarms can have significant effects on bats with regard to 1) Collision mortality, barotrauma and other injuries (Operational Phase Impact), 2) Loss or damage to commuting and foraging habitat, 3) lighting issues and all of these potential issues should be addressed in the EIAR.*		
	Ecological Data and Surveys (Watercourses & Wetlands) *Wetlands are important areas for biodiversity and ground and surface water quality should be protected during construction and operation of the proposed development. The EIAR should include a detailed assessment of the hydrological impacts on wetlands from the proposed development. Any watercourse or wetland which may be impacted on should be surveyed for the presence of protected species and species listed on Annexes II and IV of the Habitats Directive. For example, these species could include Otter (Lutra lutra) which are protected under the Wildlife Acts and listed on Annex II and IV of the Habitats Directive, Salmon (Salmo salar), Lamprey (three species in Ireland) listed on Annex II of the Habitats Directive, Freshwater Pearl Mussel (Margaritifera species) and White-clawed Crayfish (Austropotamobius pallipes) which are both protected under the Wildlife Act and listed on Annex II of the Habitats Directive, Frogs (Rana temporaria) and Newts (Trituris vulgaris) protected under the Wildlife Acts and Kingfishers (Alcedo atthis) protected under the Wildlife Acts and listed on Annex I of the Birds Directive (Council Directive 79/409 EEC).* *Further to potential impacts on the species listed above, for example, one of the main threats identified in the threat response plan for otter is habitat destruction (see https://www.npws.ie/sites/default/files/publications/pdf/2009_Otter_TRP.pdf). A 10m riparian buffer on both banks of a waterway is considered to comprise part of the otter habitat. Therefore any proposed development should be located at least 10m away from a waterway and should consider movements between waterways and waterbodies by otters. This is relevant regarding this proposal even more so Otter has been recorded at a watercourse on site already.*		Items raised addressed in Chapters 6, 7, Appendix 6.6 and 7.1.
	Hedgerows, Scrub, grasslands and related habitats *Hedgerows and scrub should be maintained where possible, as they form wildlife corridors and provide areas for birds to nest in. Hedgerows provide a habitat for woodland flora, roosting places for bats and Badger setts may also be present. The EIAR should provide an estimate of the length/area of any hedgerow/scrub that will be removed. This may be particularly relevant for the grid connection aspect of the proposed windfarm project. Where it is proposed that trees*		Items raised addressed in Chapter 6 and Appendix 6.6.

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	or hedgerows will be removed there should be suitable planting of native species in mitigation incorporated into the EIAR. Hedgerows, trees, scrub and uncultivated vegetation (including semi-natural habitats) should not be removed during the nesting season (i.e. March 1st to August 31st), noting the protection afforded under the Wildlife Act 1976-2018. *It should be noted that a large area of good quality semi-natural grassland (lowland wet grassland, meadows etc) occurs within the supplied project area and this will be relevant in terms of potential semi-natural habitat loss and consequently net biodiversity loss issues.*		
	Alien invasive species *The EIAR should also address the issue of invasive alien plant and animal species such as Rhododendron ponticuum and Japanese Knotweed, and detail the methods required to ensure they are not accidentally introduced or spread during survey and or construction. Information on alien Invasive species In Ireland can be found at http://invasives.biodiversityireland.ie/ and at http://invasivespeciesireland.com/*		Items raised addressed in Chapter 6 and 7.
	Cumulative and ex situ impacts *Cumulative impact from all windfarms in the area needs to be fully and comprehensively assessed and the data from surrounding sites needs to be considered in the assessment of impacts. Post construction monitoring results and data from nearby windfarms should be considered and their associated EIARs.*		Items raised addressed in Chapter 6 and 7.
	Post construction monitoring *This Department recognises the importance of pre and post construction monitoring, such as recommended in Drewitt et al. (2006), and Bat Conservation Ireland (2012). The applicant should not use any proposed post construction monitoring as mitigation to supplement inadequate information in the assessment. Please refer to Circular Letter PD 2/07 and NPWS 1/07 on this issue. This can be downloaded from the Department's website https://www.npws.ie/development-consultations .* *The EIAR process should identify any pre and post construction monitoring which would have to be carried out. The post construction monitoring would include bird and bat strikes/fatalities including the impact on any such results of the removal of carcasses by scavengers.* *Monitoring results should be made available to the competent authority and copied to this Department. An appropriate plan of action would have to be agreed at planning stage with the Planning Authority if the results in future show a significant mortality of birds and/or bat species.* *It is important to note that unless post decision consultation with NPWS is specifically stated as a condition of planning, NPWS has no post consent role. However, regional staff are available for liaison regarding any associated licensing requirements and or new information arising for specific species of concern.*		Items raised addressed in Chapter 6 and Appendix 2.1, 6.6 and 17.1.
Minister for Housing, Planning, Local Government and Heritage	Email received on 13/09/2022 from Nicole Coughlan stating "*The issue you raise comes under the remit of the Minister of State Peter Burke. I have, therefore, forwarded your correspondence to his Office for attention and direct reply*." No response from the Minister of State Peter Burke to date (12/04/2023) No response received as of 31/01/2024.		

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Heritage Council	No response received as of 31/01/2024.		
Aviation			
Shannon Airport	No response received as of 31/01/2024.	N/A	Issues raised under **Aviation** addressed in Chapter 15
IAA	Email Received 21/09/2022 *Thank you for your letter/scoping report and request for comments in relation to the proposed Ballykett Wind Farm, to be located at Ballykett, Co. Clare. The development appears to be approximately 35km West of Shannon Airport, as such, it is recommended that the developer engage directly with Shannon Airport and Irish Aviation Authority's Air Navigation Service Provider to make them aware of the proposal and ensure appropriate screening from an aviation safety perspective. It is likely that the following general observations would be proffered by the Authority during a formal planning process: In the event of planning consent being granted, the applicant should be conditioned to contact the Irish Aviation Authority to: (1) agree an aeronautical obstacle warning light scheme for the wind farm development, (2) provide as-constructed coordinates in WGS84 format together with ground and blade tip height elevations at each wind turbine location and (3) notify the Authority of intention to commence crane operations with at least 30 days prior notification of their erection.* Email Received 16/11/2022 *According to S.I. 215 of 2005, Irish Aviation Authority (Obstacles to Aircraft in Flight), the IAA ANSD requires any person who seeks to erect a manmade object to notify the aerodrome operator of the intended operation **at least thirty days** in advance if the structure is to be erected in the vicinity of the aerodrome or the areas around the aerodrome and other protected surfaces associated with the aerodrome. Aerodrome Operators can be contacted via IAA AIP AD 1.3 INDEX TO AERODROMES AND HELIPORTS, to evaluate the impact of the intended operation on the protected airspace established for the aerodrome.* *Additionally, any person who seeks to erect a manmade object in excess of 45 metres anywhere within the state above ground or water surface level must also notify the IAA ANSD of the intended crane erection **at least thirty days** in advance, as a crane operating at or above this height may constitute an obstacle to air navigation. The IAA ANSD can be contacted via airspace@iaa.ie.* *The State requires electronic terrain and obstacle data (eTOD) in accordance with International Civil Aviation Organisation (ICAO) Annex 15 requirements which shall be surveyed by Ordnance Survey Ireland (OSi). The cost of this OSi surveyed data is to be borne by the developer. Additionally, the following data is to be supplied once construction is planned or commenced or available to the airspace team via airspace@iaa.ie:* • *The WGS84 coordinates (In degrees, minutes and seconds) for each turbine?*		Issues raised under **Aviation** addressed in Chapter 15

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	• *Height above ground level (to blade tip) and elevation above mean sea level (to blade tip)?* • *Verification if it's a standalone wind farm or is merged with others. Does the wind farm have any alternative names?* • *Horizontal extent (rotor diameter) of turbines and blade length where applicable?* • *Lighting of the wind farm, which turbine(s) is/are lit, and what type of lighting?*		

ICAO Light Type	***Colour***
Low-intensity Type A (fixed obstacle)	*Red*
Low-intensity Type B (fixed obstacle)	*Red*
Low-intensity Type C (mobile obstacle)	*Yellow/Blue*
Low-intensity Type D (follow-me vehicle)	*Yellow*
Low-intensity Type E	*Red*
Medium-intensity Type A	*White*
Medium-intensity Type B	*Red*
Medium-intensity Type C	*Red*
High-intensity Type A	*White*
High-intensity Type B	*White*

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Ecology			
An Taisce	No response received as of 31/01//2024.	N/A	N/A
Bat Conservation Ireland	No response received as of 31/01//2024.	N/A	N/A
Birdwatch Ireland	Email received on 09/11/2022: *I have forwarded your mail to our policy officer Oonagh Duggan.* *Oonagh will get back to you regarding your query in the next few days.* No further correspondence received.	N/A	N/A
Irish Wildlife Trust	No response received as of 31/01//2024.	N/A	N/A
Soils and Water			
Geological Survey of Ireland	Email received on 02/11/2022: **Geoheritage**	N/A	Items raised are discussed in Chapter 8

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	A national inventory of geoheritage sites known as County Geological Sites (CGSs) is managed by the Geoheritage Programme of Geological Survey Ireland. The audit for Co. Clare was completed in 2005. The full report details can be found here. **Our records show that there are no CGSs in the vicinity of the proposed wind farm development.** **Groundwater** Proposed developments need to consider any potential impact on specific groundwater abstractions and on groundwater resources in general. **The Groundwater Data Viewer indicates an aquifer classed as a 'Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones' underlies the proposed wind farm development. The Groundwater Vulnerability map indicates the range of groundwater vulnerabilities within the area covered is variable. We would therefore recommend use of the Groundwater Viewer to identify areas of High to Extreme Vulnerability and 'Rock at or near surface' in your assessments, as any groundwater-surface water interactions that might occur would be greatest in these areas.** **Geological Mapping** Geological Survey Ireland maintains online datasets of bedrock and subsoils geological mapping that are reliable and accessible. We would encourage you to use these data which can be found here, in your future assessments. **Please note we have recently launched QGIS compatible bedrock (100K) and Quaternary geology map data, with instructional manuals and videos. This makes our data more accessible to general public and external stakeholders. QGIS compatible data can be found in our downloadable bedrock 100k .zip file on the Data & Maps section of our website.** **Geohazards** Geohazards can cause widespread damage to landscapes, wildlife, human property and human life. In Ireland, landslides, flooding and coastal erosion are the most prevalent of these hazards. We recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and we encourage the use of our data when doing so. **Natural Resources (Minerals/Aggregates)** Geological Survey Ireland provides data, maps, interpretations and advice on matters related to minerals, their use and their development in our Minerals section of the website. The Active Quarries, Mineral Localities and the Aggregate Potential maps are available on our Map Viewer. **Guidelines** The following guidelines may also be of assistance:		

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	• Institute of Geologists of Ireland, 2013. Guidelines for the Preparation of the Soils, Geology and Hydrogeology Chapters of Geology in Environmental Impact Statements. • EPA, 2022. Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)		
Inland Fisheries Ireland	Email Received 11/10/2022 *Thank you for your letter dated 12th September regarding a request for consultation on the proposed Ballykett wind farm. IFI have no objection in principle to the proposal as indicated but reserve the right to make further submissions as detail emerges.* • *We are concerned about soils, their structure and types around all the turbines, turbine pads, associated access roads and site development. In particular we have general concerns about the stability of the soils and the impact that works on both the turbines and access roads may have either directly or by vibration on the stability of the soils. IFI are particularly concerned where it is proposed to construct wind turbines on peat soils of which there appears to be some in this general area.* • *Particular attention should be paid to the hydrology of any site where excavations, including excavations for borrow pits and road construction are being undertaken. It is important that natural flow paths are not interrupted or diverted in such a manner as to give rise to erosion or instability of soils caused by an alteration in water movement either above or below ground.* • *Attention should be paid to drainage during both the construction phase and the operational phase. This includes waters being pumped from foundations or other excavations. It is particularly important during the construction phase that sufficient retention time is available in any settlement pond to ensure no deleterious matter is discharged to waters. We strongly recommend that settlement ponds are maintained, where appropriate, during the operational phase to allow for the adequate settlement of suspended solids and sediments and prevent any deleterious matter from discharging. In constructing and designing silt traps particular attention should be paid to rainfall levels and intensity. The silt traps should be designed to minimise the movement of silt during intense precipitation events where the trap may become hydraulically overloaded. It is essential that they are located with good access to facilitate monitoring sampling and maintenance.* • *In relation to watercourse crossings for the road or grid connection please be advised that IFI will require to be consulted well in advance in relation to all watercourse crossings or the use of any temporary diversions. We strongly recommend that these crossings should be kept to a minimum. We will also require that any instream structures or bridge crossings are approved by the IFI. In designing crossings, the length, slope and width of any instream structure will be important. Clear span bridges are the preferred option for all crossings especially in upland areas.*	N/A	Items raised Under **Soils and Water** are addressed in **Chapter 8** and **Appendix 2.1: CEMP**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	• *Please also note that any instream works or other works which may impact directly on a watercourse should only be carried out during the open season which is from 1st July to 30th of September in each year (so as to avoid impacting on the aquatic habitat during the spawning season.) It would be important that appropriate scheduling of works is allowed for.* *The EIAR should indicate proposals to monitor the impact on watercourses within the site. In the event that environmental damage to the aquatic habitat and associated riparian zone is caused, the EIAR should indicate the steps that may be taken to rectify any damage to the aquatic habitat including liaison with the appropriate authorities. In relation to wind farm structures and infrastructure it is important that a sufficient bank side riparian zone is maintained to absorb and attenuate overland flows.*		
Irish Peatland Conservation Council	Email Received 10/01/23. Thank you for consulting with the Irish Peatland Conservation Council regarding the proposed development. The Irish Peatland Conservation Council (IPCC) was established in 1982 and has 40 years of experience in peatland conservation. Our aim is to conserve a representative sample of intact peatlands for present and future generations to enjoy and benefit from the ecosystem services they provide. Only 25% of Ireland's original range of peatland is deemed worthy of conservation[1], 75% have become degraded from multiple pressures such as peat extraction, agriculture, forestry, habitat fragmentation and developments[Specifically, County Clare has lost 89% of its original peatland habitat[2] and this has had a major effect on biodiversity, climate regulation and the ecological functioning of the County's indigenous habitats and species. This makes it imperative that all must be done to reverse the climate and biodiversity emergency which was declared by Government in 2019. Our work is guided by our 6th Action Plan "Ireland's Peatland Conservation Action Plan 2020" and a recent amendment "Peatlands & Climate Change Action Plan 2030", which focuses on the role of peatlands in tackling predicted climate change. These documents are available for download on our website at www.ipcc.ie. Many of the actions in our plan have been included within the National Peatlands Strategy which has been adopted by every Government Department and Local Authority. The "National Peatlands Strategy" can be downloaded from www.npws.ie. IPCC is not inherently opposed to the construction of wind farms as we understand that Ireland has legal obligations to reach net-zero emissions by 2050 and a 51% reduction by the end of this decade in line with the Climate Action and Low Carbon Development (amendment) Act 2021, but, there is a responsibility on wind farm developers to ensure that there is no loss of important peatland habitat and the species that utilise it. Also,	All items considered during the design process.	Items raised under **Biodiversity** addressed in **Chapter 6, Chapter 7, Appendix 6.6** and **NIS** Items raised under **Soils and Geology** addressed **in Chapter 8** Items raised under **Hydrology** addressed in **Chapter 9** Items raised under **Air and Climate** addressed in **Chapter 12** Items raised under **National Monuments** addressed in **Chapter 14**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	bad construction practices can result in an active carbon sink being converted to a carbon source which is detrimental to any effort in combating anthropogenically caused global climate change and biodiversity loss. **Legal Obligations to Protect Peatlands** We are legally bound by National and European legislation (The Irish Wildlife Acts, Habitats and Bird's Directives) and international conventions (Ramsar, Bern Convention, Convention on Biological Diversity) to do our utmost to protect peatlands now and for future generations. Peatland habitats have been severely diminished in the country and this destruction is an issue in other legislation and conventions such as the UN Convention on Climate Change, Bonn Convention, World Heritage Convention, Water Framework Directive, Environment Liability Directive, Planning and Development Acts, National Monuments Acts, Environmental Directive, EIA and SEA. All of these legislative instruments have been adopted by Ireland and the IPCC ask that you assess your development with regard to these legal obligations. **Bogland** The IPCC would advise any developer planning construction in, or within close proximity to peatland habitat to be familiar with the Environmental Protection Agency funded project BOGLAND (www.ucd.ie/bogland). This project recommends the best practice guidelines to ensure no damaging development occurs on, or affects peat soils and peatlands of conservation value. **Nitrogen** It has been highlighted to the Irish Peatland Conservation Council that nitrogen is becoming an issue for designated sites, halting many construction projects in the Netherlands and in 2018 in the UK 39 of 57 Special Areas of Conservation listed on the APIS website (http://www.apis.ac.uk) exceeded the Critical Load Threshold for nitrogen (some by over 300%). This is having negative impacts on the vegetation of the designated habitats and is working against the conservation objectives of the sites. There are various sources of excess nitrogen such as construction (e.g. roads, traffic, developments), urban waste water (pollution) and agriculture (e.g. fertilizer/piggeries) and can enter a habitat via wet or dry deposition. The Irish Peatland Conservation Council ask that you assess the development in terms of its impact in regards to nitrogen and its affects on designated sites. We also ask that there is a long term monitoring agenda implemented to ascertain the long term emission rates/vectors and mitigation measures. The impacts also need to be taken into account cumulatively along with other developments and projects as they may interact synergistically. This would help inform future projects. **Designated Sites:** The Ballykett WF Scoping Report fails to list any Natural Heritage Areas or proposed Natural Heritage Areas as possible receivers of impacts from the proposed development. These sites		

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	need to be included in studies to ascertain possible negative impacts from the proposed development. NHAs are designated because of a national conservation interest is present and they also bolster the European network of designated sites. While pNHAs are not officially designated, they have been earmarked because they contain habitats or species that are also of conservation interest and IPCC could not support a project that has not included these sites for impact assessments. Sites needing investigation should also include, Snt Senan's Lough, Clonderalaw Bay, Poulnasherry Bay, Derrygeeha Lough, Cloonsnaghta Lough, and Gortaglass Lough. Please also be cogniscient that some of the NHA/pNHA NPWS site boundaries do not match with the overlapping SAC/SPA boundary if the site has overlapping designations. These sites also need to be included in assessing impacts from the haulage of construction materials and machinery. **Bird Nesting** Please ensure that all precautions are taken in regards to protecting ground nesting birds during the breeding season. It is also illegal to remove vegetation during the period from 1st March to 31st August in order to maintain biodiversity (Section 40 of the Wildlife Act 1976). Training should be given to construction workers to ensure that the laws regarding the cutting, grubbing, burning or destruction by other means to hedgerows/vegetation are adhered to. **Tullagher Lough and Bog SAC (Sitecode=2343):-** This site is an important overwintering ground for Greenland White-Fronted Geese and also known to be utilised by Whooper Swans. The impacts on these species from the proposed development needs to be ascertained. The impacts also need to be quantified cumulatively with other developments in the area, including the 17 windfarms listed as within 20km. Designated sites are being surrounded by developments and this is affecting their efficacy to provide meaningful conservation. While the ombrotrophic portions of peatland are fed by rainwater exclusively, transition mire, soak systems and lagg zones can be influenced by other external water influences where they meet other substrates at the margins. Please ensure that the water quality entering the SAC (and all other designated sites respectively) will not be reduced and impact on the sensitive habitats contained within the designated site. The Conservation Objectives for this site, published on www.npws.ie, describe nitrogen levels for Tullagher Lough & Bog SAC as exceeding its critical load of 5kg/ha/year and is near double this at 9.5kg/ha/year. This is affecting the species composition over time and needs to be reversed. Please assess the nitrogen impacts from the proposed development including the construction phase, operational phase and the decommissioning on all designated sites accumulatively with all other developments and practices in the area (such as agriculture which is the main source of nitrogen, road construction and traffic also need to be included).		

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	Carbon Accounting The carbon inputs and outputs need to be investigated for the proposed development. As it is predominantly on peat soils, highlighted as greater than 3m in most areas, and the bog surface has been mostly lost through afforestation and turbuary, this site is most certainly currently a carbon source - impacting on the aquatic habitats surrounding the site through peat sedimentation, eutrophication and ammonia emissions and is also releasing carbon to the atmosphere. How does this project propose to remedy this? What impact from drainage will occur due to the hydrological management of the windfarm infrastructure? How much peat will be removed for the development and will there be any restoration of the habitats contained within the development area? De-forestation and rewetting of the peat soils should be investigated as currently the monoculture tree cover is transpiring water away, increasing the drying out of the peat soils and this has destroyed the biodiversity quality of the site. As turbuary is also an issue and is visible on mapping resources, how does the project aim to manage this? Has turbuary finished on the site and is there an opportunity for rehabilitation/ restoration? **BOCCI** Bird surveys for species listed within the Birds of Conservation Concern in Ireland (Bird Red List) need to be conducted at the appropriate time of the year to ascertain possible disruption to behaviour or damage to breeding sites from construction works and operation of the proposed development. The IPCC ask that all species Red Listed within the National Parks & Wildlife Service Irish Wildlife Manual Series (https://www.npws.ie/publications/red-lists) be investigated within the National Biodiversity Data Centre species records to find out if they have been recorded within an appropriate distance of any proposed construction or restoration works. If a susceptible species is identified please ensure that works are planned so that they will not detrimentally impact on them and if possible responsible developers would improve habitat quality through restoration and rehabilitation. The Government of Ireland officially announced a Climate and Biodiversity Emergency in 2019 and this can not be reversed if we do not return peatland habitats to functioning ecosystems. **Water Framework Directive** The rivers and streams around the vicinity of the proposed project have been assessed under the Water Framework Directive and range from poor, moderate and good ecological status. The proposed project needs to address how it will manage its impacts to these aquatic habitats, i.e where works may improve conditions or degrade them. The construction works may increase sediment load into the receiving waters and ongoing hydrological management of the development during operation may also increase emissions. The hydrological plans for the proposed development need to be made available. Will the site be fully re-wet after construction or will there be ongoing drainage for management of the hardstands? How will this affect the carbon accounting, biodiversity and the Water Framework Directive?		

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Wetland Surveys Ireland (www.wetlandsurveys.ie) Wetland Surveys Ireland have identified a number of wetlands which need to have an ecological survey to ascertain the biodiversity and ecological value within them. Please liaise with WSI to gather as much information about these sites as possible and ensure that the proposed development will not have a adverse effect on the habitats or species that are utilising them or moving/migrating between them and other significant sites. North-Western Europe has lost ~90% of its wetlands and it is imperative that all is done to halt the loss of this important climate regulating, carbon sequestering and biodiverse landscape. Please assess your projects impacts on the sites within a reasonable distance from the proposed development and ensure that no detrimental pressures are imposed upon them including diffuse and point sources of potential water pollution and that possible accidents during construction are pre-empted and have mitigation plans to deal with chemical spills. Many of the wetlands contain fen/marsh habitats which may be susceptible to ground water emissions resulting from construction or operation of the proposed development. Please include :- Gower South and North, Tullabrack East, Gortnaskagh North and South, Durha, Moanmore Lower Cutover Bog, Kilcarrol West and East and Carrowfree. **Curlew (Numenius aquata)** The Curlew is one of the most endangered species in Ireland and the resident breeding population has declined by 98% since the 1980s (NPWS, 2022). The IPCC would like to remind you that this bird is listed as an ANNEX II section II bird species within the E.U Birds Directive [Council Directive 79/409/EEC] and also has a national status of Red on the Birds of Conservation Concern in Ireland list. The Curlew Conservation Programme (NPWS) is working to bring this species back from near extinction in Ireland and we would urge developers to liaise with them and BirdWatch Ireland in relation to any development. Breeding Curlew are site specific and will not possibly return if there are construction and operational disturbances from the proposed development. This needs to be scrutinized with ornithological surveys within the recommended survey times for breeding Curlew to ascertain as to whether they are present and if they utilise the site for any other purposes such as foraging. The operational turbines may also affect the Curlew's local migration routes. It would be disastrous if this project was to contribute to the further decline of this nearly extinct species. **Invasive Species** Peatlands, in their natural state, are not generally susceptible to invasive species as the high acidity, low nutrient and extremely wet conditions are not suitable for many species, but as most peatland in Ireland has not been responsibly utilised and is degraded the chance for invasives to take hold is increased. The movement of people and vehicles across the proposed development (and access routes) increases the risk of invasive species being introduced. Please use best practice bio-security procedures and measures to minimise the risk of spreading invasives and also ensure that there are contingency plans in place if they are identified during works. The sites need to be investigated before any works to fully understand		

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	the assemblage of invasives if any and to fully explore the implications on the proposed development. Engaging locals in this regard may help to garner local knowledge in the location of invasives which would highlight possible transmission vectors. The Irish Peatland Conservation Council appreciate that stringent measures are needed for a strong defence against the impacts of invasive species and implore developers to work with and prioritise an invasive species management plan which identifies established detrimental species within the project area, describes actions to eradicate them and also plugs the gaps where the vectors for introduction may be identified. Please refer to www.NPWS.ie, National Biodiversity Action Plan 2017-2021 and the Irish Peatland Conservation Action Plan 2020 (www.ipcc.ie) for information regarding the need to control invasives. **National Monuments** Peatlands in Ireland hold a great deal of cultural and ancestral history, preserved in the anaerobic conditions. Ireland has international obligations under the European Convention on the Protection of the Archaeological Heritage, ratified by Ireland in 1997. Article 1 of this convention states that Ireland must "protect the archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study". There needs to be scientific supervision from an independent body that will evaluate the proposed wind farm area for its archaeological importance. The IPCC could not support the development before a full archaeological survey is undertaken and the necessary precautions and mitigations are in place to ensure that no loss of cultural archaeological information occurs as course of the proposed development if permitted.		
Telecommunications			
Broadcasting Authority of Ireland	Email from Roger Woods (rwoods@bai.ie), Senior Executive Engineer on 14.09.2022. *'The BAI does not perform an in-depth analysis of the effect of wind turbines on FM networks. However, we are not aware of any issues from existing windfarms into existing FM networks. Also, the proposed windfarms are not located close to any existing or planned FM transmission sites.*	N/A	N/A
Eir Limited	Response of 19/04/22 confirmed they had no issues with the turbine locations.	No implications for the EIA/Design	**Telecommunications** discussed in Chapter 15
ESB Telecoms	No response received as of 31/01//2024.	N/A	**Telecommunications** discussed in Chapter 15
RTÉ	Response of 20/04/22: *Both of the sites detailed in your email will have no impact on our fixed linking.* *Due to the risk of interference to broadcast services from Maghera we would ask that a protocol be signed between the developer and 2rn should the site go ahead.*	No implications for the EIA/Design	**Telecommunications** discussed in Chapter 15
Tetra Ireland	Response of 19/04/22 confirmed they had no issues with the turbine locations.	No implications for the EIA/Design	**Telecommunications** discussed in Chapter 15

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Three Ireland (Hutchison) Limited	Response of 14/04/22 confirmed they had no issues with the turbine locations.	No implications for the EIA/Design	**Telecommunications** discussed in Chapter 11
Virgin Media Ireland	Email response received 04/11/2022. *Virgin Media does not have any record of underground services at this location as indicated by your drawing.* *Whilst the information given is believed to be correct no warranty is made as to its accuracy. This information must not be relied upon in the event of excavation or other works carried out in the site area. No liability of any kind whatsoever is accepted by virgin media, its servants or agents for any error or omission in respect of information contained within this communication. The actual position of underground services must be verified and established on site before any mechanical plant is used.*	Implications for the EIA/Design. Report by AI Bridges confirmed a link PTP microwave radio link from Knockanore to Slievecallan Wind Farm passing through the area. There is potential for interference depending on turbine layout.	**Telecommunications** discussed in Chapter 15
Vodafone	Response of 14/04/22 confirmed they had no issue with the turbine locations.	No implications for the EIA/Design	**Telecommunications** discussed in Chapter 15
Other			
Commission for Communications Regulation	No response received as of 31/01//2024.	N/A	N/A
Department of Agriculture	Email received 12/09/2022. '*I would like to acknowledge your recent correspondence dated to 12/09/2022 to Charlie McConalogue T.D., Minister for Agriculture, Food and the Marine regarding Ballykett Wind Farm, Co. Clare. I will bring your correspondence to the Minister's attention as soon as possible*' – Hilda Verling Minister's Office.	N/A	N/A
Department of Defence	Email received 4/11/2022 "*The Department of Defence wishes to acknowledge receipt of your e-mail below and the attached documentation.* *The Department will review your request and revert in due course."* – Don Watchorn -Property Management Branch – Department of Defence	N/A	N/A
Department Tourism, Culture, Arts, Gaeltacht, Sports & Media	No response received as of 31/01/2024.	N/A	N/A
Environmental Protection Agency	Email received on 09/12/2022 stating "*We do not generally make comments on proposed developments which are not licensable by the Agency.*"	N/A	N/A
Fáilte Ireland	Email received 05/12/2022	N/A	Tourism is discussed in Chapter 5

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Please see attached a copy of Fáilte Ireland's Guidelines for the Treatment of Tourism in an EIA, which you may find informative for the preparation of the Environmental Impact Assessment for the proposed project. The purpose of this report is to provide guidance for those conducting Environmental Impact Assessment and compiling an Environmental Impact Assessment Reports (EIAR), or those assessing EIARs, where the project involves tourism or may have an impact upon tourism. These guidelines are non-statutory and act as supplementary advice to the EPA EIAR Guidelines outlined in section 2.		
Health Service Executive	Email received 11/10/2022 The HSE will consider the final EIAR accompanying the planning application to be made to Clare County Council and will make comments to the Planning Authority on the methodology used for assessing the likely significant impacts and the evaluation criteria used in assessing the significance of the impact. This report only comments on Environmental Health Impacts of the proposed development. It is based on an assessment of the correspondence submitted to this office dated September 2022 and the comprehensive scoping report issued. **Public Consultation** It is recommended that early and meaningful public consultation with the local community is undertaken to ensure all potentially significant impacts of the proposed renewable energy development have been adequately addressed. All parties affected by the proposed development, **including those who may benefit financially from the project**, must be fully informed of what the proposal entails especially with regard to potential impacts on surrounding areas. Sensitive receptors and other stakeholders should be identified to ensure all necessary and appropriate mitigation measures are put in place to avoid any complaints about the proposed wind farm development in the future. **Decommissioning** The EIAR should detail the eventual fate of the wind turbines and associated material, i.e. will the material be recycled or how will it be disposed of. **Siting, Location and details of Turbine** The EIAR should include a map and a description of the proposed location of each of the proposed wind turbines. The Environmental Health Service expects that details (height and model) of the turbines to be installed will be available at the time planning permission is sought and will be included in the EIAR. Details of the foundations for the wind turbine including depth, quantity and material to be used should be included in the EIAR.	N/A	Items raised under **Public Consultation** are addressed in Chapter 1 Items raised under **Decommissioning** are addressed in Appendix 2.1 CEMP – Decommissioning Plan Items raised under **Siting, Location and details of Turbine** are addressed in Chapter 2 Items raised under **Assessment of Consideration of Alternatives** is addressed in Chapter 3 Items raised under **Noise & Vibration** are addressed in Chapter 10 Items raised under Shadow Flicker are addressed in Chapter 13 Air Quality is addressed in Chapter 13

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	Assessment of Consideration of Alternatives The EIAR should consider an assessment of alternatives. The EHS recommends that alternative renewable energy options to on- shore wind farms should be assessed as part of the EIAR. **Noise & Vibration** The potential impacts for noise and vibration from the proposed development on all noise sensitive locations must be clearly identified in the EIAR. The EIAR must also consider the appropriateness and effectiveness of all proposed mitigation measures to minimise noise and vibration. **Shadow Flicker** It is recommended that a shadow flicker assessment is undertaken to identify any dwellings and sensitive receptors which may be impacted by shadow flicker. The assessment must include all proposed mitigation measures. Dwellings should include all occupied properties and any existing or proposed properties for which planning consent has been granted for construction or refurbishment. It is recommended that turbine selection will be based on the most advanced available technology that permits shut down during times when residents are exposed to shadow flicker. As a result, no dwelling should be exposed to shadow flicker. **Air Quality** Due to the nature of the proposed construction works generation of airborne dust has the potential to have significant impacts on sensitive receptors. A Construction Environmental Management Plan (CEMP) should be included in the EIAR which details dust control and mitigation measures. **Surface and Ground Water Quality** The proposed development has the potential to have a significant impact on the quality of both surface and ground water. All drinking water sources, both surface and ground water, must be identified. Public and Group Water Scheme sources and supplies should be identified in addition to any private wells supplying potable water to houses in the vicinity of the proposed development. Measures to ensure that all sources and supplies are protected should be described. The Environmental Health Service recommends that a walk over survey of the site is undertaken in addition to a desktop analysis of Geological Survey of Ireland data in order to identify the location of private wells used for drinking water purposes. **Geotechnical and Peat Stability Assessment** A detailed assessment of the current ground stability of the site for the proposed renewable energy development and all proposed mitigation measures should be detailed in the EIAR. The assessment should include the impact construction work may have on the future stability of		Surface and Ground Water Quality is addressed in **Chapter 9** **Geotechnical and Peat Stability Assessment** is addressed in Chapter 8 **Ancillary Facilities** are discussed in Chapter 2 and Appendix 2.1 CEMP **Cumulative Impacts** are discussed in Chapters 3 - 15

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	ground conditions, taking into consideration extreme weather events, site drainage and the potential for soil erosion. **Ancillary Facilities** The EIAR should include details of the location of all site office, construction compound, fuel storage depot, sanitary accommodation and canteen, First Aid facilities, disposal of wastewater and the provision of a potable water supply to the site canteen. **Cumulative Impacts** All existing or proposed wind farm developments in the vicinity should be clearly identified in the EIAR. The impact on sensitive receptors of the proposed development combined with any other wind farm/renewable energy developments in the vicinity should be considered. The EIAR should include a detailed assessment of any likely significant cumulative impacts of the proposed renewable energy development.		
Irish Water	Scoping response received 22/09/2022 and included the following points: At present, Irish Water does not have the capacity to advise on the scoping of individual projects. However, in general the following aspects of Water Services should be considered in the scope of an EIA where relevant; a) Where the development proposal has the potential to impact an Irish Water Drinking Water Source(s), the applicant shall provide details of measures to be taken to ensure that there will be no negative impact to Irish Waters Drinking Water Source(s) during the construction and operational phases of the development. Hydrological / hydrogeological pathways between the applicant's site and receiving waters should be identified as part of the report. b) Where the development proposes the backfilling of materials, the applicant is required to include a waste sampling strategy to ensure the material is inert. c) Mitigations should be proposed for any potential negative impacts on any water source(s) which may be in proximity and included in the environmental management plan and incident response. d) Any and all potential impacts on the nearby reservoir as public water supply water source(s) are assessed, including any impact on hydrogeology and any groundwater/ surface water interactions. e) Impacts of the development on the capacity of water services (i.e. do existing water services have the capacity to cater for the new development). This is confirmed by Irish Water in the form of a Confirmation of Feasibility (COF). If a development requires a connection to either a public water supply or sewage collection system, the developer is advised to submit a Pre-Connection Enquiry (PCE) enquiry to Irish Water to determine the feasibility of connection to the Irish Water network. All pre-connection enquiry forms are available from https://www.water.ie/connections/connection-steps/. f) The applicant shall identify any upgrading of water services infrastructure that would be required to accommodate the proposed development.	All items considered during the design process. No implications for the EIA/Design	**Hydrology** addressed in Chapter 9 **Soils and Geology** addressed in Chapter 8

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	g) In relation to a development that would discharge trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an Irish Water collection network. h) In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks and potential measures to minimise and or / stop surface waters from combined sewers. i) Any physical impact on Irish Water assets – reservoir, drinking water source, treatment works, pipes, pumping stations, discharges outfalls etc. including any relocation of assets. j) When considering a development proposal, the applicant is advised to determine the location of public water services assets, possible connection Uisce Éireann Irish Water points from the applicant's site / lands to the public network and any drinking water abstraction catchments to ensure these are included and fully assessed in any pre-planning proposals. Details, where known, can be obtained by emailing an Ordnance Survey map identifying the proposed location of the applicant's intended development to datarequests@water.ie. k) Other indicators or methodologies for identifying infrastructure located within the applicant's lands are the presence of registered wayleave agreements, visible manholes, vent stacks, valve chambers, marker posts etc. within the proposed site. l) Any potential impacts on the assimilative capacity of receiving waters in relation to Irish Water discharge outfalls including changes in dispersion / circulation characterises. Hydrological / hydrogeological pathways between the applicant's site and receiving waters should be identified within the report. m) Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence / present a risk to the quality of the water abstracted by Irish Water for public supply should be identified within the report. n) Where a development proposes to connect to an Irish Water network and that network either abstracts water from or discharges wastewater to a "protected"/ sensitive area, consideration as to whether the integrity of the site / conservation objectives of the site would be compromised should be identified within the report. o) Mitigation measures in relation to any of the above ensuring a zero risk to any Irish Water drinking water sources (Surface and Ground water). This is not an exhaustive list. Please note. • Where connection(s) to the public network is required as part of the development proposal, applicants are advised to complete the Pre-Connection Enquiry process and have received a Confirmation of Feasibility letter from Irish Water ahead of any planning application. • Irish Water will not accept new surface water discharges to combined sewer networks		
Minister for Environment, Climate and Communications	Email Response received 02/12/2022 stating "*observations were provided on behalf of Geological Survey Ireland (a division of the Department of the Environment, Climate and Communications) to Clare County Council*".	N/A	N/A

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Transport Infrastructure Ireland	Scoping response received 23/09/2022 Transport Infrastructure Ireland (TII) will endeavour to consider and respond to planning applications referred to it given its status and duties as a statutory consultee under the Planning Acts. The approach to be adopted by TII in making such submissions or comments will seek to uphold official policy and guidelines as outlined in the Section 28 Ministerial Guidelines 'Spatial Planning and National Roads Guidelines for Planning Authorities' (DoECLG, 2012). Regard should also be had to other relevant guidance available at www.TII.ie. The issuing of this correspondence is provided as best practice guidance only and does not prejudice TII's statutory right to make any observations, requests for further information, objections or appeals following the examination of any valid planning application referred. National Strategic Outcome 2 of the National Planning Framework includes the objective to maintain the strategic capacity and safety of the national roads network. In addition, Chapter 7 'Enhanced Regional Accessibility' of the National Development Plan, 2021 – 2030, sets out the key sectoral priority of maintaining Ireland's existing national road network to a robust and safe standard for users. This requirement is further reflected in the publication of the National Investment Framework for Transport in Ireland and also the existing Statutory Section 28 Spatial Planning and National Roads Guidelines for Planning Authorities. With respect to EIAR scoping issues, the recommendations indicated below provide only general guidance for the preparation of an EIAR, which may affect the national road network. The developer/scheme promoter should have regard, inter alia, to the following: • Consultations should be had with the relevant Local Authority/National Roads Design Office, with regard to the locations of existing and future national road schemes. • TII would be specifically concerned as to potential significant impacts the development would have on the national road network (and junctions with national roads) in the proximity of the proposed development; ; N68, N85, national roads. In addition, in accordance with official policy, proposals shall not result in the creation of new direct access to a national road or the intensification of existing direct access to national roads, • The developer should assess visual impacts from existing national roads. • The developer should have regard to any EIAR/EIS and all conditions and/or modifications imposed by An Bord Pleanála regarding road schemes in the area. The developer should, in particular, have regard to any potential cumulative impacts. • The developer, in preparing EIAR, should have regard to TII Publications (formerly DMRB and the Manual of Contract Documents for Road Works). • The developer, in preparing EIAR, should have regard to TII's Environmental Assessment and Construction Guidelines, including the 'Guidelines for the Treatment of Air Quality	No implications for the EIA/Design	Transport issues are assessed in Chapter 16 **Noise** issues are assessed in Chapter 10

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	During the Planning and Construction of National Road Schemes' (National Roads Authority (NRA), 2006). • The EIAR/EIS should consider the' Environmental Noise Regulations 2006' (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see Guidelines for the Treatment of Noise and Vibration in National Road Schemes (1st Rev., National Roads Authority, 2004)), • It would be important that, where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site, with reference to impacts on the national road network and junctions of lower category roads with national roads. In relation to national roads, the TII's 'Traffic and Transport Assessment Guidelines' (2014) should be referred to in relation to proposed development with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of the NRA/TII TTA Guidelines which addresses requirements for sub-threshold TTA. Any improvements required to facilitate development should be identified. It will be the responsibility of the developer to pay for the costs of any improvements to national roads to facilitate the private development proposed as TII will not be responsible for such costs, • The designers are asked to consult TII Publications to determine whether a Road Safety Audit is required. • In the interests of maintaining the safety and standard of the national road network, the EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network. • TII recommends that that applicant/developer should clearly identify haul routes proposed and fully assess the network to be traversed. TII notes that preliminary haul route proposals outlined in the EIAR Scoping Report include the N/M6, M18, N85 and N68, national roads. Where abnormal 'weight' loads are proposed, separate structure approvals/permits and other licences may be required in connection with the proposed haul route. All structures on the haul route through all the relevant County Council administrative areas should be checked by the applicant/developer to confirm their capacity to accommodate any abnormal 'weight' load proposed. In addition, the haul route should be assessed to confirm capacity to accommodate abnormal 'length' loads and any temporary works required. Additionally, any damage caused to the pavement on the existing national road, arising from any temporary works due to the turning movement of abnormal 'length' loads (eg. tearing of the surface course, etc.), shall be rectified in accordance with TII Pavement Standards and details		

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	in this regard shall be agreed with the road authority prior to the commencement of any development on site. • Any grid connection and cable routing proposals should be developed to safeguard proposed road schemes, as TII will not be responsible for costs associated with future relocation of cable routing where proposals are catered for in an area of a proposed national road scheme. In that regard, consideration should be given to routing options, use of existing crossings, depth of cable laying, etc.		
Department of Transport	Email received 13/10/2022 *Dear Sir/Madam,* *The Department of Transport welcomes the opportunity to provide information to be included in the preparation of an Environmental Impact Assessment (EIA) for Ballykett Wind Farm, Ballykett, Co. Clare.* *It should be noted that the department considers the construction involved in providing this development and especially, the connection cables to the national grid may have effects on both the environment and the Regional and Local Road network.* *Where the developer proposes the placement of any cables (or additional cables) in one or more trenches within the extents of the (regional and local) public road network, it is necessary to consider the following:* • *Their presence within the public road could significantly restrict the Road Authority in carrying out its function to construct and maintain the public road and will likely add to the costs of those works.* • *Their installation within the lands associated with the public road may affect the stability of the road. In particular where the road is a "legacy road" (where there is no designed road structure and the subgrade may be poor or poorly drained) the design needs to take account of all the variable conditions and not be based on a sample of the general conditions.* • *The possible effect on the remaining available road space (noting that there may be need to accommodate other utilities within the road cross-section in the future).* • *The necessity to have the power in the cables switched off where the Road Authority considers this necessary in order to carry out its function to construct and maintain the public road.* *The department consider it important that the examination of the proposal should include consideration of the following:* • *Examination of options other than the routing of cables along the public road,*		Transport issues are assessed in Chapter 16 Design issues are assessed in **Chapter 2**

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	• *Examination of options for connection to the national grid network at a point closer to the wind farm in order to reduce the adverse impact on public roads.* • *Details of where within the road cross section cables are to be placed so as to minimise the effect on the Roads Authority in its role of construction and maintenance,* • *Examination of details of any chambers proposed within the public road cross section so as to minimise the effect on the Roads Authority in its role of construction and maintenance and,* • *Rationalisation of the number of cables involved (including existing electric or possible future cables) and their diversion into one trench, in order to minimise the impacts on the road network and the environment along the road boundary (hedgerows).*		
OPW	Response received 12/01/23 *Dear Sir/Madam,* *I refer to your email dated 12th September 2022 in relation to the above project seeking comments or observations from this office.* *We would make the following comments.* *If any new culverts or bridges (or modifications to any existing culverts or bridges) are required to cross watercourses as part of the development or on proposed or existing access roads to serve or access the development, you should be aware that these require consent from the Commissioners of Public Works. This is a requirement of Section 50 of the Arterial Drainage Act of 1945 as amended.* *I attach a copy of our brochure on obtaining Section 50 consent for your information. Further information on the process including copies of the appropriate application form and brochure are available on our website at* https://www.gov.ie/en/publication/957aa7-consent-requirements-constructionalteration-of-watercourse-infrastru/ *Please note that, in the context of seeking consent under Section 50, the current required design standard for bridges or culverts is based on the flood with an annual exceedance probability of 1% (often referred to as the 100 year flood), increased by 20% to cater for the effects of Climate Change. Bridges or culverts are required to be able to convey this design flood without significantly altering the hydraulic characteristics of the watercourse – further details on this issue are available in the brochure and can be clarified depending on the circumstances of any particular proposed bridge or culvert.* *You should be aware that a grant of Planning Permission by a planning authority for a development which contains bridges or culverts does not confer section 50 consent on the*	All items considered during the design process.	**Hydrology** addressed in Chapter 9 **Soils and Geology** addressed in Chapter 8

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
	applicant, nor does it absolve the applicant from the requirement to obtain such consent from the Commissioners. *With regard to the proposed Grid Connection Route which is not indicated in your documentation, it is possible that this route may cross several watercourses. If the cable and ducting are to be buried in the road, as they cross bridges over the water courses, and there is no interference with the opening in the bridge spanning the watercourse, then there is no issue. On the other hand, if it is proposed to pass the cable in its ducting through the opening of any bridge or culvert, this would be considered to be a modification of a bridge and it would require the consent of the Commissioners under Section 50 as mentioned above. Similarly, if it is proposed to carry the cable in its ducting across watercourses on new support structures spanning the watercourses, these should be treated as if they are bridges, and the consent of the commissioners under Section 50 should be obtained. If the cable and ducting is to be buried under the natural bed of the watercourses being crossed, Section 50 would not apply, and we would recommend that the duct be buried a sufficient distance below the natural bed to allow for erosion and mobility of the stream bed.* *We would recommend that a flood risk assessment be carried out with regard to the proposed development and its construction. This should consider all sources, pathways and receptors of flood risk. This should be carried out in accordance with the principles set out in the guideline document "The Planning System and Flood Risk Management" as published by the Minister for the Environment, Heritage and Local Government and the Office of Public Works. Please be aware that this is a separate issue from the requirement to obtain Section 50 consent as mentioned above.* *Include the following paragraph if the correspondence being dealt with relates to the preparation of an EIA.* *In terms of the preparation of an EIA, the matters referred to above principally relate to the Hydrology Section, and the Risk of Flooding on a development such as this can impact on Landscape (e.g. landslides that have been reported in recent years), Infrastructure (roads and bridges) and people and their homes, among other things. The aim of the Section 50 process, and the Flood Risk Assessment which is recommended would be to mitigate any increased risk of flooding and the consequences of same, as arising from the proposed development.* *Please use the reference number indicated above in any further correspondence with the office on this matter.* *Yours sincerely,* *Derek Higgins* *South-West Drainage Maintenance & Construction*		

Consultee Organisation	Response Received	Implications for the EIA/Design	EIAR Chapter/Section where comments have been addressed
Shannon Airport	No response received as of 31/01/2024.	N/A	N/A
Údarás na Gaeltachta	No response received as of 31/01/2024.	N/A	N/A

1.12 AVAILABILITY OF INFORMATION

A copy of the EIAR may be viewed online on the Clare County Council website and on www.ballykettgreenenergy.ie.

A paper copy of the EIAR can be viewed, during office opening hours at the following addresses:

1. The Offices of Clare County Council, Áras an Chontae an Chláir, New Road, Ennis, County Clare V95 DXP2.
2. Jennings O'Donovan & Partners Limited, Consulting Engineers, Finisklin Business Park, Co. Sligo, F91 RHH9.

Paper copies can be provided at the cost of printing, by writing to:
Jennings O'Donovan & Partners Limited at the above address or through Clare County Council.

Electronic copies are available via email (info@jodireland.com).

1.13 GLOSSARY OF COMMON ACRONYMS

The common acronyms used throughout this EIAR are contained in **Volume IV: Appendix 1.4**.

2 PROJECT DESCRIPTION

2.1 INTRODUCTION

This chapter of the EIAR provides a description of all elements of the proposed Ballykett Wind Farm (The Development). This includes all elements within the Redline Boundary, the wind turbines, an Electrical Substation, site access tracks, Turbine Hardstands and all site infrastructure, the Grid Connection Route (GCR) and Turbine Delivery Route (TDR) works. This chapter also provides a description of the work required along the TDR which are outside the Redline Boundary and which together with the works within the Redline Boundary are defined as the Project which form the basis of the assessments presented within chapters 5 to 14. This chapter provides details of the construction, operational and Decommissioning phases of the Project.

This chapter includes an overview of the Project followed by a detailed description of the main components and their methods of construction. Measures that have been built into the design of the Project to reduce effects, also known as 'Embedded Mitigation', measures, are set out in the various technical chapters, and in this chapter. In addition to these Embedded Mitigation measures, chapters 5 to 14 also present mitigation and enhancement measures where specifically relevant to their assessment topic.

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

- Construction Environmental Management Plan (CEMP) in **Appendix 2.1**
- A Grid Route Assessment report and accompanying drawings prepared by BFA Consulting in **Appendix 2.2**; and
- Ballykett Wind Farm Grid Technical Report prepared by Mullan Grid Consulting in **Appendix 2.3**

Common acronyms used throughout this EIAR can be found in **Appendix 1.4**.

2.2 PROJECT DESCRIPTION

Planning permission is being sought by the Developer for the construction of 4 no. wind turbines, permanent Met Mast, Electrical Substation and all ancillary works.

The Development will include:

- Erection of 4 no. 4-5MW wind turbines with an overall ground to blade tip height of 150m. The candidate wind turbine will have a rotor diameter of 136m and a hub height of 82m.
- Construction of site access tracks, Turbine Hardstand areas and Turbine Foundations.
- Construction of new site entrance with access onto the adjoining local road network (L6132).
- Construction of 1 no. Temporary Construction Compound with associated temporary site offices, parking areas and security fencing
- Installation of 1 no. permanent Met Mast of 82m overall height.
- Construction of new internal site access tracks and upgrade of existing site track, to include all associated drainage including new clear span bridge crossing of the Moyasta 27_010 watercourse.
- Development of a site drainage network and biodiversity enhancement measures.
- Construction of 1 no. Electrical Substation.
- 2. no permanent spoil storage areas.
- All Wind Farm Internal Cabling connecting the wind turbines to the Electrical Substation.
- Ancillary forestry felling to facilitate construction of the Development.
- All works associated to facilitate the permanent connection of the wind farm to the national electricity grid comprising a 38kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation and to the existing Tullabrack 110kV ESBN Substation.
- Vertical realignment of an existing crest curve on the L6132 local road in order to prevent grounding of abnormal load vehicles during delivery of turbine components.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

1. In addition, the EIA also assesses localised improvements and temporary modifications to the existing public road infrastructure to facilitate delivery of abnormal loads and turbine delivery. The red-line boundary and all works assessed as part of the Project are shown on **Figure 2.1**.

2.3 SITE LOCATION AND ENVIRONS

2.3.1 Introduction / Existing Land Use

The wind farm Site, as shown in **Figure 1.1**, is located in south-west county Clare 3.5km north-east of the town of Kilrush and 3km south-west of Cooraclare village. The wind farm Site is located within the townlands of Ballykett, and Tullabrack East. It is located within an area comprised of agricultural livestock grazing farmland, cutaway bog and conifer forestry plantation.

The townlands through which the proposed Grid Connection will transect include the townlands of Tullabrack West, Tullabrack East and Tullabrack.

Vertical realignment works will be undertaken on a small section of the L6132. These works are located in the townland Gower South.

Temporary works may be required at intervals on the L6132 to accommodate the delivery of the turbine components and HGV vehicles. These temporary works are included as part of this application and are located in the townlands of Tullabrack East, Gower South, Gowerhass, Tullagower and Derreen.

Road widening between Tullabrack Cross and the wind farm site entrance will be carried out to accommodate increased volumes of HGV vehicles associated with the construction of the wind farm. The road widening and verge strengthening are temporary works. These temporary works are included as part of this application and are located in the townland of Tullabrack East.

The Development boundary extends to 31.13ha and the Site area extends to 31.09ha, the majority of which is on former cutover bog used for commercial forestry plantation and is in the ownership of four local landowners.

There are 146 houses within 2km of the proposed turbines. All houses located within 2km of the proposed turbines are shown in **Figure 1.3**. The closest inhabited dwelling not connected with the Development is (H4) located 608m from the nearest turbine. There are three properties (H1 (560m), H2 (532m) and H5 (579m)) located less than 600m from proposed turbines. H2 is an old cottage that has been converted to a workshop and is not considered a sensitive receptor in this EIAR. H1 is a derelict house which still has an intact roof so it has been included in the EIAR. H5 is an inhabited dwelling that is financially involved with the Project and it has also been included in this EIAR.

2.3.2 Wind Farms in the Area (Cumulative)

There are 17 operational, consented and proposed wind farms for which planning applications are already submitted for determination, within 20km of the Site. **Figure 2.1** shows the location of proposed, permitted and operational wind farms within a 20km radius of the proposed turbines and **Table 2.1** below provides further information on these wind farms. The nearest operational wind farm is Moanmore wind farm which is located approximately 1.31km to the northwest of the Site.

Table 2.1: Wind Farms within 20km of the Proposed Turbines

Wind Farm	Status	No. of Turbines	Approximate Distance to the Site Boundary	Direction from the Development
Moanmore	Operational	7	c. 1.31km	West
Tullabrack	Operational	6	c. 1.52km	Northwest
Beal Hill	Operational	6	c. 16.06km	Southwest
Booltiagh	Operational	18	c. 17.42km	Northeast
Cahermurphy	Operational	4	c. 13.07km	Northeast
Carrownaweelaun	Operational	2	c. 18.08km	West
Crossmore	Consented	7	c. 11.42km	East
Curraghgerrig	Operational	2	c. 15.11km	Southwest
Glenmore	Operational	12	c. 15.18km	Northeast
Kiltumper	Operational	2	c. 12.98km	Northeast
Lahra	Operational	2	c. 16.47km	South
Leanamore	Operational	9	c. 11.57km	Southeast
Moneypoint	Operational	5	c. 5.47km	South
Shronowen	Consented	12	c. 16.86km	South
Tullahennel South	Operational	9	c. 15.58km	South
Tullahennel North	Operational	2	c. 15.72km	South
Moanmore South	Proposed but not yet consented	3	c. 3.27km	West

2.3.3 Other Developments (Cumulative)

The only other major development or proposed development (bigger than a one-off house) within 10km are the developments or proposed developments listed below in Table 2.2. The 10km radius distance search area selected for other development, other than wind farms, is considered to be reasonable for cumulative impact assessment for EIAR and consistent with the EPA "Guidelines on the information to be contained in environmental impact assessment reports" (2022).

Table 2.2: Other Major Developments or Proposed Developments (bigger than a one off house) within 10km of the Proposed Site.

Other Developments	Status	Planning Reference	Decision Due Date	Approximate Distance to the Site Boundary	Direction from the Development
Construction of Ballroom/Function Room building	Permission	18930	10/10/2019	8.5km	Northwest
Development of a livestock slatted unit, manure pit, horse stables with fenced sand arena, and associated site works	Permission	19775	20/06/2020	7.2km	Southwest
Development of a Sewerage scheme at Skagh Point, Kilrush, Co Clare.	Permission	21203	02/05/2021	5.1km	Southwest
Extend existing graveyard and associated works	Permission	17157	11/05/2017	4.6km	Southwest
New wastewater treatment plant and associated works	Permission	19643	02/10/2019	3.7km	Southwest
Development of two water storage tanks above ground level and an underground pump chamber located within the Moneypoint generating station complex	Permission	17809	14/12/2017	5.4km	South
Develop a 9-hole pitch and putt course, reception hut and car parking facilities along with all associated works	Permission	19380	15/09/2019	2.6km	Southwest
Construct a new external refrigeration plant area enclosure	Permission	20506	17/09/2020	3.0km	Southwest
To convert and extend existing Convent structures, to include 30 No apartments, to demolish part of existing outbuilding, to construct 20 No semi-detached dwellings, service road, new entrance and to upgrade/ extend existing ancillary services. The Convent is a protected structure (RPS 861) and associated works	Permission	21239	11/11/2021	3.4km	Southwest
Solar PV Energy development	Permission	18679	18/10/2018	2.5km	North/ Northwest
Development coastal erosion management	Permission	161012	21/12/2017	8.7km	North/ Northwest
Works associated with the refurbishment of the existing Moneypoint - Oldstreet 400 kV overhead line within the various townlands	Permission	161011	21/02/2017	5km	East
Construct a cubicle house for cows, extend the existing shed by one bay, construct 2 underground slurry tanks, construct a new milking complex with adjoining drafting system and calf facility. And demolish old store and section of existing parlour to facilitate construction of new milking complex	Permission	20120	12/10/2022	6.9km	Northeast

Other Developments	Status	Planning Reference	Decision Due Date	Approximate Distance to the Site Boundary	Direction from the Development
Construct a new 120m long covered 4 lane sprint track and a new storage shed along with all associated site works	Permission	17107	12/10/2022	7.1km	Northeast
Construct agricultural slatted unit, plus machinery/storage shed, silage slab, concrete yard plus all ancillary site works	Permission	2030	24/03/2020	7km	East/ Southeast

2.3.4 Land Ownership

The Site is located on lands under the ownership of third-party private landowners who have consented to the application and the Development.

2.4 WIND RESOURCE

Due to the location in west Clare, and the local elevation, the proposed wind farm Site area experiences high average annual wind speeds. The Irish Wind Atlas produced by the Sustainable Energy Authority of Ireland (SEAI) shows average wind speeds for the country and it shows that wind speeds on the Site (6.4/sec at 30m, 7.9m/sec at 75m, 8.4m/sec at 100m and 9.1m/sec at 150m) are consistent with a wind farm development being viable at this location.

2.5 SITE INFRASTRUCTURE AND CONSTRUCTION

2.5.1 Proposed Layout Design

The layout of the Development has been designed to minimise the potential environmental effects of the wind farm while utilising the maximum energy yield from the Site's wind resource. The layout design was informed by the following constraints and buffers:

- distance to watercourses of at least 50m;
- distance to land drains of at least 20m;
- distance to archaeological monuments and structures of at least 100m;
- distance from turbines to inhabited houses of at least 600m;
- avoidance of wind turbine rotor blade oversail over 3rd party lands;
- avoidance of existing telecommunications infrastructure;
- avoidance of existing 110kV overhead powerlines on northern side of the site where a 180m buffer is applied[1];
- avoidance of potential flood risk area in the western side of the Site;

[1] Set back taken from EirGrid policy document "*Policy on Wind Turbine Clearance to OHL's Rev 1*".

- avoidance of sensitive habitats e.g., blanket bog.

The overall layout of the Site is shown in **Figure 1.2**. This figure shows the locations of the wind turbines and associated hardstanding areas, Electrical Substation, Met Mast, Temporary Construction Compound, internal access tracks and the site entrance. The ITM coordinates of the wind turbines are listed in **Table 2.3**.

Table 2.3: Turbine ITM Coordinates

Turbine No.	ITM Easting (m)	ITM Northing (m)
T1	501526.42	658497.99
T2	501504.16	658098.50
T3	501928.27	657973.70
T4	501913.42	658375.12

2.5.2 Wind Turbine Generator

The proposed turbines will be of typical modern design and will be a three-bladed, rotor up wind of the tower, variable speed, pitched blade regulated machine. Turbine appearance will be a matt non-reflective finish in a white, off-white or grey colour. The foundation-to-tip height will be 150m.

The turbine will have a circular based tower, sitting on a reinforced concrete foundation. The tower will support the nacelle, rotor hub, and rotor blades. Commercial wind turbine towers are typically made of steel or a hybrid of steel and concrete. The nacelle is mainly metal (steel, copper, aluminium, etc.) with a metal/plastic/glass-reinforced plastic (GRP) body, while the blades can be made of a matrix of glass-fibre reinforced polyester or wood-epoxy or similar composite materials.

Each turbine will have a generator with a maximum capacity of 5MW giving an overall capacity up to 20MW. The turbines may be direct drive machines or may contain a gearbox. The final turbine will be chosen in a competitive tendering process as part of the Project financing process, after all necessary consents have been secured.

The final choice of turbine model is unknown at this stage, but for the purposes of EIA and planning approval the candidate turbine model used for assessment is identified as a Vestas V136 wind turbine. A schematic drawing of the candidate turbine is shown on **Figure 1.4**.

For the purposes of the assessments, the dimensions of the candidate turbine is presented in **Table 2.4**.

Table 2.4: Turbine Parameters

Turbine Parameter	Assessment Envelope
Turbine Blade Tip Height	150m
Rotor Diameter	136m
Hub Height	82m

2.5.3 Turbine Foundation and Turbine Hardstands

All turbine suppliers have a requirement for a Turbine Hardstand area to be constructed beside each turbine. The general layout of the Turbine Hardstand is designed to accommodate the delivery, laydown, and assembly of turbine components (in particular rotor assembly) prior to turbine lifting and assembly and is shown in **Figure 2.2**. The Turbine Hardstands are needed to support the cranes during turbine construction, the operational and maintenance phase, and for decommissioning. The Turbine Hardstands will be constructed in advance of the Turbine Foundation and will be used to facilitate foundation construction, such as steel reinforcement delivery and pouring of concrete.

Construction of the turbine and Met Mast hardstands will require the excavation of overburden material to the noted area and depth, the laying of a geotextile material on the formation surface and placing engineered stone and a top dressing. Each Turbine Hardstand will have a surface area of 2,770m^2 with a secondary crane area of 290m^2 .The main Turbine Hardstands will be 2,770m^2 and will be up to 2.75m in depth depending on the local bedrock profile and the varying soil depth giving a surface area of 11,080m^2 for 4 wind turbines. The secondary crane hardstand will be 290m^2, 0.8m in depth and will require approximately 928m^3 for 4 secondary crane hardstands.

The Turbine Foundations will be approximately 25.8m in diameter and have a depth of approximately 3.4m. The Turbine Foundation design will depend on the turbine type and will be decided by the structural engineers at detailed design stage but will fall within the above dimensions. The central part of the foundation will be raised from the main Turbine Foundation below ground level and will encompass cast-in bolts to connect to the bottom of the turbine tower and reinforced bar structural elements.

The volume of concrete and steel required for each Turbine Foundation will be 600m³ and 50 tonnes respectively. The area around and above the Turbine Foundation will be backfilled with compacted granular material and the only portion exposed in the long term will be the central foundation section.

There will be approximately 43,870m^3 of rock required during the construction phase. A borrow pit will be developed on-site to extract rock (32,280m^3) for most of the site infrastructure requirements; this will help to limit the volume of HGV traffic associated with wind farm construction on the local road network. Rock (c. 11,590m^3 or 11.59tonnes) will be imported to construct the L6132 site entrance, temporary construction compound, access road from the L6132 site entrance leading to the onsite borrow pit, site access road and turbine hardstand surface layers and temporary and permanent works along the L6132 as detailed in **Chapter 16 Traffic and Transport**.

Material imported to site will be sourced from a local quarry(s), such as one of those identified in **Table 2.5** below.

Table 2.5: Local Quarries and Concrete Suppliers

Quarry	ITM (Easting)	ITM (Northing)	Distance (km)	Direction	Comments
Rock Aggregates					
Ballykett Quarry	501156	657438	1km	SW	Sandstone, flagstone, stone paving and slab extraction.
Derrynalecka Quarry	513400	657028	11.2	E	Aggregates for concrete, hardcore, farm drainage, earthworks/fill. Coal stone, sandstone
Glenmore Quarry	514193	669493	16.4	NE	N/A
Hehir Quarry	518484	671278	20.8	NE	Natural gravel, pencil gravel fine and coarse. Drainage/hardcore/fill, road-making (farm roadways, tracks, etc.), forest roads.
Letterkelly Quarry	512110	678581	22.3	NE	(Shale) Gravel, stone, pencil gravel, earth
Liscormick Quarry	524882	659265	22.7	E	Green stone or shale, used for roads and fill
Nagle Stone Quarry	503427	6905554	31.5	N	Flagstone, unsawn, stone paving. Liscannor flagstone.

Quarry	ITM (Easting)	ITM (Northing)	Distance (km)	Direction	Comments
					Farm/forest road foundations, earthworks/fill
Luogh and Lisacannor Stone Company Ltd. Luogh Quarry	505317	693594	35	N	Sandstone, limestone, greenstone
Ryans Quarry (Roadstone Ltd.)	530275	683853	38	NE	Aggregates for concrete, hardcore, farm drainage, earthworks/fill (Limestone)
Bunratty Quarry (Roadstone Ltd.)	544215	661536	42	E	Aggregates for concrete, hardcore farm drainage, earthworks/fill (Limestone)
Bobby O'Connell and Sons Ltd. Ballycar Quary	556239	664430	55	W	Aggregates for concrete, hardcore, farm drainage, earthworks/fill
Esker Readymix, Athenry	554489	726233	88	NE	Concrete
McGraths Quarry	514093	756055	54	NE	Concrete, limestone rock and aggregates

Site investigations are required post consent to facilitate detailed design. Traditional gravity foundations are considered for EIA purposes as this represents a worst-case scenario due to the amounts of concrete required but it should be noted that the predicted environmental effects, such as loss of habitats and/or impacts on water quality, could be reduced where rock anchor foundations could be used for some of the Turbine Foundations where there is solid competent rock at the foundation level.

Based on the results of peat probing and geotechnical assessments to date, peat depths are not deep enough to require piling for Turbine Hardstands. Therefore, the construction method for all the Turbine Hardstands will be via excavated approach.

The construction methodology for the Turbine Foundations will depend on the strength and depth of the substrata (layers of rock or soil beneath the surface) specific to each location. Turbine Foundations will need to be taken down to competent bearing strata by excavating through the peat / soil, subsoil and rock if necessary.

A method of construction for gravity Turbine Foundation is described as follows:

- Set out Turbine Foundations and required finish levels etc.
- Construct formation and/or supporting structures e.g., piles.
- Construct drainage as required.
- Provide a minimum of 100mm concrete blinding.

- Place bottom mat of steel reinforcing.
- Place free issue turbine base insert or anchor cage.
- Fix cable ducting and foundation earthing.
- Complete reinforcing steel.
- Fix shuttering to base sidewalls.
- Fix ducts and earthing wires between insert and walls of base.
- Carry out any corrective works as directed by engineer.
- Check weather conditions and schedule concrete deliveries.
- Place concrete and take quality control slumps and cubes.
- Concrete surface finishing.
- Apply curing and protection of concrete.
- Strip formwork.
- Placing of any earthing wires around and over the base.
- Backfill base sides and place overburden.
- Confirm that cube results are satisfactory.
- Grout the top flange.

A method of construction for rock anchor Turbine Foundation is described as follows:

- Set out Turbine Foundations and required finish levels etc.
- Construct temporary coring drilling platform
- Drill cores for rock anchors to the required levels.
- Insert rock anchors and grout into position.
- Construct drainage as required.
- Provide a minimum of 100mm concrete blinding.
- Place bottom mat of steel reinforcing.
- Place free issue turbine base insert or anchor cage.
- Fix cable ducting and foundation earthing.
- Complete reinforcing steel.
- Fix shuttering to base sidewalls.
- Fix ducts and earthing wires between insert and walls of base.
- Carry out any corrective works as directed by Engineer.
- Check weather conditions and schedule concrete deliveries.
- Place concrete and take quality control slumps and cubes.
- Concrete surface finishing.
- Apply curing and protection of concrete.
- Strip formwork.

- Placing of any earthing wires around and over the base.
- Backfill base sides and place overburden.
- Confirm that cube results are satisfactory.
- Grout the top flange.

2.5.4 Access to the Site

The site access will be from a new entrance on the L6132 Gowerhass – Tullabrack road which continues west for 300m before joining the R483. The new entrance will allow abnormal load turbine delivery vehicles to safely access and exit the wind farm Site as well as achieve the required sightlines. This entrance will be used for delivery of both turbine components and building materials such as rock and concrete. The site entrance is shown on **Figure 2.3**.

It is proposed that the turbine nacelles, towers, hubs and rotor blades will be landed at the port of Foynes. Co. Limerick. From there, they will be transported to the Site via the N69 to the outskirts of Limerick city. Turbine blades may be carried from Foynes Port to the delivery site via the Shannon Tunnel (N18) but the larger / wider tower sections and generator / nacelle components will need to remain on the N69 via Dock road in Limerick City and cross the Shannon bridge on to the Condell road (R527) and Ennis road (R445) and join the N18 in the Ennis / Galway direction as far as Junction 12 of the N18 to join the N85 Ennis Distributor Road. After accessing the N85 distributor road the Turbine Delivery Route will access the N68 in the direction of Kilrush and then onto the L6132 east to the new site entrance 450 metres east of Tullabrack Cross. The L6132 may require localised temporary widening and verge strengthening along its length up to the junction with the N68 road at Derreen cross.

The delivery of the turbines will require co-ordination with a number of statutory bodies including Clare County Council, and An Garda Síochána. An agreed programme of work will be established in the Traffic Management Plan which will be prepared by the Contractor ahead of any construction work commencing on the wind farm Site. The proposed Turbine Delivery Route is shown on **Figure 2.4**.

2.5.5 Turbine Delivery Route Works

Road widening, verge strengthening and vertical realignment of the L6132 along its length up to the junction with the N68 road at Derreen cross is required to facilitate the delivery of turbine components using abnormal load vehicles. Road widening between Tullabrack Cross and the wind farm site entrance will be carried out to accommodate increased volumes of HGV vehicles associated with the construction of the wind farm. The road widening and verge strengthening are temporary works. The vertical realignment works are permanent.

The verge strengthening and widening of the L6132 will be carried out in the existing road verge to increase the running width of the L6132 local road to 4.5m. It will be constructed to withstand wheel loading from abnormal load vehicles delivering turbine components to the wind farm site. The works will involve excavating a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers.

There are three watercourse crossings along the L6132. At these three locations steel plates will be placed on the verge for 10m each side of watercourse crossings to avoid excavation and disturbance of the existing ground. Upon completion of the wind farm construction the L6132 verge will be reinstated by removing approximately 150mm of granular material from widened sections and replaced with topsoil, steel plates will also be removed from the verge at this stage.

Road widening works will be carried out in the existing road verge to increase the running width of the L6132 local road to 4.0m and 5.5m at passing locations. The works will involve excavating a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers.

Vertical realignment of the L6132 will be required at one location between the N68 and the wind farm site entrance. Realignment works will involve reducing the road level by approximately 150mm at an existing crest curve to reprofile the road for abnormal vehicles, maintain axle loading and prevent grounding. Realignment works will be carried out in the existing road boundary with surfacing to match the existing L6132. Realignment works at this location will remain in-situ following the construction of the wind farm.

All works along the TDR are assessed in **Chapter 16: Traffic and Transport** and shown on drawings attached as **Appendix 16.1**.

2.5.6 Construction Haul Route Works

Road widening between Tullabrack Cross and the wind farm site entrance will be carried out to accommodate the increased volumes of HGV vehicles associated with the construction phase of the wind farm. The road widening and verge strengthening are temporary works.

Road widening works will be carried out in the existing road verge to increase the running width of the L6132 local road to 4.0m and 5.5m at passing locations. The road widening will be constructed to withstand wheel loading from HGV delivery vehicles. The works will involve excavating a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers.

All works along the Construction Haul Route are assessed in **Chapter 16: Traffic and Transport** and shown on drawings attached as **Appendix 16.1**.

2.5.7 Site Access Tracks

The Site access tracks are necessary to allow access for cranes and delivery trucks during construction of the Development. Also, they will be used during any potential servicing/repairs to the wind turbines during the operational lifespan of the Development. A new entrance will be created on the L6132 Gowerhass – Tullabrack Cross road.

The Site access tracks will be upgraded and constructed so that the width will be 5m but will be wider at passing locations where a width of 5.5m is to be provided. The Development area is relatively flat in nature and maximum gradient on the Site will not exceed 5%. A stone layer will be provided so as to provide a good grip during wet weather on any inclines. Approximately 560m of the existing site access track length will be used for the Development. Site access tracks are shown on **Figure 1.2**. The upgraded Site access tracks will be approximately 2,800m^2 in surface area and will require approximately 1,120m^3 of stone material.

The site access track layout follows the existing access track into the Site as far as possible and follows the natural contours of the land, avoiding local environmental constraints. Every effort has been made to minimise the length of additional Site access tracks.

The Site access tracks will be upgraded to carry a minimum 12 tonne axle construction loading. The design will consist of 150mm of 50mm Down Quarried Rock / Gravel Pavement on an average of 400mm Down Crushed Run Rock. The proposed Site access track construction detail is shown in **Figure 2.5.**

There will also be 1,500m of new Site access tracks required for the Development. These will be constructed to provide a width of 5m and will cover an area of 7,500m^2 and require c.3,375m^3 of stone. At the Site entrance a 50m section of new Site access track will be excavated to firm bearing strata and constructed using stone imported to Site from a nearby quarry. The new Site access tracks across the remainder of the Site will be of a floating road construction type. Site access tracks across peat greater than 1m deep will be floated using layers of geosynthetic materials and aggregates. Site access tracks on peat less than 1m deep will generally be constructed using traditional cut and fill methodology. Stone won from the Turbine Foundation excavation areas, the on Site borrow pit area or imported to Site from a nearby quarry, as outlined in **Table 2.5** and **Chapter 16: Traffic and Trasport - Table 16.4**, will be utilised for the construction of floating roads.

The surface of the Site access tracks will have to be maintained during the construction phase. Harmful constituents such as hydrocarbons pose a risk of environmental contamination and also a risk to human health if found in drinking water sources. All imported stone to the Site will have undergone appropriate quality testing to Transport Infrastructure Ireland (TII) specifications.

Mitigation measures outlined in **Chapter 9: Hydrology and Hydrogeology - Section 9.5.2** and the **CEMP Appendix 2.1** will be implemented on site to prevent hydrocarbon release to the environment and potentially impacting water quality.

There are six watercourse crossings required for the Site access tracks. One river crossing (WCC2) will comprise a clear span bridge over a tributary of the Moyasta river. The remaining five no. water crossings (WCC 1, 3, 4, 5 and 6) are small streams or drainage channels on the Site. These water crossings will be constructed using precast bottomless culverts. Proposed crossing designs are shown on **Figures 2.6 (a), (b), (c) and (d)**. Further to consultation with Inland Fisheries Ireland (IFI), the watercourse crossing will be designed in accordance with detail shown in shown in **Figure 2.6**.

2.5.8 Met Mast

As part of the grid code[2] requirements, all wind farms with an installed capacity of greater than 10MW are required to supply continuous, real-time data for the wind farm location. The data required is the wind speed and wind direction at turbine hub height, air temperature and air pressure. The data required for the Project will be provided by a dedicated Met Mast of 82m in height (location as detailed in **Figure 1.1**).

The Met Mast will be located on the west of the Site as detailed in **Figure 1.2** and will be a free-standing lattice type structure as shown in **Figure 2.7**. The Met Mast foundation will be approximately 10m by 10m, with a depth of 3.0m. It will encompass a cast-in insert or bolts

[2] EirGrid (22 July 2005). EirGrid Grid Code Version 6

to connect to the bottom of the Met Mast and reinforced bar structural elements. The area around and above the foundation will be backfilled with compacted granular material. The Met Mast will be linked to the site Electrical Substation via buried Wind Farm Internal Cabling for power and communication; it will be required for the duration of the operational phase of the proposed wind farm Development.

2.5.9 Electrical Substation, Control Building and Associated Compound

It is proposed to construct an Electricity Substation on the Site, as shown on **Figure 1.2**. This will provide a connection point between the proposed wind farm and the existing grid connection at Tullabrack 110kV substation.

The Electrical substation will serve two main functions:

1) provide housing for switchgear, control equipment, monitoring equipment, and storage space necessary for the proper functioning of the wind farm; and
2) provide a substation for metering and for switchgear to connect to the national grid.

The construction of the substation and related electrical components will comply with ESBN specifications. The area of the substation compound will be approximately 1,171m^2 and the foundation will be up to 2.75m in depth and will be constructed from engineered stone material, using similar construction techniques as for the Turbine Hardstands. The overall compound will be enclosed by a 2.65m high fence and will contain one building, ancillary equipment, including the transformers, switch gear, fault protection, metering, car parking and other ancillary elements necessary for the operation of the Project.

The control building will be a single story pitched roof structure with traditional rendered finishes and measure approximately 17.49m x 7.33m with a floor area of approximately 128m^2. Details of the substation building are shown on **Figures 2.8 (a, b, c & d)**. The appearance and finish of the substation building will be similar to an agricultural building with a slated roof and nap plaster finish. It will have a footpath around it, and an adjacent parking area. The final finish of the control building will be an off-white or grey colour.

There will be two lightning monopole protection masts which will be approximately 17m in height and associated site works. Warning / health & safety signage will be displayed as is normal practice for such installations. Only motion-sensitive lighting will be used.

A telecommunication antenna will be fixed externally to the substation control building for communication and control purposes (e.g., for the Supervisory Control and Data

Acquisition (SCADA) System) for the Developer, turbine suppliers and ESB Networks. There will be a small area (122m^2) outside the compound, and adjacent to the access track, that will be a hard-surfaced for operational and maintenance and includes four parking spaces.

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2.5.10 Transformers and Internal Cabling

The power generated by each wind turbine will be transmitted via underground Wind Farm Internal Cabling to the new 38kV Electrical Substation also, the communications signal cabling will be installed in the same trench. The trenches will measure approximately 0.6m wide and one metre (1m) in depth. There will be approximately 1,950m of Wind Farm Internal Cable trenching (giving a surface area of approximately 1,170m^2). The electrical and fibre-optic cables running from the turbines to the substation compound will be run within the Site access tracks and/or their verges. The cable ducting will be installed to ESB Networks requirements specifications. A cross sectional drawing is shown in **Figure 2.9**.

The Wind Farm Internal Cabling routes will be bedded in surplus excavated soil material. Danger tape, incorporating a metallic strip, will be laid during backfilling. Where the Wind Farm Internal Cabling is to cross Site access tracks, suitable electrical ducting will be provided. Permanent posts up to approximately 0.5m in height will mark the trenches at regular intervals and at all changes in direction. An as-built layout plan showing the location of underground Wind Farm Internal Cabling will be on permanent display within the control building.

Clay plugs or concrete cut offs will be installed at regular intervals in the cable ducting trenches where they are located on slopes to prevent the trenches from becoming preferential flow paths for runoff from the Site.

Transformers will be located inside each turbine.

Excavated material will be stored uphill of the trench excavations which will prevent any sediments from being washed downhill. Silt fences will be installed down gradient of the excavations to prevent silt runoff.

2.5.11 Grid Connection Route (GCR)

Connection will be sought from the grid system operators by application to ESB Networks Limited. Ballykett Green Energy Limited has assessed a number of possible grid connection options for the Project. Following details assessment, it was concluded that a 1.84km 38kV connection to Tullabrack 110kV substation is the most optimal route, having considered environmental and commercial aspects; however this is subject to the substation having grid offtake capacity. The Grid Connection can be summarised as follows:

- Underground Cable (UGC) single 38kV circuit from Ballykett wind farm utilising sections of UGC primarily public roads, regional roads, and private lands to Tullabrack substation. [approx. 1.84km]

The Grid Connection Route (GCR) is shown in **Figure 2.10**, and **Appendix 2.2** contains a copy of the Grid Connection Route Assessment report undertaken by BFA Consulting.

The three conductors for the GCR will be laid in separate ducts as required by the ESBN functional specifications for 38kV Networks Ducting/Cabling (Minimum Standards). The 38kV cable trench with a trefoil formation will measure 600mm wide, and 1.22m deep. A separate duct will be provided within the trench for fibre optic communications. Refer to ESBN Cable ducting Specifications in **Appendix 2.2**.

The following is a summary of the main activities for the installation of ducts:

- All relevant stakeholders including ESB Networks Limited, Gas Networks Ireland, Eir, Clare County Council, and Uisce Éireann, will be contacted for up to date drawings regards all existing services to ensure the GCR works do not damage or interfere with them. This will be verified by the Contractor prior to excavations taking place.
- Immediately prior to construction taking place, the area where excavation is planned will be surveyed by CATSCAN (sub-surface survey technique to locate any below-ground utilities) and all existing services will be verified. Temporary warning signs will be erected.
- Clear and visible temporary safety signage will be erected all around the perimeter of the live work area to visibly warn members of the public of the hazards of ongoing construction works.
- A silt fencing filtration system will be installed on all existing drainage channels for the duration of the cable construction to prevent contamination of any watercourse see **Chapter 9: Hydrogeology and Hydrogeology - Section 9.5.2** and **Appendix 2.1 CEMP – Surface Water Management Plan.**
- A 13-tonne rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions of 600mm wide by 1.22m deep.
- Once the trench is excavated, a 50mm depth base layer of sand (in road trench) or 15 Newton CBM4 concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck into the trench.

- uPVC ducts will be installed on top of the compacted base layer material in the trench.
- Once the ducts are installed, couplers (a device used for joining pipes) will be fitted and capped to prevent any dirt entering the unjointed open end of the duct.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to record the exact location of the ducts.
- The co-ordinates will be plotted on as-built record drawings for the Grid Connection cable operational phase.
- When ducts have been installed in the correct position on the trench base layer, sand (in road trench) or Lean-mix CBM4 (CL1093) (off road trench) will be carefully installed in the trench around the ducts so as not to displace the duct and will be compacted.
- Timer spacer templates will be used during installation so that the correct cover of duct surround material is achieved above, below and at the sides of the duct in the trench.
- A red cable protection strip will be installed above duct surround layer of material and for the full length of the cable route.
- A layer of Lean-mix CBM4 (CL1093) (in road) will be installed on top of the duct surround material to a level 300mm below the finished surface level.
- Yellow marker warning tape will be installed for the full width of the trench, and for the full length of the cable route, 300mm from the finished surface level.
- The finished surface of the road will then be reinstated on a temporary basis to the requirements of the Guidelines for Managing Openings in Public Roads, 2017 (Department of Transport).
- When trenching and ducting is complete, the installation of the Grid Connection cable will commence between the Electrical Substation and the existing 110kV substation at Tullabrack.
- The underground cable will be pulled through the installed ducts from a cable drum set up at one joint bay and using a winch system which is set up at the next joint bay, the cable will be pulled through.
- The cables will be joined together within the precast concrete cable junction box (Joint Bay).
- The finished surface above each cable joint bay is reinstated on a permanent basis to the requirements of the *Guidelines for Managing Openings in Public Roads* (Department of Transport, 2017).

2.5.11.1 Joint Bays

Joint Bays are pre-cast concrete chambers where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay typically will be 6m long x 2.5m x 2.3m deep. A reinforced concreted slab will be constructed on top of the bay.

The joint bay locations have been dictated by suitable terrain and access to facilitate the operation of cable pulling equipment at any phase of the Project and future operation of the installation in accordance with the ESB Networks Limited specifications.

Communication chambers, which are similar to small manholes, will be installed at the joint bay locations to facilitate connection of fibre-optic communication cables.

2.5.11.2 Trench Layout

The trench layout will be as per the appropriate ESB Networks Ltd specifications. The specifications from Clare County Council will be followed for the excavation and reinstatement of the ducted cable trenches which is expected to be in accordance with the requirements of the *Guidelines for Managing Openings in Public Roads* (Department of Transport, 2017).

2.5.11.3 Joining Ducts

All joining ducts shall be laid in straight lines to even gradients. Once the ducts have been installed and backfilled with lean-mix concrete and with Clause 804 stone the duct run will be thoroughly cleaned by pulling the appropriate size of ESB Networks Ltd approved duct brush through the duct.

Details of the construction methodology are summarised below:

- Preparatory Works
  - Preparatory trial pit survey along the cable route
  - Access to the start point and setting out
  - Access to joint bays
  - Silt attenuation features and watercourse set back buffer
  - Joint Bay excavation
- Trenching Works
  - Storage of materials
  - Trench operations
  - Managing excess material from trench works

2.5.11.4 Directional Drilling Works

There are no watercourse crossings along the preferred GCR to Tullabrack 110kV substation. Therefore, no directional drilling work is anticipated.

2.5.12 Borrow Pit

A borrow pit is proposed to enable on-site stone extraction for the construction of part of the Site access tracks and the Turbine Hardstands. This will be located to the south of the site and is shown in **Figure 1.2.** Excavated soil and/or peat material will temporarily stockpiled in designated areas on-site, for re-use in site remediation works.

Rock breaking equipment will be employed for borrow pit stone extraction. This will involve the use of a 40-60 tonne 360-degree hydraulic excavator with a rock breaker. The rock breaker is supported by a smaller 30-40 tonne breaker which breaks the rock down to an appropriate size before it is fed into the rock crusher machine.

The broken-down rock will be loaded into an on-site mobile crusher using a wheeled loading shovel machine and crushed down into the correct grade for use in the civil construction of Site access tracks and Turbine Hardstands. If the borrow pit becomes exhausted or impractical to extract due to physical site constraints, then excess stone requirements will be imported from a nearby quarry as shown on **Figure 16.7**

2.5.13 Turbine Foundation Rock Breaking

Weaker rock will be extracted using a hydraulic excavator and a ripper. Upon the completion of further site investigations, where stronger rock is encountered and cannot be extracted using an excavator, then rock breaking equipment will be employed. This will involve the use of a 40-60 tonne 360-degree hydraulic excavator with a rock breaker attached and the foundation area will be deepened by the same process employed for the borrow pit area with broken down / crushed stone being made into the correct grade for use in the civil construction of Site access tracks and Turbine hardstands.

2.5.14 On-site Drainage

The surface water runoff contained within natural and artificial drainage channels includes stream and river waterbodies, drainage ditches, and other minor natural and artificial man-made drainage features. Drainage measures will be provided to attenuate runoff, guard against soil erosion, soil compaction, and safeguard local water quality. Details of the drainage system are shown on **Figure 2.11 - 2.13** and outlined in detail in the Surface Water Management Plan, part of the CEMP attached as **Appendix 2.1** and full details are provided in **Chapter 9: Hydrology and Hydrogeology.**

There are three watercourses within/ draining the Site i.e., the Moyasta (EPA Code: 27M04), Gowerhass (EPA code: 27G13) and Ballykett (EPA Code: 27B52). Within the Site watercourses have previously been modified to receive input from man-made arterial drains, are culverted beneath roads, or they have been altered to provide cattle access for drinking water. The preferred Grid Connection Route (GCR) connects the Site to the existing Tullabrack 110KV Substation and does not cross any watercourses. The Turbine Delivery Route (TDR) includes three watercourse crossings. The Tullagower River and the Brisla East Stream are located to the East of the Site and are part of the Doonbeg river catchment. The third crossing is on the Gowerhass, upstream of the Site and connected to the Moyasta catchment.

A buffer zone of at least 50m will be in place for the Moyasta River where possible, with the exception of the section of existing access track to be upgraded near the Moyasta River and for the six water-crossings onsite. Additional measure will be put in place for the limited works to be undertaken in the Buffer zone and are outlined in **Chapter 9: Hydrology and Hydrogeology - Section 9.5.2** and **Appendix 2.1 CEMP**. Other watercourses on site consist of manmade drainage channels and runoff channels, some of which are ephemeral. Sustainable Urban Drainage System (SuDS) principles will be employed. These are outlined in detail in **Appendix 2.1 CEMP – Surface Water Management Plan** and are as follows:

Source controls for surface water

- Interceptor drains, vee-drains, diversion drains, flume pipes, erosion and velocity control measures such as use of sandbags, oyster bags filled with gravel, filter fabrics, and other best practice systems.
- Small working areas, covering stockpiles with geotextiles layering to protect against water erosion and runoff in rainy weather, and/or cessation of works in certain areas such as working on a high gradient during wet and windy weather.

In-line controls for surface water

- In-line controls are directly applied to the surface water body, including interceptor drains, vee-drains, oversized swales, erosion and velocity control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt bags, silt fences, sedimats, filter fabrics, and collection sumps, temporary sumps/attenuation lagoons, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other best practice systems.

Treatment systems for surface water:

- Temporary sumps and attenuation ponds, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Silt busters and/or other similar/equivalent or appropriate systems.
- When heavy rainfall is predicted, then works will be suspended or scaled back.

Further details on drainage management and mitigation can be found in **Chapter 9: Hydrology and Hydrogeology** and the Surface Water Management Plan attached as **Appendix 2.1.**

2.5.15 Key Project Infrastructure Metrics

The key project infrastructure metrics are summarised in **Table 2.6** and provides a reference for the reader(s) of this EIAR.

Table 2.6: Key Project Infrastructure Metrics

Description	Length [m]	Width [m]	Depth [m]	No.	Approximate Area [m^2]
New & Upgraded Site Access Track (Floated)	2,060	5	0	1	10,300
New Site access track (Excavated) site entrance	-	-	3.5	1	591
Vertical realignment of a section of the L6132	40	3	0.15	-	120
Temporary Verge Strengthening	5,160	1	0.75	-	5,160
Temporary Road Widening	-	-	0.45	-	526
Internal Cabling (power & communications)	1,950	0.6	1.0	1	1,170
Turbine Hardstands – cranes	-	-	2.0 – 2.75	4	11,080
Secondary Crane Areas	-	-	0.8	4	1,160
Turbine Foundations (25.8m diameter)	-	-	3.4	4	2,092
Turning Heads	-	-	2	1	625
Met Mast foundation	10	10	3.0	1	100
Met Mast Hardstand	-	-	0.75	1	38
Electrical Substation	-	-	2.75	1	1,171
Site Compound	43	30	0.3	1	1,290

Description	Length [m]	Width [m]	Depth [m]	No.	Approximate Area [m^2]
Blade Handover Area	-	-	-	1	3,980
Blade Laydown Areas	-	-	-	8	69
Grid Connection	1,840	0.6	1.22	1	1,104
Borrow Pit	-	-	2.69*	1	12,000

**The borrow pit will be dug out to 2.69m and the material will be stored up to 3.19m (2.69m below ground level and 0.5m above ground level allowing 32,400m³ for spoil storage.*

Taking the above figures into consideration, the permanent land take from the Project will be 27,157m^2 which is the sum of the figures above which are to be retained following construction e.g., Site access tracks, Turbine Foundations, Met Mast foundation, Turbine Hardstands, Met Mast hardstand and Electrical Substation. Temporary landtake areas withing the Site will be 18,509m^2.

The GCR will involve works on 1,104m^2 of area on the public roads, to be reinstated following the laying of the ducts and so is classed as temporary land take. The works along the TDR (5,806m^2) are also considered temporary land take. Therefore, the total land take required for the Project will be approximately 6.0ha.

The expected volume of spoil to be generated is approximately 54,259m^3. For further detail on the calculation of spoil volumes see Appendix 2.1 CEMP – Peat Spoil Management Plan.

2.5.16 Site Signage

Signs will be placed on the R483 showing directions to the Site. Additional signage will be placed on the R483 and L6132 road, for road safety, warning of construction vehicles entering and egressing the Site. Signs will be placed on the N68 on approach to the junction with the L6132 warning of vehicles turning. The Site entrance off the L6132 road will have a sign confirming that it is the entrance to the Site and the speed limit of 30km/h will apply within the Site. There will also be additional signs during the construction phase confirming that construction works are taking place and proper precautions must be taken by anyone entering the Site. There will be no entry to unauthorised persons or the general public during construction. Additional details can be found in **Section 13.6**.

2.5.17 Peat and Spoil Management

2.5.17.1 Spoil Quantities

The quantities of spoil likely to be generated at the Project have been calculated by Jennings O'Donovan & Partners. It is estimated that based on site surveys carried out by RSK Minerex using peat probes that the amount of spoil predicted to be generated during construction of the wind farm is approximately 54,259m^3. See Appendix 2.1 CEMP – Peat Spoil Management Plan for details on the calculation of spoil volumes and how spoil will be managed on site.

2.5.17.2 Landscaping & Reinstatement

Peat excavated during the construction works will be used to reinstate exposed areas around infrastructure such as slopes/graded ground around Site access tracks and Turbine Hardstands and on the Turbine Foundations or where there is degraded cutaway bog that can be infilled by carefully depositing peat within.

Excavated peat will be used to reinstate the borrow pit on Site or stored in the designated spoil storage area next to the site entrance. The borrow pit will be used to store spoil to a height of approximately 3.19m (0.5m above ground level and 2.69m below ground level) and cover an area of approximately 12,000m^2. The borrow pit will store approximately 38,280m^3 of spoil material. Works at the excavated peat spoil storage areas will involve the machinery similar to that used for peat excavation. A 40-60 tonne 360-degree long reach hydraulic excavator and tractors and trailers will be used to place the peat spoil in areas. There will be a temporary spoil storage area of approximately 6,000m^2 created next to the borrow pit which will allow for the storage of spoil while the borrow pit is being excavated. This will store spoil to a height of up to 2m. The borrow pit will be excavated and reinstated to 50% and then the second 50% will be excavated and reinstated. At the permanent spoil storage area next to the site entrance cells will be created for the placement of spoil. This area has an area of 12,000m^2 and it is proposed that peat spoil can be stored up to 2m high which equates to the storage of approximately 24,000m^3 of capacity for peat storage. This area will be topped with the excavated top surface layer of acrotelm peat to encourage rapid revegetation. Cells will be created for the placement of spoil in this area. The cells will measure approximately 45m x 60m and have outfalls blocked and overflow management with the creation of drainage channels for excess water and sphagnum inoculation. More information can be found in **Chapter 6: Biodiversity** and **Chapter 8: Soils and Geology**.

2.5.17.3 Non-Peat Spoil

Non-peat spoil will consist of surplus glacial till gleys and bedrock / crushed stone, won on-site. The Project design makes provision for all the non-peat material won on Site to be used as fill (on Site) in the following places:

- Subsoil to be used around the blade laydown areas where load capacities required are less; and
- Rock won from excavations to be used within Site access track and Turbine Hardstand build up.

There will also be spoil generated from the grid connection works (1,347m^3). Some of this will be in the form of tarmacdam/asphalt, Clause 804 running layer material, compacted rock fill material and subsoils. Spoil generated from works along public roadways (1,185m^3) will be disposed of at a licensed waste facility. The remaining peat spoil (162m^3) from grid works not located in public roads will be disposed in the designated spoil storage areas.

2.6 CONSTRUCTION

The first phase of the Project will comprise the construction phase. This phase will begin with site preparation works and will be completed when the turbines are ready for commissioning, and when all wastes have been removed from the Site. For this Project, it is anticipated that the construction phase will last approximately 20 - 28 weeks. An indicative construction programme is set out at **Table 2.7**.

Table 2.7: Indicative Construction Programme

Proposed Works	Timetable
Mobilise on Site	1
Construction of L6132 site entrance	1-2
Construction of Temporary Construction Compound	1-2
Construction of floating Site access roads leading to the borrow pit	2-8
Clause 804 material for surfacing Site access tracks, Turbine Hardstands and staging area	6-10
Construction of 0.4km road widening (site entrance to Tullabrack Cross)	2-8
Construction of L6132 verge strengthening on Turbine Delivery Route 5.6km (site entrance to N68)	8-16
Site drainage and fencing	8-16
Ready mix concrete for Turbine Foundations	12-20
Steel reinforcement for Turbine Foundations	8-16

Proposed Works	Timetable
Foundation bolts	8-16
Substation building materials	8-20
Electrical switchgear	20-38
Electrical cables	4-20
Grid Connection works	20-28
Wind turbine components	20-28
Crane	20
Reinstatement and demobilisation	28-40

2.6.1 Construction and Environmental Management Plan (CEMP)

A CEMP is appended to the EIAR in **Appendix 2.1**. The CEMP includes all the mitigation measures proposed within the EIAR. A Summary of the mitigation measures is included in **Appendix 17.1**.

In the event planning is granted for the Development, the CEMP provides a commitment to mitigation and monitoring, and reduces the risk of pollution whilst improving the sustainable management of resources. The environmental commitments of the Project will be managed through the CEMP and will be secured in contract documentation and arrangements for construction and later phases, such that there will be a robust mechanism in place for their implementation. The CEMP addresses the construction phase, and will be continued through to the commissioning, operation and final Decommissioning phases (refer to Decommissioning Plan in **Appendix 2.1**).

An Ecological Clerk of Works (ECoW) with experience in overseeing wind farm construction projects will be appointed by the Developer for the duration of the construction phase so that the CEMP is effectively implemented. The contractor will be required to appoint an Environmental Manager.

2.6.2 Refuelling

Vehicles will be refuelled off-site where possible. For vehicles that require being refuelled on-site, fuels will be stored in the Temporary Construction Compound and bunded to at least 110% of the storage capacity of fuels to be stored. Refuelling will take place via a mobile double skinned fuel bowser. The bowser will be a double axel refuelling trailer which will be towed to the refuelling locations by a 4x4 vehicle. The 4x4 will carry a drip tray, spill kit and absorbent mats in case of any accidental spillages. Only designated competent personnel will refuel plant and machinery on the Site.

2.6.3 Concrete

There will be no concrete batching on the Site. Instead, it will be transported to the Site as it is required. A dedicated, bunded area will be created to cater for concrete wash-out and this will be within the Temporary Construction Compound located north of the site entrance. This will be for the wash-out of the chutes only after the pour. Concrete trucks will then exit the Site and return to the supply plant to wash out the mixer itself.

The main concrete pours at the turbine locations will be planned in advance and proposed mitigation measures (are detailed in **Chapter 9: Hydrology and Hydrogeology**) will be as follows:

- Avoiding large concrete pours, for Turbine Foundations for example, on days when temperatures are not optimal as per (BS 8110) (EN1992-1-2) or when heavy or prolonged rainfall is forecast i.e., during a period in which a Met Éireann Status Yellow, Orange or Red weather event has been notified.
- Providing that all concrete pour areas are dewatered prior to pouring concrete and while the concrete is curing.
- Making covers available so that areas can be covered if heavy rain arrives during the curing process which will prevent runoff of concrete which has a high pH.

The chutes wash out on-site will require a small volume of water. This water will be directed to the concrete washout area which will be a temporary lined impermeable containment area or a siltbuster type washout unit[3] or similar. The unit catches solid concrete and filters and contains the washout liquid for pH adjustment and solid separation. The residual liquids and sediments will be disposed of at an appropriately licenced facility, namely Kilrush Wastewater Treatment Plant.

If a temporary lined impermeable containment area is used, these are usually constructed using straw bales and lined with an impermeable geotextile membrane. An example is shown on **Plate 2.1**. An alternative construction method would be to dig a hole in the ground and place an impermeable geotextile membrane in the hole so that no wastewater can penetrate the cover and seep into the soil and groundwater.

[3] https://www.siltbuster.co.uk/solutions/concrete-washwater/

Plate 2.1: Typical Temporary Concrete Washout Area

The washout area is covered when not in use during periods when wet weather is forecast to prevent ponding of rainwater. During periods of dry weather the area can be left uncovered to allow evaporation of water. Once concrete pours have been completed, the remaining water will be tankered off site to a licenced facility for disposal. Solid concrete remnants will be disposed of at an EPA waste licenced facility. It can be estimated that there will be approximately 1-2m^3 of solid concrete waste per Turbine Foundation pour that will need to be disposed of, or a maximum of 8m^3 in total in the case of Ballykett Wind Farm.

The Turbine Foundations will be left in-situ during the Project decommissioning and so will not require breaking up and disposal.

Deliveries of concrete for Turbine Foundation construction are generally carried out outside of normal working hours to limit impacts on traffic and local road users. Each turbine pour can take place in a single day, so over four days for this Project.

Further measures that will be used to mitigate the risk of pollution from concrete pours are as follows:

- The concrete trucks will not be washed out on Site but will be washed out on return to the batching plant.
- Site access tracks will be constructed so that all concrete trucks will be able to access all areas of Site with ease and no concrete will be transported around the Site on open trailers or dumpers to avoid the risk of spillages.

- All concrete for the Turbine Foundations will be pumped directly into the shuttered formwork with rebars from the delivery vehicle. If this is not possible, the concrete can be pumped into a hydraulic concrete pump or into an excavator bucket for transfer to the required location.
- The Traffic Management Plan (**Chapter 16: Traffic and Transport – Appendix 16.2**) will specify the exact routes and arrangements for concrete delivery as well as outlining emergency measures to be taken.
- Signage will be erected near concrete pour areas to advise drivers that concrete washout on site is not permitted.

2.6.4 Dust Suppression

During periods of dry and windy weather, there is potential for dust to become friable and cause nuisance to nearby residences and users of the local road network. Damping down (wetting of the surface) may be required to see that dust does not become friable. A wheel cleaning facility will be employed on-site where mud and debris will be removed from vehicles egressing the Site and reduce mud and debris from getting onto the local road network. In particular the L6132 and the R483, by which all traffic to the Project will access the Site. Road debris could dry out, become friable and potentially cause a nuisance. HGVs entering the Site carrying rock will be covered to prevent dust generation. A road sweeper will be available for use on the approach roads to the Project in case of any mud or debris making it onto the public road network.

2.6.5 Construction Hours

It is estimated that the Project will have approximately 35 construction workers during the construction phase, increasing to 50 at peak construction. Working hours for construction will be from 07:00 to 19:00 on weekdays, with reduced working hours at weekends, from 08:00 to 16.30 on a Saturday. No work will be carried out on Sundays or Public Holidays.

It should be noted that during the turbine erection phase, operations will need to take place outside those hours to facilitate Turbine Foundation construction and so that lifting operations are completed safely. Hours of working for Turbine Foundation construction will be agreed with Clare County Council prior to the commencement of Turbine Foundation construction. A detailed Traffic Management Plan ("TMP") will be implemented for the construction phase, which shall be agreed during the planning (compliance) stage with the Clare County Council, to ensure controls as described herein are in place with all suppliers coming to the Site.

2.6.6 Construction Compound and Temporary Works Area

The Temporary Construction Compound will be set up upon commencement of the construction phase. The proposed location for the Temporary Construction Compound is south of the site entrance as shown in **Figure 1.2** and the layout is shown in **Figure 2.14**. The compound will be 43m by 30m and approximately 0.3m in depth [1,290m^2 / 387m^3]. The compound will be used as a secure storage area for construction materials and to contain temporary site accommodation units for sealed type staff welfare facilities. It will contain cabins for offices space, meeting rooms, canteen area, a drying room, parking facilities, and similar personnel type facilities.

An area within the compound will be used for the storage of fuel and oils and this will be suitably bunded and the bund will be lined with an impermeable membrane in order to prevent any contamination of the surrounding soils, vegetation and water table. Double protection containers / equipment will be used along with drip trays and details are included in the CEMP.

During the construction phase, water will be supplied by a water bowser. The maximum wastewater production is estimated to be the same as the maximum water consumption (up to 2,000 litres per day).

The Project will include an enclosed wastewater management system at the temporary compound capable of handling the demand during the construction phase with 50 construction workers on site at peak. A holding tank is proposed for wastewater management. Wastewater which will be removed off-site and disposed of at Kilrush Wastewater treatment plant.

2.6.7 Construction of Turbine Hardstands and Foundations

The construction method for all the Turbine Hardstands will be via excavated approach. Each Turbine Hardstand will have a surface area of 2,770m^2 for the main hardstand and with a secondary crane area of 290m^2. Foundations will be taken down to competent bearing strata by excavating through the soil, subsoil, and rock if necessary.

The method of construction for turbine foundation is also described below:

- Install temporary drainage around perimeter of excavation
- Excavate soil and rock
- Form a level working area to build foundation
- Install formwork and reinforcement

- Pour concrete
- Cure concrete
- Once the concrete has set and the earthing system is in place, backfill the foundation with rock
- Use soil to build up the area around the turbine base

2.6.8 Construction Turbine Assembly

Once on Site, the wind turbine components will follow an approved route to minimise manoeuvring. Components will be placed on Turbine Hardstands prior to assembly. It is proposed that a 'just in time' delivery strategy will be in place for turbine blades to reduce the need for temporary set down areas. Typically, one large crane (750-1,000 tonnes) will be required for erecting the turbines, assisted by a smaller crane (150-200 tonnes). Similar cranes will also be required for maintenance during the operational phase. As with all other vehicles, refuelling of cranes will be carried out in accordance with site procedures to minimise the risk of spillage or pollution.

The towers will be delivered in sections, and work on assembly will not start until a suitable weather window is available, e.g., 10-minute average wind speed of less than $8ms^{-1}$. The bottom tower section will be bolted onto the concrete foundations. The mid tower section will then be lifted into position and bolted to the bottom tower section. Finally, the top tower section will be lifted into position and bolted to the mid tower section. The nacelle, hub and blades are assembled and installed in accordance with the turbine supplier's specific procedure.

2.6.9 Construction Traffic

It is estimated that during civil construction, approximately 2,472 loads (4,944 movements) will be delivered to Site or take waste material from the main wind farm site to an EPA licensed waste facility. This breaks down to approximately 25 loads per month. The peak number of deliveries per day will occur during the concrete pour for Turbine Foundation construction. An estimated 75 (assuming a capacity of $8m^3$) concrete truck deliveries will be required per Turbine Foundation. Some other materials will also be delivered on such days, so a realistic estimation of peak deliveries is approximately 50 to 75 deliveries per day (for at least 4 separate days in the construction programme when the Turbine Foundations will be poured).

Prior to construction commencing on site, a Traffic Management Plan (TMP) will be developed by the contractor and submitted to Clare County Council for agreement. This

Plan will contain details of all proposed signage and temporary traffic control measures on the R483 and the L6132 Gowerhass/Tullabrack West road, as well as warning of the entrance to the construction Site/wind farm.

2.6.10 Construction and Management of Site Drainage

Drainage measures will be implemented to the Project to attenuate runoff, guard against soil erosion, soil compaction, and safeguard local water quality. Details of the proposed drainage system are shown on **Figure 2.11** to **Figure 2.13**. Please note that the drainage plan will be subject to a detailed design process at pre-construction phase but will conform to the parameters set out in the EIAR. Full details are provided in **Chapter 9: Hydrology and Hydrogeology**.

Further details on drainage management and mitigation can be found in **Chapter 9: Hydrology and Hydrogeology Section 9.5.2** and **Appendix 2.1 CEMP – Surface Water Management Plan**.

2.6.11 Watercourse Crossings

There are six watercourse crossings required for the Site access tracks, see **Chapter 9: Hydrology and Hydrogeology** - **Figure 9.2a**. One river crossing (WCC2) will comprise a clear span bridge over a tributary of the Moyasta river. The remaining five no. water crossings (WCC 1, 3, 4, 5 and 6) are small streams or drainage channels on the Site. These water crossings will be constructed using precast bottomless culverts. Proposed crossing designs are shown on **Figures 2.6 (a), (b), (c) and (d)**.

2.6.12 Reinstatement and Monitoring

Following completion of construction, all plant and machinery will be removed from the Site. The temporary works areas needed for the construction period such as blade laydown areas, will be reinstated using the excavated material removed and stockpiled on site.

Stockpiles will be restricted to less than 2m in height and located outside of the surface water buffer zones. All stockpiling locations will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW). The public road infrastructure comprising the GCR will be reinstated to its original condition. However, joint bays installed in the public road infrastructure will remain in-situ. Joint bays within the Site will be reinstated as per the *Forestry Road Manual: Guidelines for the Design, Construction And Management Of Forest Road* (COFORD, 2004), and as per private landowner reinstatement requirements.

All rubbish and waste/excess materials will be removed from Site to an appropriate EPA licenced facility from where it will be reused/recycled or disposed of accordingly.

Peat and spoil materials excavated during construction of the infrastructure will be used to reinstate any areas of temporary infrastructure such as blade laydown areas and for landscaping around infrastructure such as Turbine Hardstands and Site access tracks. Peat turves will be removed in layers with the vegetated side up. The top vegetated turves will be placed on top of reinstated/ restored areas so that the turves can 'knit' together effectively to form areas of restored peatland habitat in accordance with the Biodiversity Enhancement and Management Plan (see **Appendix 6.6**.)

The on-site installed drainage network will be left in place. This will be periodically monitored to see that it is operating to its stated design purpose. Water monitoring on nearby natural watercourses will be undertaken during and post construction to determine if any pollution has migrated off-site, and if so, measures will be implemented to rectify the impact which will be agreed with Inland Fisheries Ireland (IFI).

2.6.13 Construction Supervision and Monitoring

The construction activities will be monitored by a Geotechnical Engineer, a qualified archaeologist and an Ecological Clerk of Works (ECoW). A Geotechnical Engineer will be contracted for the detailed design phase and their services retained throughout the construction and reinstatement phases. They will oversee all earthworks and excavation activities and monitor for issues such as ground stability, water ingress into excavations etc.

The ECoW will be employed prior to the commencement of the construction phase and will monitor the working corridor (the area inside which construction works and plant and equipment manoeuvring will take place). Additionally, they will review the pollution control measures and working practices during construction and have input into the Site Reinstatement. The ECoW will have the authority to stop work if, for example, a sensitive habitat feature is encroached upon, or there is the possibility of silt/pollution runoff to natural watercourses.

The potential exists for the presence of unrecorded, sub-surface archaeological features within green field locations in proposed construction areas within the Site. A series of pre-construction and construction phase archaeological investigations under licence by the National Monuments Service will be carried out by a suitably qualified archaeologist. The archaeologist will have responsibility for providing that potential archaeological features are protected should any be discovered during excavations. If any potential archaeological features are discovered, the archaeologist will inform the National Monuments Service (NMS). The site will be accessible to the appointed archaeologist at all times during working hours and the nominated archaeologist will monitor all invasive works.

In the event that any sub-surface archaeological remains are identified during Site investigations, they will be cleaned, recorded and left to remain *in situ* within cordoned off areas while the National Monuments Service are notified and consulted in relation to appropriate future mitigation strategies, which may entail preservation *in situ* by avoidance or preservation by record by archaeological excavations.

Regular weekly inspections of the installed drainage system will be undertaken, especially after heavy rainfall events, to check blockages and see that there is no build-up of standing water in any part of the system where is it not designed to be. A report will be produced monthly during the construction phase detailing the results of the water quality monitoring. The results will be available on site for audits and will be submitted to Clare County Council

Excess build-up of silt will be removed at check dams, attenuation/settlement ponds or any other drainage feature by scraper or excavator and under the supervision of the ECoW.

During the construction phase, field testing and laboratory analysis of a range of parameters with relevant regulatory limits and Environmental Quality Standards (EQSs) will be undertaken upstream and downstream of the construction works, and specifically following heavy rainfall events (i.e., weekly, monthly and event based).

Once the contractor has been appointed, the CEMP will be updated to take into account conditions imposed by the planning permission, and any additional mitigation required. This will set out the proposed Site organisation, sequencing of works, methodologies, mitigation measures (including these outlined above) and monitoring measures.

Daily monitoring of excavations by the Geotechnical Engineer will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped and a geotechnical assessment undertaken.

Local roads R483 and L6132 used to transport construction materials will be monitored during construction, so that any damage caused by construction traffic associated with the Project can be identified and repaired promptly, depending on the level of damage /

inconvenience, to avoid issues for other road users. Where necessary, rock will be sourced from a local quarry and concrete may be sourced from nearby supplier. This is assessed in **Chapter 16: Traffic and Transportation**.

2.6.14 Construction Sequencing

An indicative sequence for the construction phase is as follows:

1. Temporary Construction Compound
2. Site preparation
3. Site access tracks
4. Turbine Hardstands
5. Turbine Foundations
6. Wind Farm Internal Cabling
7. Installation of the Grid Connection
8. Erection of wind turbines
9. Commissioning and energisation

The Electrical Substation will be constructed in parallel with Turbine Hardstands, Turbine Foundations and Wind Farm Internal Cabling. The first step will be to construct the Temporary Construction Compound. Access to the area will be via the new site entrance off the L6132. The next step will be to prepare the areas of the Site where site infrastructure is to be located by marking out the construction works corridor and the relevant environmental buffer zones as required.

Following the Site preparation, the Site access tracks and associated drainage will be constructed according to the turbine manufacturer specifications. The next step will involve construction of the four Turbine Hardstand areas according to the turbine manufacturer specifications. The Turbine Foundations can then be excavated and constructed using reinforcing bar (rebar) and imported concrete. No concrete batching will take place on Site.

Following the construction of the Turbine Foundations, the Wind Farm Internal Cabling from the turbine locations to the Electrical Substation will be laid in trenches along, or in the constructed Site access tracks. The GCR will be constructed from the Site by underground cable duct for a length of 1.84km to Tullabrack 110kV ESBN substation as outlined in **Section 2.5.10 and 2.5.11**.

The last step will be to erect the four wind turbines on the foundations using two cranes. Commissioning and testing of the turbines can then proceed.

2.6.15 Construction Employment

It is estimated that approximately 35 construction workers will be employed on-site with this number increasing to up to 50 during the peak period of Turbine Foundation construction.

2.7 COMMISSIONING

Wind farm commissioning can take approximately two months to complete from the erection of the final turbine to the commercial exportation of power to the national grid. It involves commissioning engineers working through an entire schedule of SCADA (Supervisory Control and Data Acquisition) and electrical and mechanical testing and control measures to check that the wind farm will perform and export power to the national grid, as designed.

2.8 AERONAUTICAL LIGHTING

The Irish Aviation Authority (IAA) will be consulted and upon request, any specified turbine or obstacle 100m or greater have a warning light system installed, under direct specification and in accordance with International Civil Aviation Organisation (ICAO) Annex 15 requirements.

It is proposed to fix a warning light to two of the wind turbines. The following data will be supplied to the IAA:

- The WGS84 coordinates (In degrees, minutes and seconds) for each turbine.
- Height above ground level (to blade tip) and elevation above mean sea level (to blade tip) in both meters and feet.
- Horizontal extent (rotor diameter) of turbines and blade length where applicable in both meters and feet.
- Lighting of the wind farm, which turbine(s) is/are lit, and what type of lighting.

2.9 OPERATION AND MAINTENANCE

During the operation of the wind farm, the turbine manufacturer, the wind farm operator, or a service company will carry out regular maintenance of the turbines. In addition, operation and monitoring activities will be carried out remotely with the aid of computers connected via a telephone broadband link. Routine inspection and preventative maintenance visits will be necessary to provide for the smooth and efficient running of the wind farm and Electrical Substation.

2.10 DECOMMISSIONING

The Developer is seeking consent for a period of 35 years. At the end of that time period, cranes of similar size to those used for construction will be used to disassemble each turbine using the same Turbine Hardstands. The towers, blades and all components will then be removed from Site and reused, recycled, or disposed of in a suitably licensed facility. The turbine transformers will also be removed from Site. There is potential to reuse turbine components, while others can be recycled.

Underground cables will be removed while the ducting will be left in-situ. The foundations will remain in-situ, apart from the above ground sections.

Hardstand areas will be remediated to match the existing landscape as closely as possible. Access tracks will be left in-situ.

Any structural materials suitable for recycling will be disposed of in an appropriate manner. The financial costs of Decommissioning, at current material values, will be more than met by the recycling value of the turbine components.

Prior to wind turbine removal, due consideration will be given to any potential impacts arising from these operations. Some of the potential issues could include:

- Potential disturbance by the presence of cranes, HGVs, and personnel on-site;
- On-site temporary compound would need to be located appropriately; and/or
- Time of year and timescale to be outside sensitive periods.

Prior to the Decommissioning work, a comprehensive plan will be drawn up that takes account of the findings of this EIAR and the contemporary best practice at that time, to manage and control the component removal and ground reinstatement.

3 ALTERNATIVES CONSIDERED

3.1 INTRODUCTION

This chapter of the Environmental Impact Assessment Report (EIAR) provides a description of the reasonable alternatives examined by the Developer, which are relevant to the Project and its specific characteristics. It includes summary of the main reasons for the option chosen, taking into account the effects of the Project on the EIAR Study Area/ surrounding environment. Alternatives were assessed taking key environmental commercial, construction, and operational constraints into consideration.

3.2 STATEMENT OF AUTHORITY

This chapter has been prepared Jennings O'Donovan & Partners Limited. It was prepared by Ms Shirley Bradley and was reviewed by Sarah Moore. Author qualifications and experience are detailed in Appendix 1.1 and outlined below.

Sarah Moore is an Environmental Scientist in JOD with over 17 years of environmental consultancy experience. She has obtained a MSc in Environmental Engineering from Queens University, Belfast, and a BSc in Environmental Science from University of Limerick. Since joining JOD, Sarah has been involved as a Project Environmental Scientist on a range of renewable energy, wastewater, structures and commercial projects. She has experience in the preparation of Appropriate Assessments, Ecological Impact Assessments, Environmental Impact Assessments and Geographic Information Systems.

Ms. Shirley Bradley is a Graduate Environmental Scientist with a First-Class Honours Degree (BSc. Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities are in report writing, assisting Senior Consultants and GIS.

3.3 METHODOLOGY

3.3.1 Requirements for Alternatives Assessment

Article 5(1) of the Environmental Impact Assessment of Projects Directive 20211/92/EU as amended by Directive 2014/52/EU (EIA Directive) requires:

"Where an environmental impact assessment is required, the developer shall prepare and submit an environmental impact assessment report. The information to be provided by the developer shall include at least: ...

(d) a description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment".

Annex IV of the EIA Directive (Information Referred to in Article 5(1) (Information for the Environmental Impact Assessment Report) states that:
"… 2. A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of environmental effects".

In 2022, the Environmental Protection Agency (EPA) published the 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (2022 EPA Guidelines), which states that *"it is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on the selected option".*

The EPA guidance documents on EIAR preparation[1] [2], stipulate the following:
"The presentation and consideration of the various alternatives investigated by the applicant is an important requirement of the EIA process… And the alternatives can include:

- *a 'do-nothing' alternative (where appropriate);*
- *alternative locations;*
- *alternative layouts;*
- *alternative designs;*
- *alternative processes*; and
- *alternative mitigation measures*."

As stated in the 2022 EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports:

> The objective is for the Developer to present a representative range of the practicable alternatives considered. The alternatives should be described with 'an indication of the main reasons for selecting the chosen option. It is generally sufficient to provide a broad description of each main alternative and the key issues associated with each, showing how environmental considerations were taken into account in deciding on

[1] EPA. (2002). Guidelines on the information to be contained in Environmental Impact Statements.
[2] EPA. (2022). Guidelines on the information to be contained in Environmental Impact Assessment Reports.

the selected option. A detailed assessment (or 'mini-EIA') of each alternative is not required[3].

In an effective EIA process, different types of alternatives may be considered at several key stages during the process. As environmental issues emerge during the preparation of the EIAR, alternative designs may need to be considered early in the process or alternative mitigation options may need to be considered towards the end of the process. These various levels of alternatives are set out in this, **Chapter 3**, of the EIAR.

Taking the legislative and guidance requirements into account, this chapter addresses alternatives under the following headings:

- 'Do Nothing' alternative
- Strategic site selection
- Alternative turbine numbers and specifications
- Alternative layout and design
- Alternative transport route and Site access
- Alternative Grid Connection
- Alternative mitigation measures

When considering a wind farm Development, given the intrinsic link between layout and design, the two will be considered together in this chapter.

3.3.2 Approach to Alternatives

The Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017) states that reasonable alternatives *"must be relevant to the proposed project and its specific characteristics, and resources should only be spent on assessing these alternatives"* and *that "the selection of alternatives is limited in terms of feasibility. On the one hand, an alternative should not be ruled out simply because it would cause inconvenience or cost to the Developer. At the same time, if an alternative is very expensive or technically or legally difficult, it would be unreasonable to consider it to be a feasible alternative"*.

3.4 'DO-NOTHING' ALTERNATIVE

Annex IV, Point 3 of the EIA Directive requires a "*...description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution*

[3] Ref CJEU Case 461/17.

thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge". This is referred to as the "do nothing" alternative. The Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (European Commission, 2017) states that this should involve the assessment of "an outline of what is likely to happen to the environment should the Project not be implemented – the so-called 'do-nothing' scenario."

Ireland has adopted binding agreements to reduce dependency on fossil fuels and increase energy production from sustainable sources, creating a requirement for the nation to transition to a low carbon economy. The binding EU targets have been transposed into Irish National Policy in the 2023 Climate Action Plan which focuses up to 9 GW future electricity production on the onshore wind energy sector accounting for 80% of the share of electricity demand by 2030 together with offshore wind (5GW) and solar (8GW). This demonstrates the significance of wind energy in the Irish energy context and highlights the need for the proposed Ballykett Wind Farm in reaching both EU and national renewable energy targets.

Ireland is obliged to ensure that 32% of the total energy consumed in heating, electricity and transport is generated from renewable resources by 2030 and reduce its greenhouse gas emissions by at least 55% by 2030, relative to its 1990 levels, with an overall objective of carbon neutrality by 2050. This is in order to help reduce the nation's CO_2 emissions and to promote the use of indigenous renewable sources of energy. These targets have been incorporated into national policy in the Climate Action Plan (2023) which aims to:

- Reduce CO_2 eq. emissions from the electricity sector by 62-81%.
- Deliver an early and complete phase-out of coal - and peat - fired electricity generation. (Note although peat-fired electricity generation has ceased in Ireland, coal and oil-fired plants are still operational. Tarbert Power Station (620 MW) was scheduled to close by 2023, and Moneypoint Power Station (915 MW) was scheduled to close by 2025. These dates have been delayed arising from concerns about security of electricity supply. The delays mean that more carbon emissions will arise. It highlights the urgency of constructing this and other wind farms.
- Increase electricity generated from renewable sources to 80%, indicatively comprised of up to 9 GW onshore wind energy by 2030.

Furthermore, the Climate Action and Low Carbon Development (Amendment) Act (2021) will act to reduce 51% emissions over a ten-year period to 2030, in line with the programme for Government which commits to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieving net zero emissions by 2050.

Under a 'Do Nothing' alternative, The Development will not be constructed. The land upon which the Development would occur would remain unchanged. Consequently, the environmental impacts, identified in the EIAR, positive and negative, would not occur. However, in the "Do-Nothing" scenario, the prospect of creating sustainable energy through County Clare's wind energy resource would be lost at this Site. Part of the Site around T4 has been used for turbary activities and this practice may be continued in a 'do nothing' scenario. Conifer plantation would continue on the Site at T1, T2 and T3 in a 'do nothing' scenario.

The nation's ability to produce sustainable energy and reduce greenhouse gas emissions to meet EU targets and national targets, as set out above, would be stifled. This may result in the nation incurring significant financial penalties from the EU if targets are not achieved.

The Development has the potential to prevent approximately between 10,234 and 12,792 tonnes of CO_2 emissions per annum, or between 358,176 and 477,720 tonnes of CO_2 emissions will be displaced over the proposed 35-year lifetime of the wind farm, see **Chapter 12: Air and Climate** for details on the Carbon Calculator method. This would otherwise be released to the atmosphere through the burning of fossil fuels in the "Do-Nothing" scenario. This would result in continued global warming and fail to limit warming as agreed to in the Paris Agreement to the United Nations Framework Convention on Climate Change (2015). This will result in continued negative impacts to air quality and climate.

According to EirGrid Group's All-island Generation Capacity Statement 2021 – 2030 (EirGrid, 2021), the growth in energy demand for the next ten years on the Island of Ireland will be between 18% and 43%. In the 'Do-nothing' scenario, importation of fossil fuels to maintain growing energy supply will continue and Ireland's energy security will remain vulnerable. A "Do-nothing" scenario would contribute to the strain on existing energy production and may impact on economic growth if energy demand cannot be met. The delay in closing Tarbert and Moneypoint means we continue to rely on imported fossil-fuels with unpredictable pricing, a vulnerable supply chain and higher carbon emissions.

Under the "Do-Nothing" scenario, the socio-economic benefits associated with the Development will be lost. These benefits include approximately 35 No. jobs during the construction phase of the project, and between 6 and 8 long-term jobs once operational[4]. Furthermore, under the "Do-Nothing" scenario the local community will not benefit economically from the community benefit fund associated with the Development which could be used to improve physical and social infrastructure within the vicinity of the Project.

The potential environmental effects of the 'Do-Nothing' Alternative when compared against the choice of developing a renewable energy project at this Site are presented in **Table 3.1**. Refer to each respective chapter for full details of residual impacts.

Table 3.1: Environmental effects of 'Do-Nothing' compared with a wind farm development

Criteria	Residual Impact of the Project	Do-Nothing Alternatives
Population & Human Health (incl. Shadow Flicker)	Long-term positive economic benefit to local area due to job creation and Community Benefit Fund.	No increase in local employment and no financial gains for the local community. No potential for shadow flicker to affect sensitive receptors.5
Terrestrial Ecology	Moderate positive impact with increase in area of unplanted cutover bog. Moderate negative impact of loss of cutover bog at T4.	Main land use on site, namely afforestation, will continue, with future harvesting and replanting according to the forest cycle. The cutover bog on site could be subject to future turbary.
Aquatic Ecology	Neutral	If the Development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'Do-Nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site subject to the continuation of current activities and practices.
Ornithology	The predicted effects during the construction phase by loss of cutover bog habitat can be reduced to Not Significant with the implementation of the	Without the proposed wind farm Development proceeding, it is expected that the present mainland uses on Site, namely forestry and turbary will continue.

[4] According to SEAI, there are approximately 0.34 new long-term jobs per MW
[5] It should be noted that it is proposed to have shadow flicker detection systems on the turbines which would shut them down when shadow flicker is predicted and therefore, there will be no shadow flicker effects from the Development in any case.

Criteria	Residual Impact of the Project	Do-Nothing Alternatives
	Habitat Enhancement Plan and, in the long-term, potentially Positive as a larger area of cutover bog will be available for important species such as meadow pipit.	It is possible that further afforestation would occur on the Site in the future.
Soils & Geology	Imperceptible residual impact following implementation of mitigation measures	Should the proposed Development not proceed, the existing land-use practices will continue with associated modification of the existing environment., including the underlying soils and geology through commercial forestry.
Hydrology & Hydrogeology	Non-significant impacts following implementations of mitigation measures.	Should the proposed Development not proceed, the existing land-use practice of commercial afforestation activities will continue with associated gradual alteration of the existing environment and associated pressures on surface water and groundwater quality.
Air & Climate	Slight to moderate temporary localised residual impacts arising from fugitive dust emissions during construction. Long-term positive impact on air quality and climate due to avoidance of burning of fossil fuels and the net displacement of between 10,233 & 12,792 of CO2 per annum.	There will be no increase in air quality or a reduction of greenhouse gas emissions. By the Development not proceeding, it will not assist in achieving the renewable energy targets set out in the Climate Action Plan 2023. Fossil fuel power stations will be the primary alternative to provide the required quantities of electricity resulting in greenhouse gas and other air pollutant emissions.
Noise	Non-significant to slight temporary noise impacts associated with construction activities. Temporary moderate impact along the grid route at certain dwellings during construction. Long-term slight to moderate negative impact on the dwellings	Neutral.

Criteria	Residual Impact of the Project	Do-Nothing Alternatives
	closest to the project as a result of the operational phase.	
Landscape & Visual	Aside from design iterations, which are embedded in the assessed project, other specific landscape and visual mitigation measures are not considered necessary/ likely to be effective. Thus, the impacts are assessed in Chapter 11 Landscape and Visual. It is not considered that there will be any significant effects arising from the proposed Ballykett Wind Farm.	The receiving landscape stays in the same or similar condition as it currently is.
Material Assets	Positive impact by offsetting use of fossil fuel. Positive impact due to provisions of electrical infrastructure. No significant effects from waste. Slight negative effect on natural resources in the area.	Neutral
Cultural Heritage	Slight-moderate indirect visual impacts on nearby monuments. No residual impacts envisaged that cannot be reversed following Decommissioning.	Neutral
Traffic and Transport	Slight to minor localised short-term impact due to construction and Decommissioning activities.	No potential for increased traffic during construction.

3.5 STRATEGIC SITE SELECTION

3.5.1 Project Site requirements

The Developer (i.e., described in Chapter 1 Introduction) carried out an initial mapping exercise to identify candidate sites for wind energy development. The purpose of the site identification exercise was to identify an area that would be capable of accommodating a wind farm development while minimising the potential for adverse effects on the environment. To satisfy this requirement, a significant landholding that would yield a sufficient viable area for each element of the Development was required.

The Developer considered suitable sites based on designations in the County Development Plan. The area near the Site in the Kilrush area of West Clare was considered suitable for a wind farm due to zoning, wind regime and proximity to grid connection options. The initial constraints assessment considerably reduced the area available for potential development. There are two existing wind farms in the area, Tullabrack Wind Farm and Ballykett Wind Farm. The area between these two wind farms was considered to maintain the turbines in a cluster. However, on further assessment, this site was not considered suitable for development of a wind farm due to areas of deep peat and a large number of turbary rights making it difficult to negotiate with landowners and holders of turbary rights.

The wind energy designations map of the Clare County Development plan, Volume 5: Clare Wind Energy Strategy 2023 to 2029[6] was used as the basis for the screening. The Developer was also looking for areas close to existing wind farms in the area with good access to the national grid and to maintain the turbines in a cluster. Areas close to existing wind farms in areas classed as 'Open to Consideration' were examined using a GIS exercise applying a 600m buffer around sensitive receptors, namely, houses. The 600m buffer was derived from the Draft Revised Wind Energy Development Guidelines (Department of Housing, Local Government and Heritage, 2019) which stipulates a setback of four times turbine tip height being appropriate. The setback criteria was applied both to existing residences and to sites with planning permission granted by Clare County Council but not yet constructed. The exercise was then extended using a wide array of key spatial datasets such as ordnance survey land data, house location data, transport, forestry data, existing wind energy and grid infrastructure data and environmental data such as ecological designations and landscape designations. Having considered all of the constraints identified within the study exercise the final site selection was determined by those sites with a significant landholding capable of accommodating a feasible wind farm development while minimising the potential for adverse effects to the surrounding environment.

Study Areas not selected for further study were largely excluded because of some or all of the following:

- County Development Plan Zone
- Wind Resource
- Designated European Sites
- Tourism
- Ornithology

[6] https://clarecdp2023-2029.clarecoco.ie/stage3-amendments/adoption/volume-5-clare-renewable-strategy-clare-county-development-plan-2023-2029-51389.pdf

- Grid Risk
- Planning Precedence
- Terrain / Land Use
- Housing Density

This exercise identified only two potentially viable areas in the Kilrush region close to the existing Ballykett and Tullabrack Wind Farms after the initial screening as outlined above. These sites were also deemed suitable due to the proximity of substations from which any proposed wind farms could connect to the national grid, the existing Tullabrack 110kV substation and the existing Moneypoint 400kV ESBN substation approximately 3.6km southeast of Kilrush. The sites are not located in, or close to, any European designations such as Special Protection Areas (SPA) or Special Areas of Conservation (SAC) or significant hydrological or geotechnical considerations. The sites are the proposed Ballykett Wind Farm (the Development) and another area approximately 3km to the west. **Figure 3.1** shows the proposed Site in relation to the existing Ballykett and Tullabrack Wind Farms. The other potential wind farm site (Moanmore South) is located c. 3km to the west of the Site.

Lands between the existing two wind farms were also considered for development. However, this area was deemed not suitable due to extensive deep peat deposits, making it difficult to develop. Also, there are longstanding, and fragmented turbary rights on these lands.

Residential and commercial building locations were attained from Eircode's database of 2.2 million address points in Ireland. A buffer of 600m was applied to each building point, ensuring an adequate setback distance from each dwelling ensuring compliance with the draft Wind Energy Guidelines (DOHLG,2019). As the feasibility studies progressed, this dwelling setback distance was further refined to comply with project and area specific details. It is noteworthy that the Developer's GIS screening process identified other areas that warranted further study and some areas were not considered for further study due to constraints.

The proposed Ballykett Wind Farm site is located approximately 3km northeast of Kilrush. The region is situated within *Farming Rolling Hills* landscape character area and is located in an area designated as 'Open to Consideration'. wind farm development.

3.5.2 Preliminary Constraints Mapping and Landscape Study

Constraints mapping was carried out at the preliminary stage of the project (Q3-Q4 2022) for the selected Site. The constraints mapping process involved the placing of buffers around different types of constraints to identify the areas within which no development works could take place. A description of the constraints and buffers applied are outlined in **Section 3.8.1**. As a result of examining the site constraints, the proposed development at Ballykett will have four wind turbines.

3.5.3 Suitability of the Candidate Site

It is critical for the Developer and their project team to ensure the most suitable site for development of a proposed wind farm is identified and progressed through planning due to the financial commitments involved i.e., the cost of building each megawatt (MW) of electricity-generating capacity in a wind farm is in the region of €1.8 million to €2.0 million.

The site selection process for the current proposal has been fully informed by national, regional and local policy constraints at a macro level as well as site specific constraints that influence the turbine layout and project design on site at a micro level. The main policy, planning and environmental considerations for the selection of a potential wind farm site include:

- Site location relative to the Clare County Wind Energy Strategy's classification of areas considered suitable for wind farm development from a planning policy perspective
- Access to the national electricity grid possible within a viable distance
- Located outside areas designated for protection of ecological species and habitats including European Designated Sites
- Located predominantly within an existing commercial forestry which allows the site to take advantage of existing access roads
- Consistently high average annual wind speeds; Low population density; and Visual Amenity

3.5.3.1 Clare County Development Plan (CDP) 2017-2023

The CDP 2017-2023 has been replaced by the CDP 2023-2029 and the policies of the new CDP are outlined below. When alternatives were initially being considered, the CDP 2017-2023 was in force and so details of the plan have been included here. In the Wind Energy Strategy that accompanies the CDP, proposed Site is in an area classed as 'Open to Consideration' for wind energy development.

County Development Plan Goals, Policies and Objectives

The CDP has the following goals:

"Goal IX A County Clare with diverse and strong rural communities and economy, where its natural resources are harnessed in a manner that is compatible with the sensitivity of rural areas and the existing quality of life."

"Goal XVII A County Clare that is resilient to climate change, manages flood risk, facilitates a low carbon future, supports energy efficiency and conservation and enables the decarbonisation of our lifestyles and economy."

The CDP 2017-2023 has the following Objectives:

CDP6.17 Development Plan Objective: Energy Supply – *"It is an objective of the Development Plan: To contribute to the economic development and enhanced employment opportunities in the County by:*

A. A Facilitating the development of a self-sustaining, secure, reliable and efficient renewable energy supply and storage for the County;
B. B Enabling the County to become a leader in the production of sustainable and renewable energy for national and international consumption through research, technology development and innovation."

CDP6.17 Development Plan Objective: Energy Supply – "*It is an objective of the Development Plan: To contribute to the economic development and enhanced employment opportunities in the County by:*

A. Facilitating the development of a self-sustaining, secure, reliable and efficient renewable energy supply and storage for the County;
B. *Enabling the County to become a leader in the production of sustainable and renewable energy for national and international consumption through research, technology development and innovation."*

CDP6.18 Development Plan Objective: Green Technology – *"It is an objective of the Development Plan: To support the development of low carbon and green tech businesses and industries throughout the County."*

CDP8.38 Development Plan Objective: Electricity Networks "*It is an objective of Clare County Council:*

a) To facilitate improvements in energy infrastructure and encourage the expansion of the infrastructure within the County;

b) *To facilitate future alternative renewable energy developments and associated utility infrastructure throughout the County;*

c) *To collaborate with Eirgrid to facilitate the delivery of quality connection, transmission and market services to electricity generators, suppliers and customers utilising the high voltage electricity system in County Clare;*

d) *To collaborate with Eirgrid over the lifetime of the Plan to ensure that the County's minimum target of 966MW renewable energy generation is achieved and can be accommodated on the electricity network in County Clare;*

e) *To have regard to environmental and visual considerations in the assessment of developments of this nature."*

CDP8.40 Development Plan Objective: Renewable Energy "It is an objective of the Development Plan:

a) *To encourage and to favourably consider proposals for renewable energy developments and ancillary facilities in order to meet national, regional and County renewable energy targets, and to facilitate a reduction in CO 2 emissions and the promotion of a low carbon economy;*

b) *To assess future renewable energy-related development proposals having regard to the Clare Renewable Energy Strategy 2017-2023;*

c) *To assess proposals for wind energy development and associated infrastructure having regard to the Clare Wind Energy Strategy and the associated SEA and AA, or any subsequent updated adopted strategy;*

d) *To prepare an updated Wind Energy Strategy for County Clare during the lifetime of this Development Plan;*

e) *To strike an appropriate balance between facilitating renewable and wind energy related development and protecting the residential amenities of neighbouring properties;*

f) *To support and facilitate the development of new alternatives and technological advances in relation to renewable energy production and storage, that may emerge over the lifetime of this Plan;*

g) *To ensure that all proposals for renewable energy developments and ancillary facilities in the County are in full compliance with the requirements of the SEA and Habitats Directives and Objective CDP2.1;*

h) *To promote and market the County as a leader of renewable energy provision;*

i) *To support the implementation of 'Ireland's Transition to a Low Carbon Energy Economy 2015-2030'."*

CDP 10.11 Development Plan Objective: Renewable Energy Development:

"It is an objective of the Development Plan: To facilitate the development of renewable energy developments in rural areas in accordance with the adopted Clare Wind Energy Strategy and Renewable Energy Strategy and the associated SEA and NIR (and any subsequent strategies)."

3.5.3.2 Clare County Development Plan (CDP) 2023-2029

In the Wind Energy Strategy that accompanies the CDP, proposed Site is in an area classified as 'Open to Consideration' for wind energy development. The Strategic Environmental Assessment (SEA) Environmental Report was also consulted.

The relevant objectives of the WES of the CDP are as follows:

- To develop a Wind Energy Strategy having regard to the Wind Energy Development Guidelines, Guidelines for Planning Authorities (DoEHLG, 2006) (the Planning Guidelines issued by the Department of Environment, Heritage, and Local Government).
- To more closely align the County's wind generation policy to the existing wind energy resources.
- To support a planned approach to wind energy development in County Clare predicated on the optimal harnessing of the County's wind energy resource, and at a minimum, requiring that 40% of the County's electricity needs can be met from wind farms.
- To identify strategic areas for wind energy development of Regional and National importance.
- To recommend that a working target of 550 MW of wind energy is harnessed in County Clare, to enable the County to make the initial steps toward a low carbon economy by 2020.
- To support County Clare in reducing the CO_2 emissions associated with energy production, as identified in the Limerick Clare Climate Change Strategy (Limerick Clare Energy Agency 2006) and subsequent Mid-West Regional Climate Change Strategy (2008).
- To promote economic development through wind energy and other renewables in the County, underpinning the need for energy security, the promotion and establishment of a low carbon economy and the development of green business within the County.
- To ensure the production of wind energy is consistent with and takes account of nature conservation and environmental legislation and targets, including the conservation and protection of the Designated Natura 2000 sites in the County.

Relevant general objectives for wind energy developments are as follows:

- WES One: Development of Renewable Energy Generation
  It is the objective of the Council to support, in principle and in appropriate scales and locations, the development of wind energy resources in County Clare. It is an objective of the Council to ensure the security of energy supply by accommodating the development of wind energy resources in appropriate areas and at appropriate scales within the County.
- WES Four: Response to National Policy
  The White Paper on Energy has set a target of 40% of electricity to be generated from renewable sources by 2020. In the Mid-West Regional Climate Change Strategy, County Clare is identified as having a potential 600MW energy produced from renewables by 2020. Clare County Council will aim to achieve a minimum target of 550MW from wind energy by the conclusion of this Strategy.
- WES Six: Infrastructure Development Proposals
  Proposals for the development of infrastructure for the production, storage and distribution of electricity through the harnessing of wind energy will be considered in appropriate sites and locations, subject to relevant policy, legislation and environmental considerations.
- WES Ten: 'Open to Consideration
  Wind energy applications in these areas will be evaluated on a case-by-case basis subject to viable wind speeds, environmental resources and constraints and cumulative impacts.

The objectives of the Council in relation to wind energy are as follows:

CDP2.16 - It is an objective of Clare County Council: a) To support and encourage the development of community owned energy initiatives at appropriate locations across the County; b) To support communities seeking designation as 'Sustainable Energy Communities'; and c) To explore the potential of designating Shannon Town Centre as a 'Sustainable Energy Community' during the lifetime of the Plan.

CDP6.17 - It is an objective of Clare County Council: a) To contribute to the economic development and enhanced employment opportunities in the county by: i) Enabling the development of a self-sustaining, secure, reliable and efficient renewable energy supply and storage for the County in line with CDP Objective 3.1; ii) Facilitating the county to become a leader in the production of sustainable and renewable energy for national and international consumption through research, technology development and innovation; and iii) Supporting on-land and off-shore renewable energy production by a range of appropriate technologies in line with CDP Objective 3.1.

3.5.3.3 National Grid Connection

The proposed development site at Ballykett is located within 3km of the existing Tullabrack 110kV substation and there are 110kV overhead lines that cross the northern part of the Site. Additionally, the Site is also located within approximately 9km of the Moneypoint 400kV station to the south. Therefore, a wind energy development at this location has a number of route options to enable connection to the national electricity grid.

3.5.3.4 Designated Sites

The Site is not located within any area designated for ecological protection. The nearest Natura 2000 site, i.e., Special Area of Conservation (SAC) or Special Protection Area (SPA) is River Shannon and River Fergus Estuaries SPA and the Lower River Shannon SAC 4.7m southwest of the Site at the nearest point. The Site is located within the Shannon Estuary North Catchment [WFD Catchment ID 27, Sub Catchment ID 27_4, Wood_SC_010].

3.5.3.5 Wind Speeds

The Irish Wind Atlas produced by Sustainable Energy Ireland shows average wind speeds for the country. With the geographic location of the landscape close to the western seaboard, the Wind Atlas shows that wind speeds on the Site are consistent with a wind farm development (6.4m/sec at 30m, 7.9m/sec at 75m, 8.4m/sec at 100m and 9.1m/sec at 150m/s).

3.5.3.6 Population Density

The applicants sought to identify an area with a relatively low population density. Having reviewed the settlement patterns in the vicinity of the Site, the study area has emerged as suitable to accommodate the proposal. The population density of the EIAR Study Area (as described in the **Chapter 5: Population and Human Health**) is 2.9 persons per square kilometre. This is significantly lower than the average national population density of 68.1 persons per square kilometre.

3.5.3.7 Summary

From the review of the criteria set out above, the Site was identified as a suitable location for the provision of a wind farm of the scale proposed (i.e. four turbine layout). The Site is located predominantly within existing commercial forestry which allows the Site to take advantage of some existing access tracks (which will be upgraded), this when combined with the proximity to the existing Tullabrack 110kV substation further highlights the suitability of the Site as it can make further sustainable use of these established infrastructure elements.

The Site does not overlap with any environmental designations i.e., is not located in any Natura 2000 designated site, or other nature designations. Also, it is located in an area with a relatively low population density with appropriate annual wind speeds.

The purpose of the site identification process was to identify an area that would be capable of accommodating a wind farm development while minimising the potential for adverse effect(s) on the environment. To satisfy this requirement, a significant landholding that would yield a sufficient viable area for the siting of each element of the Development was required.

3.6 ALTERNATIVE RENEWABLE ENERGY TECHNOLOGIES

Forestry and agriculture will continue to be carried out on the Site around the footprint of Development. The only reasonable alternative source of renewable energy considered for Site following its identification was solar energy. Commercial solar energy production is the harnessing and conversion of sunlight into electricity using photovoltaic arrays (panels). The capacity factor of solar energy is significantly lower than that of onshore wind energy, requiring approximately three times the capacity of the Development (c.60MW) to produce the same amount of energy. Solar farms require 1.6-2 hectares per MW, the land area required would be in the region of 32 to 40 hectares for a 20MW solar farm. This compared to a wind turbine footprint of c. 2.74ha for the four proposed turbines and associated infrastructure. **Table 3.2** outlines the potential impact from the development of a solar photovoltaic array when compared with wind energy development.

Table 3.2: Environmental Effects from a Solar Photovoltaic Array Compared to a Wind Farm Development

Criteria	Solar Photovoltaic	Wind farm
Population & Human Health (incl. Shadow Flicker)	No potential for shadow flicker to affect sensitive receptors.	No glint and glare impacts on local road users.
Biodiversity	Larger development footprint would result in greater habitat loss.	Smaller development footprint resulting in less habitat loss.
Ornithology	Potential for mimicry of sensory cues i.e., glint and glare similar to water. No risk of collision from turbines, however	No potential for mimicry of sensory cues i.e., glint and glare similar to water. Collision risk from turbines

Criteria	Solar Photovoltaic	Wind farm
Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated. Shallower excavations involved in solar PV array development would decrease the potential for peat instability.	Smaller footprint would result in lower volumes of peat and spoil to be excavated.
Hydrology & Hydrogeology	Requires a larger development footprint therefore increasing the potential for silt laden runoff to enter receiving watercourses.	Smaller development footprint therefore reducing the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	Reduced capacity factor of solar PV array technology would result in a longer carbon payback period.	Larger output capacity (MEC) for wind farm results in a shorter carbon payback period when compared with solar farms.
Noise	No potential for operational noise impacts on nearby sensitive receptors.	Potential for operational noise impacts on nearby sensitive receptors.
Material Assets	The larger development footprint will have a greater impact on the land use (Forestry and Agriculture) of the Site.	Smaller development footprint will have less impact on the land use (Forestry and Agriculture) of the Site.
Landscape & Visual	Less visible from surrounding area due to screening from forestry and topography.	Wind turbines are visible from surrounding area
Cultural Heritage	Neutral	Neutral
Traffic & Transport	Potential for more traffic volume during construction phase.	Less traffic during construction phase.

3.7 ALTERNATIVE TURBINE NUMBERS AND SPECIFICATIONS

The proposed wind turbines will have a potential power output in the 4-5MW range. It is proposed to install four turbines which could achieve up to 20MW output. A wind farm with the same potential power output could also be achieved on the Site by using smaller turbines (for example 2.5MW machines). However, this would necessitate the installation of approximately 8 turbines to achieve a similar output. Furthermore, the use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the Site.

A larger number of smaller turbines would result in the wind farm occupying a greater footprint within the Site, with a larger amount of supporting infrastructure being required (i.e., hardstands etc.) and increasing the potential for environmental impacts to occur. The proposed number of turbines takes account of all Site constraints and the distances to be maintained between turbines and features such as roads and houses, while maximising the wind energy potential of the Site. The four turbine layout selected has the smallest development footprint, while still achieving the optimum output at a more consistent level than would be achievable using different turbines.

The turbine model to be installed on the Site will be the subject of a competitive tendering process. For the purposes of the EIA assessments, a Vestas V136 (4.5MW) turbine has been chosen. Vestas V150 turbines were also considered during the design stages but were not considered as suitable for the site. The maximum height of the turbines that will be installed on site will have an overall ground to blade tip height of 150 metres.

A comparison of the potential environmental effects of the installation of a larger number of smaller wind turbines when compared against the chosen option of installing a smaller number of larger wind turbines are presented in **Table 3.3**.

Table 3.3: Environmental Effects from a Large Number of Smaller Wind Turbines Compared to the proposed Development

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	More turbines would increase the potential for shadow flicker impacts on nearby sensitive receptors.
Biodiversity	A larger development (i.e. more turbines) footprint would result in greater habitat loss.
Ornithology	The presence of more turbines would increase the potential collision risk for birds.
Soils & Geology	Larger development footprint would result in greater volumes of peat and spoil to be excavated.
Hydrology & Hydrogeology	The larger development footprint would increase the potential for silt laden runoff to enter receiving watercourses.
Air & Climate	More turbines would result in an increased potential for more vehicle, and dust emissions due to an increased volume of construction material and turbine component deliveries to the Site.
Noise	More turbines would potentially increase noise impacts on nearby sensitive receptors.
Material Assets	More turbines would potentially increase impact on existing telecommunication links traversing the Site.

Criteria	Comment
Landscape & Visual	A larger number of turbines would have a greater visual impact.
Cultural Heritage	Larger development footprint would increase the potential for impacts on unrecorded, subsurface archaeology including on the archaeological setting in the landscape.
Traffic and Transport	Potential for greater traffic volumes during construction phase due to larger development footprint and requirement for more construction materials and turbine components.

3.8 ALTERNATIVE LAYOUT AND DESIGN

The design of the Development has been informed by the designers, developers, engineers, landowners, environmental, hydrological and geotechnical, archaeological specialists, telecommunication specialists, and traffic consultants. The aim of this is to reduce potential for environmental effects while designing a project capable of being constructed and viable. Throughout the preparation of the EIAR, the layout of the Development has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout. The design process has also taken account of the recommendations and comments of the relevant statutory and non-statutory organisations, the local community and local authorities as detailed in **Chapter 1: Introduction, Section 1.10** and in **Appendix 1.3** of this EIAR.

3.8.1 Constraints Led Approach

The design and layout of the Development follows the recommendations and industry guidelines set out in the 'Wind Energy Development Guidelines' (Department of the Environment, Heritage and Local Government, 2006), 'Best Practice Guidelines for the Irish Wind Energy Industry' (Irish Wind Energy Association, 2012) and the Draft Revised Wind Energy Development Guidelines, December 2019 (Draft Wind Energy Guidelines 2019). The layout and design were an iterative process which followed the constraints-led design approach.

The constraints-led design approach consists of the identification of environmental sensitivities within the Site by the design team with a view to identifying suitable areas in which wind turbines may be located. The resulting area is known as the 'developable area'.

The constraints identification process included the gathering of information through detailed desk-based assessments, field surveys and consultation. Sensitive receptors were mapped, and the design constraints were applied. Setback buffers were placed around different types of constraints to clearly identify the areas within which no Development works will take place. The size of the buffer zone for each constraint has been assigned using guidance presented in the Wind Energy Development Guidelines (Department of the Environment, Heritage and Local Government, 2006) and other relevant Best Practice standards, which are identified in each chapter of this EIAR. The proposed setbacks comply with the Draft Wind Energy Guidelines 2019 requirements.

The constraints map for the Site, as shown in **Figure 3.2** encompasses the following constraints and associated buffers:

- 600m buffer of residential dwellings (exceeding the requirement for a four times the tip height separation distance from the curtilage of properties in line with the new draft guidelines)
- Operator specific buffer of Telecommunication Links
- 50m buffer of Watercourses (apart from crossing locations)
- 100m buffer of Archaeological Sites or Monuments

This demonstrates the avoidance of significant impacts on the receiving environment through mitigation by design.

The Site layout design builds on the existing site characteristics and includes the following:

- Available lands for Development
- Separation distance from landowners not involved in the Project
- Distance from designated sites
- Good wind resource
- Existing access points and general accessibility of all areas of the Site due to existing road infrastructure
- Avoidance of environmental constraints identified from desk studies

The inclusion of the constraints on a map of the Study Area allowed for a viable development area to be identified. An initial turbine layout was then developed to take account of all the constraints mentioned above, their associated buffer zones and the separation distance required between the turbines.

Following the mapping of all known constraints, detailed site investigations were carried out by the project team. The ecological assessments of the Site encompassed habitat mapping and extensive surveying of birds and other fauna. These assessments, as described in **Chapter 6: Biodiversity** and **Chapter 7: Aquatic Ecology**, were used to inform the selection of the optimal siting of turbines and associated infrastructure works (e.g. construction of access tracks.)

Similarly, the hydrological and geotechnical investigations of the Site informed the proposed locations for turbines, access tracks and other components of the Development, such as the substation and the construction compound. This included peat depth and peat stability analysis (**Chapter 8: Soils and Geology and Appendix 8.1 Peat Stability Impact Assessment**) and the identification of watercourses, groundwater constraints, flood risk and wells (**Chapter 9: Hydrology and Hydrogeology**). Where specific areas were deemed as unsuitable (e.g., unstable peat giving high risk for slippage) for the siting of turbines or roads, etc., alternative locations were proposed and assessed, taking into account the areas that were already ruled out of consideration. The turbine layout for the proposed wind farm has also been informed by wind data which has been collected from a lidar measurement and the results of noise assessments as they became available.

3.8.2 Turbine Layout

The final proposed turbine layout of the Development takes account of all site constraints and the distances to be maintained between turbines and from houses, roads, etc. The layout is based on the results of all site investigations that have been carried out during the EIAR process. As information regarding the Site was compiled and assessed, the number of turbines and the proposed layout have been revised and amended to take account of the physical constraints of the Site. The requirement for buffer zones and other areas in which no turbines could be located was also compiled and assessed. The selection of turbine number and layout has had regard to wind-take, noise and shadow flicker impacts and the separation distance to be maintained between turbines.

The wind farm design process and related EIAR were an iterative process. Findings at each stage of the assessment were used to further refine the design, always focused on minimising the potential for environmental effects. The development of the final proposed wind farm layout reflects the findings, and recommendations from a range of site surveys and assessments in addition to ongoing negotiation and discussions with the landowners. There were several reviews of the specific locations of the various turbines during the optimisation of the Site layout. The initial constraints study identified a significant viable area, suitable for four turbines. The initial turbine layout, shown in **Figure 3.3** occupied the viable area within the wider Study Area. However, the proposed turbine locations were refined following feedback from the project team, the Developer, and telecommunications providers who have links running through the Site. The final turbine layout is considered optimal because the alternative, earlier iterations of the layout had the potential for greater environmental effects.

The first iteration of the turbine layout, shown in **Figure 3.3**, refined the four turbine layout. It involved repositioning all turbine locations to achieve setback for turbine T2 outside the fresnal zone of the telecommunications links, and greater separation distances between turbines and residential dwellings. This layout was refined with relatively minor movements of turbine positions and access track alignments following a design team workshop and feedback from ongoing environmental studies. The Site access was changed from the creation of a new entrance on the R483 to a new entrance on the local road (L6132) to the north of the Site.

It was also at this point that the boundary of the Site for the purposes of the EIAR was defined. The initial boundary was amended to focus on the final iteration of the layout and proposed entrance and access route and to include part of the Turbine Delivery Route. The final proposed turbine layout as presented in **Figure 1.2** takes account of all Site constraints (e.g. ecology, ornithology, hydrology, peat depths etc.) and design constraints (e.g. setback distances from houses and third-party lands/infrastructure and distances between turbines on-site etc.). The layout also takes account of the results of all Site investigations and baseline assessments that have been carried out during the EIAR process. A comparison of the potential environmental effects of the layout as presented in the initial iteration when compared against the final layout are presented in **Table 3.4**.

Table 3.4: Environmental Effects from Initial to Final Layout

Criteria	Initial Layout (Figure 3.3)	Final Layout (Figure 1.2)
Population & Human Health (incl. Shadow Flicker)	No material environmental difference for population or human health.	No material environmental difference for population or human health.
Biodiversity	No significant environmental effects	No significant environmental effects
Ornithology	No significant environmental effects	No significant environmental effects
Soils & Geology	Slight increase in the volume of peat and spoil to be managed.	This layout was amended following initial geotechnical investigations to reduce areas of deep peat and reduce the

Criteria	Initial Layout (Figure 3.3)	Final Layout (Figure 1.2)
		volume of peat and spoil to be managed.
Hydrology & Hydrogeology	Longer length of access track in or near hydrological buffer increases potential for silt laden runoff to watercourses.	Less access track from site entrance in hydrological buffer zone.
Air & Climate	Neutral	Neutral
Noise	Neutral	Neutral
Material Assets	Potential for impact to existing telecoms links traversing the Site.	Neutral
Landscape & Visual	Neutral	Neutral
Cultural Heritage	Neutral	Neutral
Traffic and Transport	New entrance onto busy Regional Road	New entrance onto relatively quiet local road.

3.8.3 Site Access Track Layout

Site access tracks are required to enable transport of infrastructure and construction materials within the Site. Tracks must be of a sufficient gradient and width to allow safe movement of equipment and vehicles. It was decided during the initial design of the Development existing roads would be utilised where possible to minimise the potential for impacts by constructing new tracks as an alternative. This has meant that where possible, the proposed access tracks have followed the existing forestry/turbary access tracks on Site.

At the outset it was planned to reuse as much of the existing access tracks on the Site as possible to reduce effects on habitats. There is an existing track on the western side of the Site which allows access to the forestry and the turbary plots further east and also an existing track on the eastern side of the Site which allows access to the turbary plots. These access tracks are in poor condition and only suitable for a tractor or tracked vehicles in their current state. Therefore, new floating roads will be constructed on the footprint of the existing tracks.

As the overall Site layout was finalised, the most suitable routes between each component of the Development were identified, taking into account the existing track and the physical constraints of the Site.

3.8.4 Location of Ancillary Structures

The ancillary infrastructure required for the proposed Development include a Temporary Construction Compound, Electrical Substation, Meteorological Mast and Grid Connection.

3.8.4.1 Temporary Construction Compound

The Temporary Construction Compound will be used as a secure storage area for construction materials and to contain temporary Site units for sealed staff welfare facilities. The compound will contain cabins for offices space, meeting rooms, canteen area, a drying room, parking facilities, and similar personnel type facilities. The Temporary Construction Compound is located on the north of the Site near the entrance from the local road (L6132). Details of the temporary Construction Compound can be seen in Drawing No. 6777-JOD-BKWF-XX-DR-C-1505. The use of a single temporary construction compound instead of two smaller compounds located in different areas of the Site will result in less disturbance to the Site and reduced visual impact. A number of locations were assessed for the location of the temporary compound. The current proposed location is considered the most suitable due to its location to the Site entrance and its location on a forested area which will reduce the effects on more valuable peatland on other parts of the Site.

A comparison of the potential environmental effects of constructing a single, large construction compound when compared against constructing two smaller compounds is presented in **Table 3.5**.

Table 3.5: Environmental Effects from Constructing a Two Smaller Construction Compounds Compared to One Large Construction Compound

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Neutral
Biodiversity	Potential for a greater impact to the Site ecology by constructing two construction compounds in different areas of the Site.
Ornithology	Potential for a greater impact to the Site ornithology by constructing two construction compounds in different areas of the Site.

Criteria	Comment
Soils & Geology	Increased amounts of peat extraction required if constructed on other part of the Site.
Hydrology & Hydrogeology	The use of multiple construction compounds sites has the potential to increase the risk of erosion and increase risk to watercourses.
Air & Climate	The use of multiple construction compounds sites has the potential to increase the number of potential dust sources on the Site.
Noise	Potential for increased noise impacts on nearby sensitive receptors.
Material Assets	Neutral
Landscape & Visual	Potential for greater visual and landscape impacts due to the construction of tracks.
Cultural Heritage	Neutral
Traffic and Transport	Less efficient movement and management of material across the Site.

3.8.4.2 Electrical Substation

In order to provide flexibility to the electrical network provider and having regard for the Site constraints the location of the Electrical Substation is restricted to the north of the Site. It should also be noted that while the operational lifespan of the proposed turbines is expected to be 35 years (following which they may be replaced or decommissioned). The electricity substation and associated infrastructure will become an ESBN asset. It will then be a permanent feature of the proposal as it will be required to continue to form part of the electrical infrastructure of the area. This will be in the event that the remainder of the Site is Decommissioned. The current location was chosen due to its location on the north of the site in a forested area on habitat that is not valuable compared to non-forested areas.

3.8.4.3 Grid Connection

A key consideration in determining the Grid Connection Route (GCR) for a proposed wind energy development is whether the cabling is undergrounded or run as an overhead line. While overhead lines are less expensive and allow for easier repairs when required, underground lines will have no visual impact. For this reason, it was considered that underground lines would be a preferable alternative to overhead lines. The Draft Wind Energy Guidelines 2019 also indicate that underground cables are the preferred option for connection of a wind energy development to the national grid. Therefore, the preferred Grid Connection options are an underground cable duct.

There is an existing 110kV overhead line running through the north of the site to the 110kV Tullabrack substation. Due to the proximity of this line, the construction of a new 110kV substation was initially considered, with a 'Loop in' to the existing lines. However, given the capacity of the Development (c. 20MW), and the cost of constructing a new 110kV substation, ultimately this option was not retained. Instead, for a four-turbine development it is considered that a 38kV substation and an underground cable ducting connection to the existing Tullabrack 110kV substation is the most optimal.

Connections to Moneypoint 400kV substation were considered in a high-level study undertaken by Mullan Grid (see **Appendix 2.3**). Although a potentially viable grid connection route, Tullabrack was considered a more favourable option due the closer proximity to the proposed Development. Two other potential routes were assessed in a grid connection route design report carried out by BF Consulting. These two options are not as favourable as the option to Tullabrack due to distances involved at 9.1km and 11km as opposed to 1.7km for Tullabrack.

BF Consulting were contracted to undertake a detailed review of GCR options. Three grid connection cabling route options were considered and assessed as part of the initial design process to determine which route would be brought forward as part of the planning application. All three Grid Connection Route options that were considered during the iterative design phase are shown on **Figure 3.4**, and are as follows:

- <u>Underground Grid Connection (UGC) Option 1</u> - UGC from Tullabrack Substation to Ballykett Wind Farm utilising sections of UGC in public roads. [UGC: 1.7km]
- <u>UGC Option 2</u> - UGC from Moneypoint Substation to Ballykett Wind Farm utilising sections of UGC in public road, primarily regional and local roads. [9.1km]
- <u>UGC Option 3</u> - UGC from Moneypoint Substation to Ballykett Wind Farm utilising sections of UGC in public roads. [UGC: 11km]

Option 1 was selected as the preferred option due to the shorter distance (1.7km) and related lower potential environmental effects. Hence, only Option 1, from Tullabrack Substation to Ballykett Wind Farm utilising sections of UGC in public roads, is assessed further in this EIAR. However, there are only small differences between Options 2 and 3 and therefore effects of both these options have been considered together, as summarised in Appendix 3.1.

Table 3.6: Environmental Effects from GCR Option 2 and Option 3 compared with the preferred GCR Option 1

Criteria	Comparison of preferred Option 1 with Options 2 & 3
Population & Human Health (incl. Shadow Flicker)	Option 1 (i.e., from Tullabrack Substation) likely to have less vehicular movements and road closures so less disruptions. Options 2 and 3 are longer routes with more potential to impact on nearby residents due to road closures and vehicular movements.
Biodiversity	Options 2 and 3 have more potential effects due to the longer distance from the proposed development site, and more watercourse crossings (7 or 9 crossing) compared to no water crossings required for Option 1
Ornithology	Neutral
Soils & Geology	Options 2 and 3 would have more effects on soils and geology due to distance, and more watercourse crossings than that of Option 1.
Hydrology & Hydrogeology	Options 2 and 3 have more potential effects due to the longer distance from the proposed development site, and more watercourse crossings (7 or 9 crossing) compared to no water crossings required for Option 1
Air & Climate	Option 1 (i.e., from Tullabrack Substation) likely to have less vehicular movements and road closures so less disruptions. Options 2 and 3 are longer routes with more potential to impact on nearby residents due to road works and vehicular movements.
Noise	Options 2 and 3 would result in greater noise generated on/near the proposed development site from increased road opening and backfilling activities compared to Option 1.
Material Assets	Neutral
Landscape & Visual	Neutral
Cultural Heritage	Neutral
Traffic and Transport	Option 1 (i.e., from Tullabrack Substation) likely to have less vehicular movements and road closures so less disruptions. Options 2 and 3 are longer routes with more potential to impact on nearby residents due to road closures and vehicular movements.

3.8.4.4 Borrow Pit

There will be approximately 43,870m^3 of rock required during the construction phase. A borrow pit will be developed on-site to extract rock (32,280m^3) for most of the site infrastructure requirements; this will help to limit the volume of HGV traffic associated with wind farm construction on the local road network. Rock (c. 11,590m^3 or 11.59tonnes) will be imported to construct the L6132 site entrance, temporary construction compound, access track from the L6132 site entrance leading to the onsite borrow pit, site access track and turbine hardstand surface layers and temporary and permanent works along the L6132 A comparison of the potential environmental effects from using an on-site borrow pit in comparison to using an off-site quarry is presented in **Table 3.7**.

Table 3.7: Environmental Effects from Utilising an On-Site Borrow Pit Compared to Local Quarries

Criteria	Comment
Population & Human Health (incl. Shadow Flicker)	Less vehicular movements and potential health benefits.
Biodiversity	Increased amount of habitat affected (albeit no very valuable improved agricultural grassland).
Ornithology	Increased amount of habitat affected (albeit no very valuable improved agricultural grassland).
Soils & Geology	Neutral
Hydrology & Hydrogeology	Neutral
Air & Climate	Less vehicular movements and decrease in air quality effects.
Noise	Increased noise generated on site from rock blasting or breaking activities.
Material Assets	Neutral
Landscape & Visual	No landscape effects from importing rock. Slight and temporary visual effects from use of an on-site borrow pit.
Cultural Heritage	Neutral
Traffic and Transport	Decreased vehicular movement on local roads.

3.8.4.5 Alternative Spoil Storage Sites

Spoil material will be generated from excavations to construct the infrastructure on Site. This will be mostly in the form of peat and subsoils, that will be stored on-site as it is excavated. Generally, it is preferred to store spoil as close as possible to the Site from where it was excavated. However, there is forestry and relatively valuable habitat on Site. Therefore, it is proposed to store spoil in two areas, a designated area to the east of the site entrance and in the borrow pit. Spoil will be temporarily stored to the east of the borrow pit until it is being reinstated and the spoil will then be transferred for permanent storage at the borrow pit. An alternative option would be to store the spoil at an off-site location.

A comparison of the potential environmental effects of storing spoil on-site in comparison to using an offsite storage is presented in **Table 3.8**.

Table 3.8: Environmental Effects from Utilising On-Site Storage Compared to Off-Site storage

Criteria	On-site spoil storage	Off-site spoil storage
Population & Human Health (incl. Shadow Flicker)	Less vehicular movements and potential health benefits.	Increased vehicular movements.
Biodiversity	Increased amount of habitat affected. No enhancement of areas of degraded peat habitat.	Less habitat affected.
Ornithology	Increased amount of habitat affected.	Less habitat affected.
Soils & Geology	More likely to have bog slide if peat stored on slopes.	Less likely to have an impact on peat stability if spoil is stored off site.
Hydrology & Hydrogeology	Increased risk of sediment laden runoff to watercourses. Increased risk of peat instability.	Lower risk of sediment runoff to watercourses. Lower risk of peat instability.
Air & Climate	Less vehicular movements and decrease in air quality effects.	Increased vehicular movements and increase in air quality effects.
Noise	Less noise generated from vehicular movements.	Increased noise generated from vehicular movements.
Material Assets	Neutral	Neutral
Landscape & Visual	No landscape screening of infrastructure from spoil bunds and/or reinstatement of borrow pit.	No impact on the landscape of the Site.
Cultural Heritage	Neutral	Neutral
Traffic and Transport	Less vehicular movement on local roads.	Increased vehicular movement on local roads.

3.9 ALTERNATIVE TURBINE DELIVERY ROUTE AND SITE ACCESS

Wind turbine components (blades, nacelles and towers) are not manufactured in Ireland and therefore must be imported from overseas and transported overland to the Site. Alternative transport routes to the Site were considered in relation to turbine components, general construction-related traffic, and site access locations.

3.9.1 Port of Entry

The alternatives considered for the port of entry of wind turbines into Ireland for the proposed Development include Galway Port and Foynes Port. Both Ports offer a lift-on lift-off procedure to facilitate importation of wind turbines. Foynes Port was selected as the port of entry for this project because it is located closer to the Site and a number of the existing wind farms in the vicinity of the Site and therefore less requirements for works to facilitate turbine deliveries on the route. Other ports were not considered as these two options are the closest to the Site and are proven to have the required capabilities for turbine deliveries.

A comparison of the potential environmental effects of using Foynes Port in comparison to other options is presented in **Table 3.9**.

Table 3.9: Environmental Effects from Utilising Foynes Port v Other Options

Criteria	Foynes Port	Other Options
Population & Human Health (incl. Shadow Flicker)	Shorter route to site on a proven route.	Longer route to site on a non-proven route.
Biodiversity	Less works in third party lands off the road network.	More work in third party lands off the road network.
Ornithology	Less works in third party lands, in particular hedge and tree trimming off the road network.	More works in third party lands.
Soils & Geology	Less works in third party lands off the road network.	More works in third party lands.
Hydrology & Hydrogeology	Decreased risk of sediment laden runoff to watercourses.	Increased risk of sediment laden runoff to watercourses due to widening and crossing works required to allow access of turbine component delivery vehicles.

Criteria	Foynes Port	Other Options
Air & Climate	Less vehicular movements and decrease in air quality effects.	More vehicular movements and increase in air quality effects.
Noise	Less noise generated from vehicular movements.	Higher number of sensitive receptors.
Material Assets	Neutral	Neutral
Landscape & Visual	Neutral	Neutral
Cultural Heritage	Neutral	Neutral
Traffic and Transport	Shorter vehicular movement on local roads.	Longer vehicular movement on public roads.

3.9.2 Delivery to Site

In assessing the most suitable route for turbine transport, cognisance was taken of the Turbine Delivery Route (TDR) used for the existing Tullabrack and Ballykett wind farms, which are located directly to the northwest of the Site. Those windfarms utilised the N68 to reach the Site(s). The route was subjected to a full route survey and swept path analysis survey prior to construction. The alternative to using the N68 to Kilrush and the R483 to the Site was examined and found be a less favourable route because it would route the turbine deliveries through Kilrush Town with associated pinch points.

The updated transport analysis (as presented in **Chapter 16: Traffic and Transportation**) shows that only relatively minor accommodation works will be required, at two locations in lands under public control on the TDR, to accommodate the proposed development at Ballykett. The TDR proposed will utilise the national and primary roads available which have been designed to carry larger loads and Heavy Goods Vehicles (HGVs).

The Turbine Delivery Route is shown on **Figure 2.4** and the Construction Haul Route is shown on **Figure 16.1**.

It is proposed that the turbine components will be delivered via Foynes Port. The following route is proposed (Detailed analysis of the proposed Turbine Delivery Route between the N68 / L6132 and the Site entrance have been carried out by Jennings O'Donovan and are included in **Appendix 16.1**. The proposed Turbine Delivery Route traffic from Foynes Port is shown on **Figure 16.4**, The Turbine Delivery Route in the vicinity of the Site is shown on **Figure 16.5**.):

- Loads would exit the harbour and join the N69 southbound and follow the N69 to Limerick City;
- West of Limerick City loads (except for nacelles and lower tower sections) would continue on the N18/M18 northbound before turning left to join the N85 westbound;
- Loads for nacelles and lower tower sections will continue on the R510 and onto the R527 and continue to the R445 at the Coonagh Roundabout and then onto the N18. This is due to height restrictions in the Limerick Tunnel under the River Shannon.
- Loads would turn onto the N68 at the Rocky Road Roundabout and travel on the N68 southwest; and
- Loads would turn right onto the L6132 westbound to the site access junction.

Where materials won at the borrow pit are not suitable (subject to quantity and quality available), it is envisaged that hardcore materials for Site access tracks and turbine hardstands construction will be sourced from one of the local quarries, such as that to the southwest of the Site. There are no local concrete manufacturers. Therefore, concrete for construction of the Development will come from a supplier highlighted on **Figure 16.7** (Concrete and Aggregate Suppliers).

3.10 ALTERNATIVE MITIGATION MEASURES

Mitigation by avoidance underpins the proposed development. By avoiding the ecologically sensitive areas of the Site as much as possible, the potential for environmental effects is reduced. As noted above, the Site layout aims to avoid any environmentally sensitive areas through the application of Site-specific constraints. The Site is not located in a designated site for nature conservation. However, following the implementation of the habitat enhancement proposals, there will be a net gain in peatland habitat on the Site.

The alternative to this approach is to encroach on the environmentally sensitive areas of the Site and accept the potential environmental effects and risk associated with this. The best practice design and mitigation measures set out in this EIAR will contribute to reducing risks and have been designed to break the pathway between the Site and any identified sensitive receptors.

3.11 CONCLUSION

A description of the reasonable alternatives in terms of project design, technology, location, size and scale which are relevant to the proposed Development and its specific characteristics [maximum 20MW output, 4 no. turbine with a tip height of 150m, a hub height of 82m and a rotor diameter of 136m – large scale wind farm], has been provided. An indication of the main reasons for selecting the chosen options, including a comparison of the environmental effects has also been provided. Through appropriate consideration of the reasonable alternatives, as outlined in this chapter, the Site has been shown to be a suitable location for the Development given consideration of the main criteria of distances from dwellings, wind speeds, potential environmental effects and use of an existing, optimal Grid Connection Route.

4 PLANNING AND LEGISLATIVE CONTEXT

4.1 INTRODUCTION

This Chapter sets out the planning policy context relevant to the Development by providing an overview of the international, national and regional legislation and policy of relevance, as well as a detailed review of the planning policy framework within which the application will be assessed. This section also provides a brief overview of the most up-to-date statistics on Irish renewable energy production, climate emissions, and the benefits the Development can bring to helping Ireland meet 2030 and 2050 targets.

The planning policy assessment demonstrates that the Development is consistent with European, National and Local Plan Policies. In particular, the Development will help to meet the objectives of the Climate Action Plan 2023 (CAP2023) and the Climate Action Low Carbon Development (Amendment) Act 2021. Ballykett Wind Farm will make an important contribution to Ireland's renewable energy targets. The Development will have a generating capacity of 16 – 20MW and will be of economic and social importance to both the region and the state.

The urgent need to fight climate change and society's rising demand for energy is prevalent across the policies reviewed. Renewable energy is identified throughout this review as being required to play a vital role in mitigating climate change by transitioning to a low carbon economy and society. By investing in renewable energy, Ireland can promote sustainable economic development using its own, secure and clean energy.

4.2 STATEMENT OF AUTHORITY

This chapter has been prepared by Jennings O'Donovan & Partners Limited, in particular Breena Coyle, Sarah Jones and David Kiely.

Breena Coyle, Senior Town Planner in Jennings O'Donovan & Partners Limited (JOD), has a Masters in Environment Planning from Queens University and has over 13 years' experience in Environmental Planning throughout Ireland and the UK. She has a clear understanding of the legislative framework and has experience in the development of windfarms from the pre-planning process through to construction.

Sarah Jones is an Environmental Scientist and Planner and holds a first-class Masters in Environmental Sustainability from University College Dublin and a Bachelor (Hons.) Degree in Geography from Manchester Metropolitan University. Sarah is currently working towards a Higher Diploma in Planning and Environmental Law from Kings Inn, Dublin. Sarah's key capabilities include Environmental Impact Assessment (EIA) screenings, Appropriate Assessment (AA) screenings, Planning and Environmental reports and Applications, Environmental Impact Assessments, Feasibility Studies, Construction Environmental Management Plans, Stakeholder Engagement, Project Management.

David Kiely has a Bachelor of Engineering Degree in Civil Engineering and a Master's of Science degree in Environmental Protection, in addition to 40 years' experience in the civil engineering/ environmental sector. David has led/managed EISs/EIARs and overseen the development of over 50 wind farms in Ireland. This includes whole life cycle from feasibility, planning and environmental assessment through to construction, including the preparation of alternative consideration chapters for other wind farms. David Kiely has undertaken EISs/ EIARs for wind farms throughout Ireland. He has 40 years' experience in the civil engineering and environmental sector and has obtained a Bachelor of Engineering Degree in Civil Engineering and a Master of Science degree in Environmental Protection. David has overseen the development of over 50 wind farms from feasibility, planning and environmental assessment through to construction.

4.3 IRISH PLANNING LEGISLATION AND POLICY CONTEXT

Table 4.1: Irish Planning Legislation and Policy Context

Legislation / Policy	Context
Planning and Development Acts 2000 to 2023 (the Planning and Development Act)	The Planning and Development Act sets out the statutory basis for the carrying out of an Environmental Impact Assessment (EIA).
Planning and Development Regulations 2001 – 2023 (the Planning and Development Regulations)	The Planning and Development Regulations implement the Planning and Development Act by prescribing the details of the planning code.
Habitats and Birds Directives	The Habitats Directive 92/43/EEC and the Birds Directive 2009/147/EC set out the requirements for the protection of habitats and species and in the case of the latter, bird species, of European and national importance. For the purposes of planning, these directives have been transposed into Irish legislation under the Planning and Development Act

Legislation / Policy	Context
	(in particular Part XAB), the Planning and Development Regulations (in particular Part 20), and the European Union (Birds and Habitats) Regulations 2011-2015.
Wildlife Act 1976, as amended	The requirements for the designation and protection of habitats and species in a natural heritage area (NHA) are set out in the Wildlife Act 1976, as amended.
EIA Directives	The EIA Directive has been transposed into Irish legislation by way of a number of EIA Regulations from 1989 to 2018. EIA provisions in relation to planning consents are currently contained in the Planning and Development Act) (Part X) and in Part 10 of the Planning and Development Regulations. Developments for the purpose of Part 10 (i.e. those developments requiring an EIA) are set out in Schedule 5 (Parts 1 and 2) of the Planning and Development Regulations.
National Energy Security Framework	Ireland has one of the highest rates of importing fuel in Europe with imported dependency increasing to 80% in 2021 according to the SEAI1. Energy demand in Ireland has been growing and is expected to continue to increase by 37% to 20312. The high rate of imported fossil fuel dependency and the increasing demand for electricity make it vital to introduce more domestic renewable energy generation like the proposed wind farm development in County Clare. The National Energy Security Framework (DECC, 2022) sets out how Ireland is seeking to phase out dependency on Russian gas, oil and coal imports in order to address the urgent need to secure a long-term, resilient energy supply.
Climate Action and Low Carbon Development Act 2015	The Climate Action Act 2015 provides for the establishment of a national framework with the aim of achieving a low-carbon, climate-resilient, and environmentally sustainable economy by 2050 (referred to in the Climate Action Act 2015 as the "national transition objective"). The Climate Action Act

[1] SEAI. (2022). ENERGY IN IRELAND. https://www.seai.ie/data-and-insights/seai-statistics/key-publications/energy-in-ireland/?gclid=EAIaIQobChMI-LH_o6r8_QIV09_tCh23YAykEAAYASAAEgJipvD_BwE Accessed 29/03/2023.
[2] EirGrid. (2022). EirGrid's Generation Capacity Statement Predicts Challenging Outlook for Ireland https://www.eirgridgroup.com/newsroom/eirgrids-generation-capac/#:~:text=The%20GCS%2C%20in%20its%20median,relatively%20consistent%20across%20the%20decade. Accessed 29/03/2023

Legislation / Policy	Context
	2015 was commenced in the days before the historic COP21 agreement in Paris where consensus was reached by 200 countries on the need to reduce greenhouse gas emissions.
Climate Action Plan 2023	The plan implements the carbon budgets and sectoral emissions ceilings and sets a roadmap for taking decisive action to halve Irelands emissions by 2030 and reach net zero no later than 2050. It also outlines the intention of the government to meet up to 80% of electricity demand from renewable power by 2030.
Climate Action and Low Carbon Development (Amendment) Act 2021	The Climate Action and Low Carbon Development (Amendment) Act 2021 supports Ireland's transition to Net Zero and a target of achieving a climate neutral economy by no later than 2050. It has established a legally binding framework containing clear targets and commitments which are set in law to embed the necessary structures and processes on a statutory basis to achieve our national, EU and international climate goals and obligations in the near and long term.
The National Planning Framework 2018-2027	The National Planning Framework (NPF) (which is given statutory recognition in the Planning and Development (Amendment) Act 2018) is intended to guide development and investment through a shared set of national objectives and principles. It is then left to the three regional planning bodies and the 31 city and county councils to take a lead in refining these into more detailed plans.
The National Development Plan 2021-230	The National Development Plan (NDP) sets out the investment priorities that will underpin the implementation of the National Planning Framework, through a total investment of approximately €116 billion. This represents a very substantial commitment of resources and is expected to move Ireland close to the top of the international league table for per capita public investment.
Regional Planning	The Local Government Reform Act 2014 provided for three new regional assemblies: the Northern and Western, Eastern and Midland and Southern Regions. Members of the

Legislation / Policy	Context
	Regional Assemblies consist of the local authorities within that region. The Regional Spatial and Economic Strategy (RSES) for the Southern Regional Assembly area provides a long-term regional level strategic planning and economic framework, to support the implementation of the National Planning Framework, for the future physical, economic and social development for the Southern Region.
The Clare County Development Plan 2023-2029	Under Section 9 of the Planning and Development Act , each planning authority is obliged to make a Development Plan for the whole of its functional area. The Development Plan (City/County Development Plan [CDP]) is a statutory land-use plan generally consisting of a written statement and associated maps. The Development Plan is the statutory land use plan which sets out a strategy for the proper planning and sustainable development for the area. The County Clare Development Plan 2023-2029 was adopted in April 2023. The County Clare Wind Energy Strategy is included as Volume 6 of the CDP 2023-2029.
The Wind Energy Development Guidelines, DoHLG 2006	The Wind Energy Development Guidelines (DoHLG, 2006) offer advice to planning authorities on planning for wind energy through the development plan process and in determining applications for planning permission. The guidelines are also intended to provide a consistency of approach throughout the country in the identification of suitable locations for wind energy development and the treatment of planning applications for wind energy developments.
Draft Revised Wind Energy Development Guidelines (Department of Housing, Local Government and Heritage, 2019)	The Developer has had regard to the Draft Wind Energy Guidelines 2019, however the current version dated 2006 remain valid until the revised, final version of the Draft WEDGs (DOHLGH, 2019) are published by the government. The draft guidelines set out how wind energy is to be delivered in accordance with best practice and in particular, in partnership with people living in areas local to proposed

Legislation / Policy	Context
	developments. The Draft guidelines, provide a roadmap as to how Ireland's 2030 climate commitments can be met and ultimately move the country towards a position of net zero emissions by 2050. The key aspects for the new draft proposed wind energy guidelines include the following: • A visual amenity setback of 4 times the turbine height between a wind turbine and the nearest residential property, subject to a mandatory minimum distance of 500 metres • the elimination of shadow flicker • The application of a more stringent noise limit, consistent with World Health Organisation standards • The introduction of new obligations in relation to community engagement with local communities along with the provision of community benefit measures.
The National Landscape Strategy for Ireland 2015-2025	Ireland signed and ratified the Council of Europe's European Landscape Convention (ELC) which came into effect on 1 March 2004. The Convention has been ratified by thirty-eight countries. It obliges Ireland to implement policy changes and objectives concerning the management, protection and planning of the landscape. The National Landscape Strategy will be used to ensure compliance with the ELC and to establish principles for protecting and enhancing it while positively managing its change. It is a high-level policy framework to achieve balance between the protection, management and planning of the landscape by way of supporting actions.

4.4 INTERNATIONAL POLICY

This section of the EIAR documents the international policy perspectives with regards to climate change and renewable energy. Ireland is party to both the United Nations Framework Convention on Climate Change and the Kyoto Protocol, which together provide an international legal framework for addressing climate change.

4.4.1 The United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC)[3] implemented by the United Nations in May 1992, determined a long-term objective to lessen greenhouse gases in the atmosphere, with the purpose of preventing anthropogenic interference with the climatic system. Subsequently, the Kyoto Protocol was adopted in 1997. National governments who signed up to the Kyoto Protocol are committed to reducing their greenhouse gas emissions. The UNFCCC recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The convention enjoys near universal membership, with 197 countries listed as being Parties of the Convention[4].

The Paris Agreement (2015)

The Paris Agreement is a legally binding international treaty on climate change. It was adopted by 196 Parties at COP 21 in Paris, on 12 December 2015 and entered into force on 4 November 2016. It seeks to accelerate and intensify the actions and investment needed for a sustainable low carbon future. Its central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. The Agreement also aims to strengthen the ability of countries to deal with the impacts of climate change. The Paris Agreement commits the EU as a whole to reduce greenhouse gas emissions by at least 40% by 2030, compared with 1990 levels. This figure was revised upwards under Article 4 of Regulation 2021/1119 by the EU in April 2021 to a 55% domestic Green House Gas reduction by 2030 compared to 1990.

The United Nation's (UN) 26th global climate summit was held in 2021 in Glasgow, where nations committed to a range of decisions in a collective effort to limit global temperatures to 1.5 degrees. The conference focussed on driving action across:

- Mitigation - reducing emissions
- Adaptation - helping those already impacted by climate change
- Finance - enabling countries to deliver on their climate goals
- Collaboration - working together to deliver even greater action

The 27th Global climate summit; The COP27 UN Climate Change Conference, was held in 2022 in Egypt. Agreement was reached on financing loss and damage from the impacts of

[3] The United Nations Framework Convention on Climate Change (UNFCCC) (1992). Available online at: http://unfccc.int/resource/docs/convkp/conveng.pdf Accessed 08/02/2024
[4] http://unfccc.int/essential_background/items/6031.php Accessed 08/02/2024

climate change – an agreement which was negotiated in part by Ireland's Minister for Environment, Climate and Communications, Eamon Ryan.

At COP28 in Dubai (Nov. 2023), it was expected that the wording of the agreement will include a stronger message on "transitioning away from fossil fuels". This highlights the importance of alternative, renewable energy generation projects, such as the Development.

Out of 189 Parties that have ratified the Paris Agreement, 90% mentioned renewables and roughly 70% included quantifiable energy targets in their initial Nationally Determined Contributions. However, a report by the International Energy Agency (IEA) cautions that renewables growth will still need to double to reach the Paris Agreement goal of achieving net-zero emissions by 2050. The International Renewable Energy Agency (IRENA), an intergovernmental organisation focusing on sustainable energy, in a report on the Nationally Determined Contributions relating to renewable energy also note that even with the renewable energy pledges in the 2021 Paris agreement, the 1.5°C goal will still be exceeded before the end of the century.

Ireland is one of the 186 countries signed up to the Paris agreement, under the terms, Ireland is required to reduce greenhouse gas emissions by at least 40% by 2030 when compared with levels in 1990. The Development will displace heavily polluting fossil fuels by producing renewable wind energy.

4.4.2 EU Directive 2011/92/EU (as amended by EU Directive 2014/52/EU)

European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive'), was transposed into Irish planning legislation by the Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001 (as amended). The objective of the Directive (Directive 2011/92/EU), as amended by Directive 2014/52/EU, is to ensure a high level of protection of the environment and human health, through the establishment of minimum requirements for EIA, prior to development consent being given, of public and private developments that are likely to have significant effects on the environment.

Planning Authorities and An Bord Pleanála have lengthy experience in assessing the effects of proposed developments on the environment as this is an integral part of considering whether the proposal is in the interests of the proper planning and sustainable development of the area. The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 transpose the requirements of the 2011 EIA Directive (as amended) into existing planning consent procedures.

Amending Directive 2011/92/EU defined the EIA process as a process consisting of:

(a) the preparation of an Environmental Impact Assessment Report (EIAR) by the Developer

(b) the carrying out of consultations

(c) the examination by the competent authority of the EIAR, any supplementary information provided, where necessary, by the developer and relevant information received through consultations with the public, prescribed bodies and any affected Member States

(d) the reasoned conclusion of the competent authority on the significant impacts of the project on the environment and

(e) the integration of the competent authority's reasoned conclusion into any development consent decision.

4.5 EUROPEAN LEGISLATION & POLICY CONTEXT

The European Union's (EU) energy policies are set out and powered by three main objectives:

- To ensure energy providers operate in a competitive environment, ensuring affordable prices for homes and businesses.
- To secure energy supplies and to ensure reliable energy delivery whenever and wherever it is needed; and
- To have sustainable energy consumption, through lowering dependence on fossil fuels and decreasing greenhouse gas emissions and pollution.

The importance of delivering on these key objectives have been underlined by the Commission's robust and ambitious response to the ongoing conflict in Ukraine – and has seen a suite of legislative files introduced in the sustainability and environmental sectors in its current mandate.

The EU will be climate neutral by 2050. To do this, it will carry out a series of initiatives that will protect the environment and boost the green economy[5].

4.5.1 Renewable Energy Directive

The EU produced the Renewable Energy Directive (REDI) 2009/28/EC, revised in 2018, to make the EU a global leader in renewable energy and ensure that the target of the final energy consumption being at least 16% renewables by 2020 and 27% renewables are met

[5]European Commission. https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en Accessed 09/02/2024

by 2030. In 2015, the EU set itself a long-term goal of reducing greenhouse gas emissions by 80-95%, when compared to 1990 levels, by 2050. Under the 2009 Renewable Energy Directive (REDI), Ireland committed to produce at least 16% of all energy consumed by 2020 from renewable sources. Ireland did not meet its 2020 target for overall Renewable Energy Share resulting in Ireland being obligated to acquire statistical transfers of 3.3 TWh of renewable energy from other Member States to compensate for this shortfall.

From 2021, REDI was replaced by the second Renewable Energy Directive (REDII), which continues to promote the growth of renewable energy out to 2030. The recast directive sets a new binding renewable energy target for the EU for 2030 of at least 32%, with a clause for a possible upwards revision by 2023.

In 2023, the European Union (EU) adopted an amendment of the Renewable Energy Directive, which is referred to as "RED III". RED III raises the share of renewable energy in the European Union's overall energy consumption to 42.5% by 2030, with an additional 2.5% indicative top-up to allow the target of 45% to be achieved.

The proposed wind farm Development in Ballykett, County Clare will have an installed capacity of 16-20MW of renewable energy which would contribute towards the RED targets for 2030 and help to prevent further requirements to acquire statistical transfers from other Member States.

4.5.2 The European Green Deal 2019

The European Green Deal 2019 resets the European Commission's commitment to tackling climate and environmental-related challenges. It focuses on three key principles for the clean energy transition, which will help reduce greenhouse gas emissions and enhance the quality of life of our citizens:

(1) Ensuring a secure and affordable EU energy supply.

(2) Developing a fully integrated, interconnected and digitalised EU energy market.

(3) Prioritising energy efficiency, improving the energy performance of our buildings and developing a power sector based largely on renewable sources.

The European Green Deal is a plan to make the EU's economy sustainable. The EU aims to be climate neutral in 2050. Reaching this target will require action in all sector economy, including:

- Investing in environmentally friendly technologies
- Supporting industry to innovate

- Rolling out cleaner, cheaper and healthier forms of private and public transport
- Decarbonising the energy sector
- Ensuring buildings are more energy efficient
- Working with international partners to improve global environmental standards
- Sustainable finance – all of which are strongly interlinked.

4.5.3 REPowerEU

In May 2022, The European Commission presented the REPowerEU Plan6, in response to the global energy market disruption caused by Russia's invasion of Ukraine. It puts forwards a set of actions to:

- Save energy;
- Diversify supplies;
- Quickly substitute fossil fuels by accelerating Europe's clean energy transition;
- Smartly combine investments and reforms.

It states:

"*Lengthy administrative procedures are one of the key barriers for investments in renewables and their related infrastructure. These barriers include the complexity of the applicable rules for site selection and administrative authorisations for projects, the complexity and duration of the assessment of the environmental impacts of the projects, grid connection issues, constraints on adapting technology specifications during the permit-granting procedure or staffing issues of the permit-granting authorities or grid operators. In order to accelerate the pace of deployment of renewable energy projects it is necessary to adopt rules which would simplify and shorten permit-granting processes.*"

The REPowerEU Plan also includes proposed amendments to the Renewable Energy Directive[7] including:

- Specifying that renewable energy plants are presumed to be of overriding public interest.
- Increasing the Union's renewable energy target to 45% – up from 40% in the Commission's initial Fit-for-55 energy package.

[6] European Commission. (2022). REPowerEU Plan https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_1&format=PDF Accessed 08/02/2024
[7]European commission. (2022). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022PC0222&from=EN Accessed 08/02/2024

In 2021, the EU reached a 22.8%[8] share of its gross final energy consumption from renewable sources – down from 22.1% in 2020. This leaves a long way to go to reach this increased target. In accordance with the REPowerEU Communication, in May 2022, the Commission published a recommendation[9] on speeding up permit-granting procedures for renewable energy projects, accompanied by guidance to help the Member States speed up permitting for renewable energy plants.

The recommendation was created in order to help Member States exploit all possibilities for acceleration that exist within the legislative framework. It proposes measures to streamline procedures at national level, addresses ambiguities in the application of EU legislation and sets out good practices in Member States. It recommends participatory approaches that involve local and regional authorities and providing authorities with the necessary resources so as to facilitate the timely realisation of locally adapted investments.

Recommendations include:

"*Member States should ensure that the planning, construction and operation of plants for the production of energy from renewable sources, their connection to the electricity, gas and heat grid and the related grid itself and storage assets* ***qualify for the most favourable procedure available in their planning and permit-granting procedures*** *and are presumed as being in the overriding public interest and in the interest of public safety, in view of the legislative proposal amending and strengthening the provisions of Directive (EU) 2018/2001 related to administrative procedures and without prejudice to the Union law."*

"Member States should establish clearly defined, accelerated and as short as possible deadlines for all the steps required for the granting of permits to build and operate renewable energy projects, specifying the instances where such deadlines may be extended and under which circumstances. Member States should establish binding maximum deadlines for all relevant stages of the environmental impact assessment procedure."

4.5.4 Renewable Deployment Acceleration

On 22nd December 2022, Council Regulation (EU) 2022/2577 set out a framework to accelerate the deployment of renewable energy which was adopted by the Council of the European Union[10]. This regulation, which has immediate effect in Member States, applies

[8] European Commission. (2023). https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics#Share_of_renewable_energy_more_than_doubled_between_2004_and_2020 Accessed 08/02/2024

[9] EU. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=PI_COM:C(2022)3219&from=EN Accessed 09/02/2024

[10] Council of the European Union Regulation (EU) 2022/2577 of the 22 December 2022, laying down a framework to accelerate the deployment of renewable energy https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R2577 Accessed 07/02/2024

to "*all permit-granting processes that have a starting date within the period of its application*". The period of application of the Regulation is the 30 December 2022 to 29 June 2024 and therefore applies to the current application. It confirms the EU policy position that renewable energy plants, including wind energy, are crucial to fight climate change and pollution, reduce energy prices, decrease the Union's dependence on fossil fuels and ensure the Union's security of supply. The aim of the regulation is to eliminate bottlenecks in new permitting procedures and will allow new projects to benefit from a simplified assessment for specific derogations foreseen in the relevant Union environmental legislation with immediate effect.

It states:

"*A fast deployment of renewable energy sources can help to mitigate the effects of the current energy crisis, by forming a defence against Russia's actions. Renewable energy can significantly contribute to counter Russia's weaponisation of energy by strengthening the Union's security of supply, reducing volatility in the market and lowering energy prices*."[11]

[11] *Ibid* Recital 1

4.6 NATIONAL, REGIONAL AND LOCAL POLICY

This section sets out the key planning and other related policies from a national, regional and local perspective. **Figure 4.1** provides an overview of National Planning Policy Context in Ireland.

Figure 4.1: Hierarchy of National Planning Policy Context.

The National Planning Framework is assessed in section 4.6.1.7. The Regional Spatial and Economic Strategy is assessed in section 4.6.2.1. The relevant County Development Plan is assessed in section 4.6.3.1. The Development is not located in a Local Area plan.

4.6.1 National Policy

4.6.1.1 National Planning Framework - Project 2040

Ireland has developed a strategic outlook for the future development of the country under the 'Project Ireland 2040.' Project 2040 comprises two plans, The National Planning Framework (NPF) and the ten-year National Development Plan (NDP) which will guide strategic development and infrastructure investment at the national level. The NDP 2018-2027 sets out investment priorities of €21.8 billion for climate action for the 10-year period, €7.6 billion is to come from the Exchequer. The remaining investment is to be made by Ireland's semi-state companies and by the private sector. In addition, some €8.6 billion funding has been made available for sustainable mobility projects, mostly in public transport. This substantial funding increase will facilitate upscaling of investments and implementation of actions needed to move the country towards its 2030 climate targets.

Section 1.5 of the NPF sets out that "*sustainability is at the heart of long-term planning and the National Planning Framework seeks to ensure that the decisions we make today, meet our own needs without compromising the ability of future generations to meet their needs."*

The NPF with the NDP will also set the context for each of Ireland's three regional assemblies to develop their Regional Spatial and Economic Strategies taking account of and co-ordinating Local Authority County and City Development Plans in a manner that will ensure national, regional and local plans align. The National Planning Framework is based on a set of values that will ensure Ireland's "long term economic, environmental and social progress for all parts of the country".

The NPF sets a number of shared goals for Ireland which the Development will contribute to achieving, including:

- Strengthened rural economies and communities
- A strong economy, supported by enterprise, innovation and skills
- Transition to a low carbon and climate resilient society

NPF Chapter 9 states that "*The Government is committed to a long-term climate policy based on the adoption of a series of national plans over the period to 2050, informed by UN and EU policy. This is being progressed through the National Mitigation Plan and the National Climate Change Adaptation Framework, both of which will be updated and reviewed periodically.*

In addition to legally binding targets agreed at EU level, it is a national objective for Ireland to transition to be a competitive, low carbon, climate resilient and environmentally sustainable economy by 2050, guided by a long-term vision based on:

- *an aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and*
  in parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production."

The NPF states that in relation to rural areas and renewable energy that:

Transition to a Low Carbon and Climate Resilient Society

"The National Climate Policy Position establishes the national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. This objective will shape investment choices over the coming decades in line with the National Mitigation Plan and the National Adaptation Framework. New energy systems and transmission grids will be necessary for a more distributed, renewables-focused energy generation system, harnessing both the considerable on-shore and off-shore potential from energy sources such as wind, wave and solar and connecting the richest sources of that energy to the major sources of demand.

National Policy Objective 54

"Reduce our carbon footprint by integrating climate action into the planning system in support of national targets for climate policy mitigation and adaptation objectives, as well as targets for greenhouse gas emissions reductions."

National Policy Objective 55

"Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050."

The proposed Development will generate renewable energy, reducing Ireland's carbon footprint by displacing fossil fuels and contributing to climate policy mitigation objectives. It is located in an area "Open to Consideration" for wind energy development (see Figure 4.2) in the Clare County Development Plan 2023-2029 and has been assessed under each of the topics contained in the EIAR and has been found to be in an appropriate location.

4.6.1.2 Climate Action and Low Carbon Development (Amendment) Act 2021

At a national level, the Climate Action and Low Carbon Development (Amendment) Act 2021 commits Ireland to reach a legally binding target of net-zero emissions no later than 2050, and a cut of 51% by 2030 (compared to 2018 levels). It establishes a framework with clear, legally binding targets and commitments, and ensures the necessary structures and processes are embedded on a statutory basis to achieve Ireland's national, EU and international climate goals and obligations in the near and long term.

The Act includes the following key elements:

- It places on a statutory basis a 'national climate objective', which commits Ireland to pursue and achieve no later than 2050, the transition to a climate resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy.
- It embeds the process of carbon budgeting into law. Government are required to adopt a series of economy-wide five-year carbon budgets, including sectoral targets for each relevant sector, on a rolling 15-year basis, starting in 2021.
- Actions for each sector will be detailed in the Climate Action Plan, updated annually.
- A National Long Term Climate Action Strategy will be prepared every five years.

A recent report from the EPA Ireland's Greenhouse Gas Emissions Projections[12] found that Ireland is not on track to meet the 51 per cent emissions reduction target (by 2030 compared to 2018), indicating that further measures are needed.

4.6.1.3 Climate Emergency

On 29th November 2019 the European Parliament declared a climate emergency ahead of the UN COP 25 in Madrid in December 2019. In May 2019, the Oireachtas declared a "climate emergency" in an amendment to the report 'Climate Action: A cross-party consensus for action' which followed the recommendations of the Citizens Assembly on Climate Action. There then followed the publication of the Cross-Departmental Climate Action Plan 2019 on 17th June 2019 this was revised in 2021 and 2023.

4.6.1.4 The Climate Action Plan 2023

On the 21st of December 2022 the Climate Action Plan 2023 (CAP2023) was published, it sets out a detailed sectoral roadmap designed to deliver a 51% reduction in greenhouse gas (GHG) emissions by 2030 and make Ireland a zero-carbon economy by 2050. The plan sets an ambitious 80% target for electricity production from renewable sources by 2030 and highlights the need to remove barriers to the development of renewables, including onshore wind. It notes that electricity will play an important role in the decarbonisation of other sectors through electrification, including transport, heating, and industry. The goal in the electricity sector is to make Ireland less dependent on imported fossil fuels.

The targets set out in the Climate Action Plan 2023 envisages a radical step-up of our existing targets to meet the required level of emissions reduction by 2030, including:

- An increase in electricity generated from renewable sources to 80%.

[12] EPA 2023. https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/ Accessed 09/02/2024

- Complete the phase-out of coal and peat-fired electricity generation.
- 75% reduction in overall greenhouse gas emissions.
- Achieve net zero emissions no later than 2050.
- Target 6 GW of onshore wind by 2025.
- Increase onshore wind to 9GW; As of May 2022, this was 4.3GW, leaving a shortfall of 4.7GW to be achieved in the next 7 years.

The plan highlights the need to remove barriers to the development of renewables including onshore wind and focusses a large amount of future electricity production on the wind energy sector. To accelerate renewable electricity generation, the relevant constituent elements of the planning and permitting system will be aligned to support accelerated renewable energy development.

The plan states that since 2021, there have been significant increases in prices in the international fossil fuel markets, attributed to increased demand as post-COVID 19 recovery and the disruption to traditional energy supplies following the Russian invasion of Ukraine. The plan notes that the transition away from fossil fuels and towards locally generated renewables will improve energy security and reduce Irelands dependence on imported energy. Renewables accounted for 35% of electricity generated in 2021 (down from a high of 42% in 2020), this needs to increase to 80% by 2030 to achieve the national target. Therefore, there is a clear necessity of urgent national importance to increase the amount of energy from renewable sources for our future energy security, energy price stability and electricity system resilience.

The proposed Development in Ballykett will contribute to the de-carbonisation of the Irish electricity network by producing 16-20MW of renewable electricity. This will help to mitigate the impacts of climate change by reducing the emissions related to energy production. These contributions will help to decarbonise multiple sectors and assist Ireland in reaching emissions reductions and renewable energy targets. The Development will assist in the transition away from fossil fuels and contribute towards Irelands energy security by reducing the dependence on imported energy. As a renewable energy generation project, it should be considered to be in the overriding public interest.

4.6.1.5 National Energy and Climate Plan 2021-2030

The National Energy and Climate Plan (ENCP)[13] is a ten-year integrated document mandated by the European Union to each of its member states in order for the EU to meet its overall greenhouse gases emissions targets.

The plan establishes key measures to address the five dimensions of the EU Energy Union;

1) Decarbonisation: GHG emissions and removals and Renewable Energy
2) Energy efficiency
3) Energy security
4) Internal energy market
5) Research, innovation and competitiveness

Key, relevant renewable energy objectives include:

- Ireland has established an objective of achieving a 34% share of renewable energy in energy consumption by 2030.
- Increase electricity generated from renewable sources to 70% (note this target has been increased to 80% in the CAP2023), underpinned by the Renewable Electricity Support Scheme (RESS).
- Streamline consenting and connection arrangements.
- Phase-out of coal and peat-fired electricity generation
- Increase onshore wind capacity by up to 8.2 GW (note increase to 9 GW in the CAP2023)

Key, relevant energy security objectives include:

- Support efforts to increase indigenous renewable sources in the energy mix, including wind, solar and bioenergy.
- Facilitate infrastructure projects, including private sector commercial projects, which enhance Ireland's security of supply and are in keeping with Ireland's overall climate and energy objectives.

According to a report published by the Environmental Protection Agency (EPA) in June 2023, Ireland will achieve a reduction of only 29% in its greenhouse gas emissions by 2030, far short of a legally binding target of 51%. Almost all sectors are on a trajectory to exceed their national ceilings – including agriculture, industry, electricity and transport. The EPA

[13] Department of Communications, Climate Action and Environment. (2021). National Energy and Climate Plan https://energy.ec.europa.eu/system/files/2020-08/ie_final_necp_main_en_0.pdf Accessed 08/02/2024

report warns that the 2030 targets can only be reached by "implementing policies that deliver emission reductions across all sectors of the economy in the short term".[14]

4.6.1.6 National Energy Security Framework

In April 2022, the Government of Ireland issued the National Energy Security Framework[15] in response to the European Commission's REPowerEU action statement. It provides a single overarching and initial response to address Ireland's energy security needs in the context of the war in Ukraine. It sets out how Ireland is seeking to phase out dependency on Russian gas, oil and coal imports as soon as possible, emphasising throughout the urgency of the need to secure Irelands energy supply.

It is focussed on three areas of work:

- Reducing demand for fossil fuels, which would seek to reduce overall demand for oil, natural gas and coal in Ireland.
- Replacing fossil fuels with renewables, which would seek to reduce the use of gas, oil and coal in Ireland by replacing it with renewable energy sources such as wind energy, solar energy or bioenergy.
- Diversifying fossil fuel supplies, which would seek to replace any Russian supplies of gas, oil and coal (direct or indirect) with supplies from other sources.

The framework highlights the impact of the Russian invasion of Ukraine on energy security, consumer price wise in the short term and how and where energy is sourced to ensure long term system resilience. It notes that:

"*The war has highlighted key dependencies in our energy system which can no longer be relied on and has led to affordability issues for many consumers and businesses*".

The framework builds on the idea of energy security as the uninterrupted availability of energy sources at an affordable price and is a response to the challenges of ensuring the ongoing and long-term security of affordable energy supply.

The new framework underlines the importance of new renewable energy generation projects, such at the Ballykett Wind Farm, in securing Ireland's energy supply in light of the war in Ukraine and resulting energy supply issues.

[14] Environmental Protection Agency. (2023) Ireland's Greenhouse Gas Emissions Projections. https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-GHG-Projections-2022-2040_Finalv2.pdf 08/02/2024

[15] Government of Ireland. (2022) National Energy Security Framework. https://assets.gov.ie/221399/86cb99f5-58e3-4821-bc4c-e1bb1fa706fb.pdf Accessed 08/02/2024

4.6.1.7 Department of Communications Climate Action and Environment: Renewable Electricity Support Scheme 2018 (RESS)

The Renewable Electricity Support Scheme (RESS) provides support to renewable electricity projects in Ireland. With a primary focus on cost effectiveness, the RESS delivers a broader range of policy objectives, including:

- enabling communities to participate in renewable energy projects
- increasing renewable technology diversity
- delivering an ambitious renewable electricity policy to 2030
- increasing energy security, energy sustainability and ensuring the cost effectiveness of energy policy

The RESS 2 auction will be a major step in meeting the ambition set out in the Programme for Government of at least 80% renewable electricity by 2030. It will also support the achievement of the increased ambition set out under the Climate Action and Low Carbon Development Act and the policies and measures in the Climate Action Plan 2023.

It has been designed to promote investment in renewable energy generation to support the growth of the green economy, create sustainable work opportunities, and ultimately benefit the consumer as renewables become more cost effective. The Programme for Government commits to hold RESS auctions at frequent intervals throughout the lifetime of the scheme. This will allow Ireland to take advantage of falling technology costs and avoid 'locking in' higher costs for consumers. If consented the proposed Ballykett Wind Farm will also provide a community fund calculated in accordance with the Renewable Electricity Support Scheme (RESS) Terms and Conditions at €2 per MWh of electricity produced by the project. This is to be made available to the local community for the duration of the RESS (15 years).

4.6.2 Regional Policy

4.6.2.1 The Regional Spatial and Economic Strategy (RSES) for the Southern Regional Assembly (SRA)

The Regional Spatial and Economic Strategy (RSES) for the Southern Regional Assembly (SRA) came into effect on 31st January 2020. The objective of the RSES is to support the implementation of the National Planning Framework and the economic policies and objectives of the Government by providing a long-term planning and economic framework which shall be consistent with the National Planning Framework (NPF) and the economic policies or objectives of the Government. The RSES sets objectives at a regional level, informs County Development Plan and Local Areas Plans.

The RSES provides a development framework of the region that supports the implementation of the NPF and the relevant economic policies and objectives of the government. It provides a 12-year strategy for the period 2020 – 2032 to achieve the objectives and vision of the regional assembly. Within the RSES, the Regional Policy Objectives (RPO) in relation to renewable energy are set out in **Table 4.2.**

Table 4.2: Key Planning Policy Objectives from the RSES

Regional Policy Objective (RPO)	Project contribution
RPO 40 Regional Economic Resilience; It is an objective to sustainably develop, deepen and enhance our regional economic resilience by widening our economic sectors, boosting innovation, export diversification, productivity enhancement and access to new markets.	The Development represents a major investment in the region and in renewable energy. It will provide an improved and more resilient renewable electricity supply in the area. This could attract new enterprise to the region, bringing jobs, economic growth and diversification. The increased renewable electricity supply will also help to meet increased demand to facilitate further economic growth.
RPO 46 Digital and Physical Infrastructure in Rural Areas; It is an objective to expedite the completion of infrastructure servicing diverse settlements to support innovation, enterprise start-ups and competitiveness. This includes high quality broadband and mobile communication services to all rural locations, water and wastewater facilities for the growth of settlements, ***sustainable energy supply****, enhanced transport connectivity including rural public transport services and greenway walking and pedestrian corridors between settlements.*	The Development, by producing renewable electricity in a rural area, provides a sustainable energy supply. The Development includes a substation and grid connection which will become and asset of the nation grid, upgrading the physical electricity infrastructure in the region. By providing renewable electricity, the Development further boosts the positive environmental effect of an increase in electronic vehicle use, including those in rural public transport services. It also increases the stability of energy supply to meet the growing demand of increased electrification.

Regional Policy Objective (RPO)	Project contribution
RPO 49 Innovation in Rural areas; It is an objective to support innovation, enterprise start-ups and competitiveness of our rural Region.	The Development is located in a rural area, it represents a significant investment into the locality in an innovative and sustainable industry and will create jobs. It will provide an improved renewable electricity supply county. This could attract new enterprise to the region, bringing jobs, economic growth and population increases. The introduction of renewable electricity helps to stabilise and reduce electricity costs, making Ireland a more attractive investment location. The increased renewable electricity supply will also help to meet increased demand to facilitate further economic growth.
RPO 50 Diversification; It is an objective to further develop a diverse base of smart economic specialisms across our rural Region, including innovation and diversification in agriculture (agri-Tech, food and beverage), the marine (ports, fisheries and the wider blue economy potential), forestry, peatlands, ***renewable energy****, tourism (leverage the opportunities from the Wild Atlantic Way, Ireland's Ancient East and Ireland's Hidden Heartlands brands), social enterprise, circular economy, knowledge economy, global business services, fin-tech, specialised engineering, heritage, arts and culture, design and craft industries as dynamic divers for our rural economy*	The Development is a renewable energy project. The Site is located in agricultural lands, represents diversification for the farmers involved. The Development also provides the opportunity to reinforce the existing local renewable energy industry knowledge and skills base, providing stability and diversity to the rural economy that can drive further investment.
RPO 56 Low Carbon Economy;	Renewable energy, wind energy in particular, is identified throughout this

Regional Policy Objective (RPO)	Project contribution
a. The RSES recognises the urgency to transition to a low carbon future and it is therefore an objective to accelerate the transition towards low carbon economy and circular economy through mechanisms such as the Climate Action Competitive Fund; *b. It is an objective to develop enterprises that create and employ green technologies.* *c. Local authorities should ensure that the development of green industry and technologies incorporates careful consideration of potential environmental impacts at project level including the capacity of receiving environment and existing infrastructure to serve new industries.* *d. Local authorities shall include objectives in statutory land use plans to promote energy conservation, energy efficiency and the use of renewable energy sources in existing buildings, including retro fitting of energy efficiency measures in the existing building stock, energy efficiency in traditional buildings and initiatives to achieve Nearly Zero-Energy Buildings (NZEB) standards in line with the Energy Performance of Buildings Directive (EPBD).* *e. It is an objective to support investments in energy efficiency of existing commercial and public building stock with a target of all public buildings and at least one-third of total commercial premises upgraded to BER Rating 'B'. Local authorities shall report annually on energy usage in all public buildings and will achieve a target of 33% improvement in energy efficiency in all buildings in accordance with the National Energy Efficiency Action Plan (NEEAP)*	review as being required to play a vital role in mitigating climate change by transitioning to a low carbon economy and society. The Development will contribute to the regions electricity network by producing 16-20MW of renewable electricity. The site location has been selected for its excellent wind resource and minimal environmental impacts; these impacts have been assessed throughout this EIAR. By producing renewable energy for use in the region, the Development helps to contribute to lowering the carbon footprint of existing and new buildings.

Regional Policy Objective (RPO)	Project contribution
RPO 96: Integrating Renewable Energy Sources; To support the sustainable development, maintenance and upgrading of electricity and gas network grid infrastructure to integrate renewable energy sources and ensure our national and regional energy system remains safe, secure and ready to meet increased demand as the regional economy grows.	The Development produces renewable wind energy by harnessing the wind resource of the southern region and helping to meet the increased energy demand as the regional economy grows. The Development includes a substation and grid connection which will become assets of the nation grid, upgrading the electricity infrastructure in the region.
RPO 99: Renewable Wind Energy; To support the sustainable development of renewable wind energy (onshore and offshore) at appropriate locations and related grid infrastructure in the Region in compliance with national Wind Energy Guidelines.	The Development is an excellent example of sustainable development (see section 4.8.4) it has been assessed under each of the topics contained in the EIAR and has been found to be in a suitable location. The Development is located in an area designated '*Open to Consideration*' to wind farm development in the Clare County Development Plan. The Development has been designed in accordance with the current Wind Energy Development Guidelines 2006 and has had regard to the Draft Revised Wind Energy Development Guidelines (see section 4.7.1 and 4.7.2).
RPO 100: Indigenous Renewable Energy Production and Grid Injection; To support the integration of indigenous renewable energy production and grid injection.	The Development will provide up to 20MW of renewable, indigenously produced wind energy. This additional renewable power generated will contribute to a reduction in greenhouse gas emissions from fossil fuels, improve regional/national

Regional Policy Objective (RPO)	Project contribution
	energy security and help Ireland achieve our renewable electricity targets.

The RSES recognises and aims to support the many opportunities for wind as a major source of renewable energy. It declares that opportunities for both commercial and community wind energy projects should be harnessed, having regard to the requirements of DoHPLG Guidelines on wind energy. It also states that wind energy technology has an important role in delivering value and clean electricity for Ireland.

Action EL/23/2 of the Climate Action Plan, 2023 requires the publication of a Renewable Electricity Spatial Policy Framework to set out targets for onshore renewable electricity to inform spatial plans and that a roadmap for the development of the Regional Electricity Strategies be published by Q4, 2023.

As identified in **Table 4.2** above, the Development is in line with the regional policies as set out in the RSES. By producing renewable energy, in a suitable location, the Development contributes to policies associated with transitioning to a low carbon economy, economic development and rural diversification. This contributes to positioning County Clare as a leader in delivery of renewable electricity for the Southern Regional Assembly region.

4.6.3 Local Policy

4.6.3.1 The Clare County Development Plan 2023-2029

The Clare County Development Plan (CDP) was formally adopted in April 2023. The CDP sets out an overall strategy for the proper planning and sustainable development of the functional area of Clare County Council over a 6-year period. The plan builds on the previous plan, seeking to develop County Clare as a place to be part of and proud of and as a dynamic, resilient, connected and internationally competitive location for innovation and investment and as a national leader in climate action. The CDP informs Local Area Plans and local energy policy.

The plan includes goals relevant to the project including;

Goal II: *A county that drives local and regional sustainable growth by harnessing the potential of its unique location, quality of life, natural resources and other competitive advantages.*

The Development helps to harness the wind energy of the county, enabling the exploitation of this natural resource for competitive advantage, facilitating economic development, improving the security of the energy supply and helping to stabilise and reduce energy prices.

Goal X: *A county that supports strong economic growth and a high quality of life for all residents through the provision of efficient and robust physical infrastructure whilst having regard to environmental responsibilities and complying with European and national legislation.*

The proposed Development at Ballykett represents a major investment in the county and in renewable energy. It will provide an improved renewable electricity supply in the county. This could attract new enterprise, bringing jobs and economic growth. The increased renewable electricity supply will also help to meet increased demand to facilitate further economic growth. By displacing fossil fuels, the Development also contributes to improved air quality and helps to mitigate climate change, both of which add to a high quality of life for County Clare residents.

There are five Strategic Principles in the Clare County Development Plan. These are summarised in **Table 4.3** along with the Developments contribution.

Table 4.3 Strategic Development Plan Principles from the Clare County Development Plan 2023 – 2029 (p15 and 16).

Strategic Development Plan Principles	Contribution of the Development
Quality of Life; Mental and physical health is affected by the environment in which we live.	By producing renewable energy, the Proposed Development contributes to the displacement of fossil fuels, which pollute the air, this improves air quality, which is closely linked to good health and well-being. See **Chapter 12; Air Quality and Climate.**
Sustainability: "development which meets the needs of today without compromising the ability of future generations to meet their own needs".	The Proposed Development an excellent example of sustainable development, enshrined in the National Planning Framework. The Proposed Development meets each of the three pillars of sustainable development as outlined in section 4.8.4.
Climate Action: The County Development Plan and with the	By generating renewable energy and displacing fossil fuels the Proposed Development helps to reduce carbon

Strategic Development Plan Principles	Contribution of the Development
Clare County Council Climate Change Adaptation Strategy 2019-2024 provide a framework for the transition towards a low carbon and more climate resilient county.	emissions and other greenhouse gases and mitigate climate change, supporting Ireland's transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy.
Resilience: Resilience is built into the strategic policies and recommendations of each of the cross-cutting themes: quality of life, sustainability, climate action, and inclusivity.	Increasing the diversity of energy generation with renewables reduces vulnerability to climate change and improves the resilience of the energy system.
Inclusivity: Inclusivity affects the wellbeing of individuals, families, social groups and communities. Creating a more socially inclusive society by alleviating social exclusion, poverty and deprivation is a major challenge.	Concern over energy costs amongst the population of Ireland is high, a survey by the Journal in 2022[16] found that 77% of people said that they already or intend to use their home heating less often. The Economic and Social Research Institute (ESRI)[17] report on Energy Poverty published in 2022, has also warned that as many as 43% of households could now be in energy poverty. The Development will produce between 16-20MW of renewable electricity which will improve the security of County Clare's energy supply, helping to stabilise and reduce energy prices.

Chapter 2; Climate Action includes the goal:

*"A county that is resilient to climate change, plans for and adapts to climate change and flood risk, is the **national leader in renewable energy generation**, facilitates a low carbon future, supports energy efficiency and conservation and enables the **decarbonisation** of our lifestyles".*

The Development, by producing renewable energy, would assist County Clare in achieving the goal of becoming a national leader in renewable energy generation. Renewable

[16] The Journal. (2022). Cost of living crisis: Most households intend to use their home heating less often this winter https://www.thejournal.ie/poll-energy-use-ireland-heating-5891701-Oct2022/ Accessed 09/02/2024

[17] ESRI. (2022). Energy poverty at highest recorded rate https://www.esri.ie/news/energy-poverty-at-highest-recorded-rate Accessed 09/02/2024

electricity can play an important role in the decarbonisation of other sectors through electrification, including transport, heating, and industry, helping to facilitate the decarbonisation of the lifestyles of County Clare residents.

The CDP sets out the policies and objectives aimed at mitigating and adapting to climate change in the county. It outlines an overarching objective to reduce the carbon output from developments and activities in the plan area.

The plan includes renewable energy targets for County Clare by 2030, including a 550MW target for onshore wind. The current installed capacity of County Clare stands at 153MW[18], leaving a short fall of 397MW to be achieved in the next 7 years. The proposed Development in Ballykett, by generating 16-20MW, would contribute circa 5% of this shortfall.

Chapter 6 Economic Development and Enterprise, notes that County Clare's ability to continue to attract and retain high levels of foreign direct investment and to provide a supportive environment for industry will depend on its capacity to deliver a competitive and uninterrupted energy supply. The plan notes that County Clare has one of the best wind resources in the world – almost the entire County has either an excellent or very good wind energy resource. It states that there is significant potential for the development of renewable energy in County Clare.

Chapter 8 Rural Development and Natural Resources includes the strategic aim;
"To ensure that key assets of rural areas such as the natural and built environment are protected and enhanced, and that rural areas with resources such as renewable energy, water sources, and aggregates are sustainably developed."
The Development harnesses the renewable wind energy resources of a rural area in a sustainable way, Section 4.8.4 outlines how the Development meets the three pillars of sustainable development.

Chapter 11; Physical Infrastructure, Environment and Energy highlights that energy security, i.e. secure and uninterrupted sustainable energy supply at a competitive cost, is critical to County Clare's ability to continue to provide a supportive environment for industry and innovation and to attract and retain high levels of foreign direct investment. A key driving objective of this chapter is to facilitate and attract further renewable energy developments.

[18] Clare Renewable Energy Strategy 2023-2029 https://clarecdp2023-2029.clarecoco.ie/stage3-amendments/adoption/volume-5-clare-renewable-strategy-clare-county-development-plan-2023-2029-51389.pdf Accessed 07/1/2024

The proposed Development has been designed on the basis of compliance with and supporting the policy objectives of the Clare County Development Plan, these are set out in **Appendix 4.1.**

4.6.3.2 Renewable Energy Strategy (RES) and Clare Wind Energy Strategy

The RES is included in Volume 5 of the CDP plan whilst the Clare Wind Energy Strategy (WES) is included in Volume 6. These outline the renewable energy resources of the county and seek to position County Clare as a national leader in renewable energy generation.

The WES identifies sites of strategic regional and national importance that have the potential to accommodate wind energy development. It designates areas as being either a) strategic, b) acceptable in principle, c) open for consideration or d) not normally permissible, for wind energy development, as shown on **Figure 4.2**. The Development is located in an area designated *'Open to Consideration'* to wind farm development.

These are defined as;

> *"The Areas Open to Consideration will be assessed on a case-by-case basis, subject to viable wind speeds, environmental resources and constraints and cumulative impacts".*

The Irish Wind Atlas produced by the Sustainable Energy Authority of Ireland (SEAI) shows that wind speeds on the Site (6.4/sec at 30m, 7.9m/sec at 75m, 8.4m/sec at 100m and 9.1m/sec at 150m) are consistent with a wind farm development being viable at this location. A constraints led approach has been undertaken in the design of the wind farm, no significant adverse environmental impacts have been identified during the EIA process. Cumulative impacts have been assessed throughout the EIAR, in-line with the EIA directive and no significant cumulative impacts have been identified.

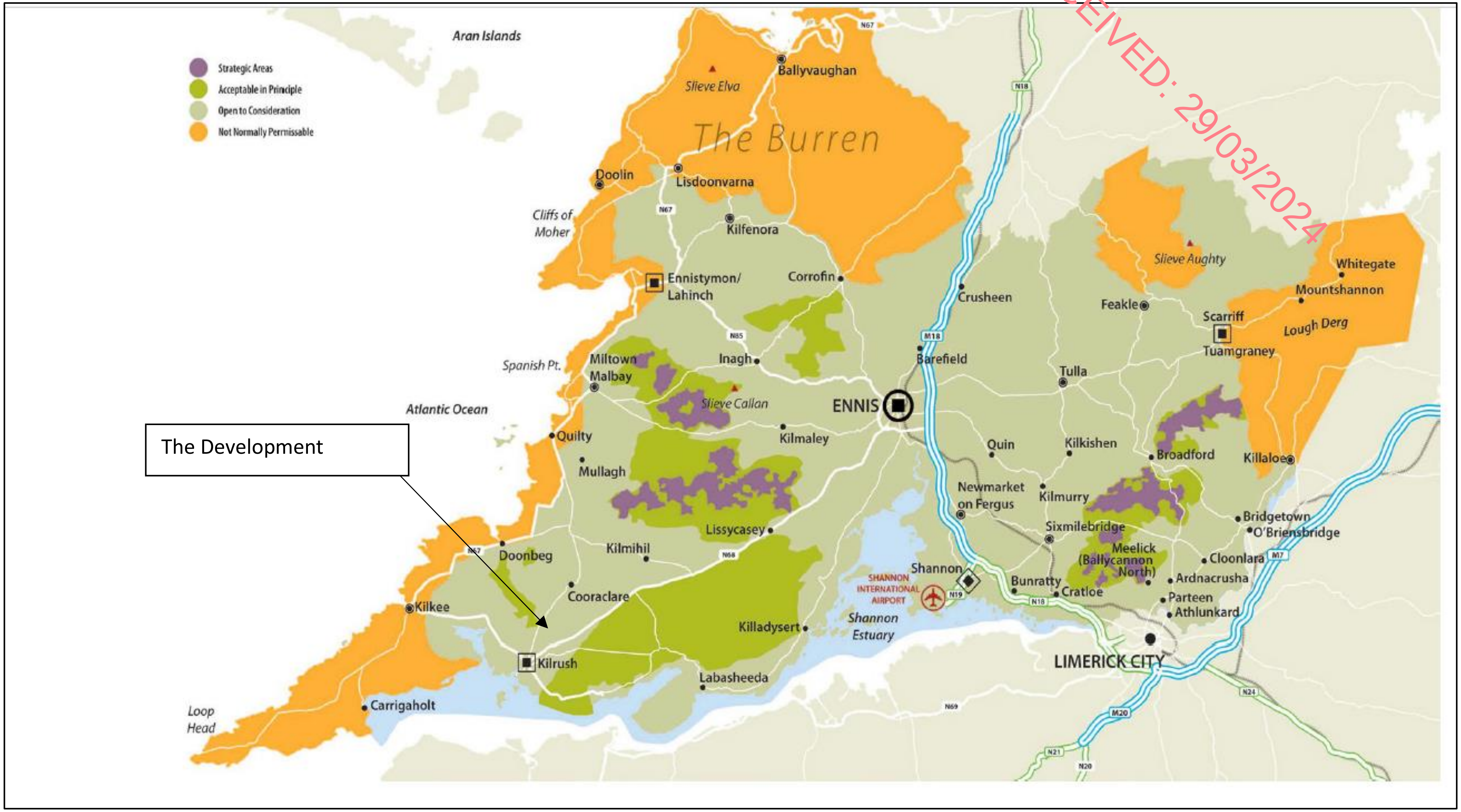


Figure 4.2: Extract from Chapter 6 -RES 'Figure 6.1 Wind Energy Designations

The RES includes Strategic Aims for the county which include:

- To support the attainment of and to exceed in County Clare, where possible, the National targets and commitments to renewable energy.
- To maximise the opportunities for renewable energy development whilst safeguarding the environment and existing residential amenities
- To safeguard, where appropriate, areas with potential for renewable energy projects and to guide renewable energy development to preferred locations.

The Development will help to county Clare to achieve the goals outlined in the RES and in National targets. This includes a 550MW target for onshore wind in the county by 2030. The current installed capacity of County Clare stands at 153MW according to the RES. This leaves a short fall of 397MW to be achieved in the next 7 years. The Development would contribute 16-20MW, circa 5% of this shortfall. The Development provides an opportunity to harness the excellent wind resources of County Clare, it has been assessed under each of the topics contained in the EIAR and has been found to be in a suitable location. The Development is located in an area designated 'Open to Consideration' to wind farm development. It has been designed to safeguard the environment, including residential amenity.

The RES includes overarching objectives for environmental protection to be applied to all renewable energy developments. These are set out in **Table 4.4** below.

Table 4.4: RES 1.1 Proposed SEA Mitigation Measures (apply to all renewable energy development)

Proposed SEA Mitigation Measures	Development Contribution
A. Any proposals for renewable energy infrastructure shall comply with Chapter 17 Environmental Considerations & Development Management Advice and the overarching policies and objectives of the Clare County Development Plan 2023-2029	The Development is in compliance with Chapter 17 of the RES, including requirements relating to Biodiversity, Noise, Landscape and Visual, Water Resources, Built Heritage and Air Quality and Climate. Section 4.6.9 assesses the Development in relation to the Clare County Development Plan 2023-2029. It concludes that the Development is in compliance with the policies outlined in the plan.

Proposed SEA Mitigation Measures	Development Contribution
B. The EPA Environmental Sensitivity Mapping (ESM) Webtool and the Appropriate Assessment GeoTool should be applied to inform decision-making in terms of infrastructural/siting considerations as well as consideration of environmental sensitivities.	The Proposed Development has been assessed under each of the topics contained in the EIAR, with adverse residual environmental impacts actively avoided. The EPA Environmental Sensitivity Mapping (ESM) Webtool and the Appropriate Assessment GeoTool were used along with other on Site and desk-based assessment tools to inform the assessments.
C. To ensure that renewable energy development proposals support and enhance the connectivity and integrity of habitats in the Renewable Energy Strategy (RES) area by incorporating natural features into the design of development proposals; and to work with infrastructure providers to co-develop infrastructural management plans to enhance biodiversity.	Biodiversity is assessed in Chapter 6. Throughout the preparation of the EIAR, the layout of the Development has been revised and refined to take account of the findings of all site investigations. The aim of this was to reduce potential for environmental effects while designing a project capable of being constructed and viable. A constraints led approach was taken, resulting in the avoidance of impacts to the connectivity and integrity of the habitats in the vicinity of the wind farm. The Biodiversity and Enhancement Management Plan is presented in Appendix 6.6. The Plan will restore and enhance an area of cutover bog that has been degraded by afforestation. This will improve biodiversity at the Site, increasing the habitats available for species of conservation value.
D. To require any Renewable Energy project to be in compliance with the objectives and requirements of the Habitats Directive, specifically Article 6(3) and where necessary 6(4), Birds, Water Framework (including the implementation of the 3rd	Habitats Directive: A Natura Impact Statement has been prepared for the project and will be submitted with the application. Chapter 6 Assesses the impact of the Development on Biodiversity. The Water Framework Directive is considered

Proposed SEA Mitigation Measures	Development Contribution
Cycle RBMP), and all other relevant EU Directives and all relevant transposing national legislation.	in Chapter 9 Hydrology and Hydrogeology. This Chapter has found the Development to be incompliance with the EIA directive and Renewable Energy Directive.
E. To require project planning for any renewable energy project to be fully informed by ecological and environmental constraints at the earliest stage of project development and any necessary assessment to be undertaken, including assessments of disturbance to species and habitats, as required. Any ecological assessment shall also be required to consider ecological connectivity and potential supporting habitats to European Sites.	Impacts to Biodiversity are addressed in Chapter 6. A constraints led approach was followed to the design of the Development, as detailed in Chapter 3; Alternatives. The Site layout design has evolved through a series of iterations, to avoid or minimise potential effects, including effects on views, hydrology, peat, ecology and fisheries, ornithology and noise. Throughout the preparation of the EIAR, the layout of the Development has been revised and refined to take account of the findings of all site investigations, which have brought the design from its first initial layout to the current proposed layout.
F. To require the preparation and assessment of all planning applications for renewable energy projects to have regard to the information, data and requirements of the Appropriate Assessment Natura Impact Report, SEA Environmental Report and Strategic Flood Risk Assessment Report of the County Clare County Development Plan 2023- 2029 and SEA of the Renewable Energy Strategy.	The design of the Development and preparation of this EIAR has had regard to information, data and requirements of the Appropriate Assessment/Natura Impact Report, the SEA Environmental Report[19] of the County Development Plan 2023 – 2029 which includes assessment of the Clare Renewable Energy Strategy and the Strategic Flood Risk Assessment Report of the County Clare[20].

[19] https://clarecdp2023-2029.clarecoco.ie/stage3-amendments/adoption/volume-10b-i-strategic-environmental-assessment-environmental-report-51397.pdf Accessed 09.01.24.
[20] https://clarecdp2023-2029.clarecoco.ie/stage3-amendments/adoption/volume-10c-strategic-flood-risk-assessment-clare-county-development-plan-2023-2029-51404.pdf Accessed 09.01.24.

4.6.3.3 The Clare Climate Change Adaptation Strategy 2019-2024

The Clare Climate Change Adaptation Strategy 2019-2024 outlines the strategy of the Council to adapt to the effects of climate change and to safeguard the biophysical infrastructure and wellbeing of the people and communities of County Clare. The strategy highlights that one of the main factors driving climate change is the increased level of CO_2 emissions caused by energy related power consumption. It includes a number of objectives relevant to the Development in relation to renewable energy including;

- *OBJECTIVE 2: To promote County Clare as a Low Carbon County and support the development of low carbon and green technology businesses and industries throughout the County.*

This objective includes supporting on-land and off-shore renewable energy production and the increased use of renewable energy in the commercial and agricultural sectors.

- *OBJECTIVE 4: To promote and facilitate the provision of high quality, secure, efficient and reliable renewable energy sources along with appropriate energy storage facilities in order to assist in the creation of a low carbon County Clare.*

This objective includes encouraging proposals for renewable energy developments and ancillary facilities in order to meet national, regional and county renewable energy targets, and to facilitate a reduction in CO_2 emissions and the promotion of a low carbon economy.

By producing renewable energy which will displace greenhouse gas emitting fossil fuels, the Development assists in achieving the outcomes of the Clare Climate Change Adaption Strategy 2019-2024.

4.7 OTHER CORE PLANNING POLICY DOCUMENTS

4.7.1 The Wind Energy Development Guidelines (WEDGs), Guidelines for Planning Authorities, (DoHLG, 2006)

The Wind Energy Development Guidelines (DoHLG, 2006) advise that a reasonable balance must be achieved between meeting Government Policy on renewable energy and the proper planning and sustainable development of an area, and it provides advice in relation to the information that should be submitted with planning applications. The effects on residential amenity, the environment, nature conservation, birds and the landscape should be addressed. It states that particular landscapes of very high sensitivity may not be appropriate for wind energy development.

The Wind Energy Development Guidelines 2006 remain valid until the revised, Draft Wind Energy Guidelines 2019 are finalised and published by the government.

4.7.2 The Draft Revised Wind Energy Development Guidelines (DoHLG, 2019)

The key aspects for the draft proposed new wind energy guidelines include the following:

- a visual amenity setback of 4 times the turbine height between a wind turbine and the nearest residential property, subject to a mandatory minimum distance of 500 metres.
- the elimination of shadow flicker.
- the application of a more stringent noise limit, consistent with World Health Organisation standards.
- the introduction of new obligations in relation to community engagement with local communities along with the provision of community benefit measures.

The Development has been designed in accordance with the current Wind Energy Development Guidelines 2006 and has had regard to the Draft Revised Wind Energy Development Guidelines in relation to:

- Noise impacts (assessed in **Chapter 10: Noise**) are in line with the guidance.
- To avoid shadow flicker at nearby dwellings, assessment and mitigation measures have also been included in the project, in line with the draft guidelines, full details of this can be found in **Chapter 5: Population and Human Health**.
- Engagement with local communities has taken place throughout the design and planning phases of the proposed development. Full details can be found in **Chapter 1; Introduction** and in the Community Report in **Appendix 1.5**.
- Community Benefit: Establishing a community fund of up to €99,163 annually in the first 15 years of operation that will be administered by a management committee including local community representatives, in line with the Renewable Energy Support Scheme (RESS) Community Benefit Fund Good Practice Principles published in 2021[21].

4.7.3 National Landscape Strategy for Ireland 2015-2025

The National Landscape Strategy for Ireland sets out a roadmap. The objectives of the National Landscape Strategy are to:

- *Implement the European Landscape Convention by integrating landscape into our approach to sustainable development.*

[21] Government of Ireland. (2021) https://www.gov.ie/en/publication/5f12f-community-projects-and-benefit-funds-ress/ Accessed 07/2/2024

- *Establish and embed a public process of gathering, sharing and interpreting scientific, technical and cultural information in order to carry out evidence-based identification and description of the character, resources and processes of the landscape.*
- *Provide a policy framework, which will put in place measures at national, sectoral - including agriculture, tourism, energy, transport and marine - and local level, together with civil society, to protect, manage and properly plan through high quality design for the sustainable stewardship of our landscape.*
- *Ensure that we take advantage of opportunities to implement policies relating to landscape use that are complementary and mutually reinforcing and that conflicting policy objectives are avoided in as far as possible.*

4.8 MATERIAL PLANNING CONSIDERATIONS

4.8.1 The National Interest and Strategic Importance

The Development will make a valuable contribution to climate change adaptation and greenhouse gas reductions as part of the international (Section 4.4) and European (Section 4.5) efforts to combat climate change.

Ireland is facing significant challenges in efforts to meet renewable energy and emissions targets and is falling behind in the longer-term movement away from fossil fuels. Ireland has one of the highest rates of importing fuel in Europe with energy import dependency increasing to 80% in 2021[22]. Energy demand in Ireland has been growing and is expected to continue to increase, especially electricity demand which is expected to grow by 37% to 2031[23]. Increases to the cost of carbon, supply issues and potential political insecurity increases fossil fuel price volatility. Since the Russian invasion of Ukraine, energy prices in Ireland have increased significantly. The SEAI's Electricity Prices in Ireland Report; January to June 2022[24], found on average residential electricity prices increased 10.4% in the 12 months prior to June 2022. The Economic and Social Research Institute (ESRI)[25] report on Energy Poverty published in 2022, has also warned that as many as 43% of households could now be in energy poverty.

The high rate of imported fossil fuel dependency, the increasing demand for electricity and current energy price volatility make it vital to introduce more domestic renewable energy

[22] SEAI. (2022). ENERGY IN IRELAND. https://www.seai.ie/data-and-insights/seai-statistics/key-publications/energy-in-ireland/?gclid=EAIaIQobChMI-LH_o6r8_QIV09_tCh23YAykEAAYASAAEgJipvD_BwE Accessed 07/01/2024
[23] EirGrid. (2022). EirGrid's Generation Capacity Statement Predicts Challenging Outlook for Ireland https://www.eirgridgroup.com/newsroom/eirgrids-generation-capac/#:~:text=The%20GCS%2C%20in%20its%20median,relatively%20consistent%20across%20the%20decade. Accessed 07/01/2024
[24] SEAI. (2022). https://www.seai.ie/publications/SEAIs-EPR-data-for-JAN-to-JUN-2022.pdf Accessed 07/02/2024
[25] ESRI. (2022). Energy poverty at highest recorded rate https://www.esri.ie/news/energy-poverty-at-highest-recorded-rate Accessed 07/01/2024

generation plants, such as the Development, to provide reliable, secure and affordable energy supplies in Ireland. The Development could improve Irish energy security and reduce reliance on imported fossil fuels in line with the National Energy Security Framework (4.6.5) and the REPowerEU Plan (Section 4.5.3).

The construction of the Development will also positively contribute to the regional economy bringing investment and jobs that will help to support and retain confidence in the key regional industries of construction and renewable energy.

4.8.2 The Economic Importance of The Development

The Development would represent a strategically significant investment in the locality of County Clare and the wider southern region. The Development will provide a multi-million euro benefit to both the Irish and local economies and the opportunity to reinforce the existing local renewable energy industry knowledge and skills base, providing the stability and diversity to the rural economy that can stimulate further industry investment to take place. This will have a positive economic impact with several Irish firms commissioned to work on the design, environmental assessment and planning aspects of the Project. Local suppliers will be used wherever possible during the construction phase and in the operational stage, Irish businesses will benefit from the provision of a reliable, local renewable energy source.

4.8.3 Renewable Energy Policy

The Proposed Development meets the objectives of Project 2040 as it will contribute to the economic, environmental, and social objectives of the NPF, in particular National Policy Objectives 54 & 55.

It is critical that a progressive approach is taken to development of renewable energy projects in order to deliver the CAP2023 objective of meeting an 80% share of electricity generated by renewables by 2030. The Development would contribute 16-20MW of renewable electricity to the CAP2023 target of 9GW by 2030 helping to reduce the current 4.7GW shortfall. It also contributes to assisting Ireland to increase from 42% electricity produced by renewable sources in 2020 to 80% by 2030 to meet the CAP2023 target.

As a form of sustainable energy, with an output potential of between 16-20MW of installed capacity at the Wind Farm, the Development will contribute significantly to renewable energy targets and the strategy supported in the RSES for the Southern Region.

The Clare County Development Plan 2023-2029 includes renewable energy targets for 2030, including a 550MW target for onshore wind. The current installed capacity of County Clare stands at 153MW[26], leaving a short fall of 397MW to be achieved in the next 7 years. The Development would contribute circa 5% of this shortfall.

4.8.4 The Proposed Development as Sustainable Development

Sustainable Development is development which meets the needs of the present without compromising the ability of future generations to meet their own needs[27]. There are three pillars to sustainable development which are economic, social and environmental. The Development an excellent example of sustainable development, enshrined in the National Planning Framework. The Development meets each of the three pillars of sustainable development as outlined in **Table 4.5**.

Table 4.5: How the Proposed Development Interacts with the three pillars of sustainable development.

Economic Role	The Development would represent a strategically significant investment in the locality. The Development provides the opportunity to reinforce and grow the existing local renewable energy industry knowledge and skills base, providing the stability and diversity to the rural economy that can stimulate further development by attracting new business to the region due to the improved supply of electricity. The Development will have a positive economic impact with several Irish firms commissioned to work on the design, environmental assessment and planning.
Social Role	The influence of the Development to the de-carbonisation of the Irish electricity network will contribute positively to issues of strategic social importance. It will assist in mitigating climate change and improve air quality while enhancing energy security, including helping to stabilise and reduce energy costs. The Development will also create jobs, economic development and rural diversification.

[26] Clare Renewable Energy Strategy 2023-2029 https://clarecdp2023-2029.clarecoco.ie/stage3-amendments/adoption/volume-5-clare-renewable-strategy-clare-county-development-plan-2023-2029-51389.pdf Accessed 07/02/2024

[27] Our Common Purpose: Bruntland Report, 1987

Environmental Role	Overall, the EIAR sets out that the environmental impacts arising from the Development can be satisfactorily mitigated. The findings demonstrate that the environment can accommodate the Development without giving rise to significant environmental impacts in line with the Clare County Development Plan objectives as well as regional, national and international policy. The NIS concludes on the best available scientific evidence that it can be demonstrated objectively that no elements of the Development will result in a significant adverse effect on the integrity or on the Qualifying Interests/Special Conservation Interests of any relevant European site, either on their own or in-combination with other plans or projects, in light of their conservation objectives. Over its' lifespan (35 years), the Development would displace between 358,176 tonnes and 447,720 tonnes of CO_2. This would help to mitigate climate change and the impacts to ecosystem globally.

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. The UN Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. Learn more and take action.

The Development positively contributes to the following UN Sustainable Development Goals:

By producing renewable energy, the Development contributes to the displacement of fossil fuels, which pollute the air, this improves air quality, which is closely linked to good health and well-being. See Chapter 12: Air and Climate for details.

The Development would produce a renewable energy source locally, this improves Ireland's energy security and helps to stabilize and reduce energy costs for households and businesses.

The Development is a renewable energy enterprise, representing a multi-million-euro investment into the Southern Region. This could attract new enterprise to the county, bringing jobs and economic growth. This is examined in more detail in Chapter 5: Population and Human Health.

The Development by producing renewable energy contributes to decarbonising industry sectors through electrification. The Substation and Grid Connection will become assets of the national grid under the management of EirGrid and assist in improving energy infrastructure in the region.

The renewable energy that the Development will generate will help support Ireland's low carbon transition and reduce anthropogenic greenhouse gases. The Proposed Development could provide power for to up to 12,000 homes with renewable energy.

By generating renewable energy and displacing fossil fuels the Development helps to reduce carbon emissions and other greenhouse gases and mitigate climate change, supporting Ireland's transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050.

4.9 CONCLUSIONS

Throughout this Planning Policy Chapter, renewable energy has been identified as being required to play an essential role in mitigating climate change by transitioning to a low carbon economy and society. By investing in renewable energy, Ireland can promote sustainable economic development using its own, secure and clean energy.

All planning applications have to be determined on their individual merits with due consideration given to the overall planning balance of a scheme. While many development proposals will encompass both positive and negative aspects that require consideration, planning weight should air on the side of a 'presumption in favour of development unless material considerations indicate otherwise' as per the paragraph 11 of National Planning Framework. The pressing need to address climate change, the challenges to energy security giving rise to the adoption of Regulation (EU) 2022/2577, and the presumption of overriding public interest being given to renewable energy projects, makes giving additional renewable energy projects, such as the Development this '*presumption in favour of development unless material considerations indicate otherwise*' more important.

The development in Ballykett, County Clare will provide up to 20MW of renewable, domestically produced wind energy. This additional renewable power generated will contribute to a reduction in greenhouse gas emissions from fossil fuels, improve regional/national energy security and help Ireland achieve our renewable electricity targets.

The Development contributes to supplying the national demand for renewable energy, which in the context of the ongoing climate emergency and increasing demand is an urgent Irish national priority.

While renewable energy in Ireland has come a long way, there is still a shortfall in where the nation needs to be to achieve increasing targets. Ireland missed its 2020 target for renewable energy achieving 12% instead of 16% of overall renewable energy share. There is a clear national mandate to accommodate significant onshore wind within the next decade with The Climate Action Plan 2023 setting a 9GW target for installed wind energy capacity by 2030. In May 2022 this was 4.3GW, leaving a shortfall of 4.7GW to be achieved in the next 8 years.

Further, the National Planning Framework emphasises a move to a low-carbon economy, reducing Ireland's carbon footprint and integrating climate action into the planning system. The Regional Spatial and Economic Strategy (RSES) for the Southern Region supports opportunities for onshore wind as a major source of renewable energy with an important role in delivering value and clean electricity for Ireland. The Clare County Development plan reinforces the national and regional energy policies. The Development falls in an area classed as *'Open to Consideration'* to wind farm development in the Renewable Energy Strategy for Co. Clare.

The Development meets the definition of Sustainable Development as defined by the National Planning Framework in terms of the three sustainability pillars: Economy, Environment and Social. It also contributes to the UN sustainability goals; 3 Good Health and Wellbeing, 7 Affordable and Clean Energy, 8 Decent Work and Economic Growth, 9 Industry Innovation and Infrastructure, 11 Sustainable Cities and Communities and 13 Climate Action.

The development process adopted by the Developer has represented a best practice approach to a renewable energy scheme design, minimising the potential impact through multiple design iterations and modifications to minimise the impact on the receiving environment, and ensuring compliance with the suite of planning policies and objectives of the Clare County Development Plan. The layout of the Development presented in the Planning Application and EIAR represents the optimum fit with the technical and environmental parameters of this project.

Environmental Impacts have been considered within this EIAR and through the process of assessment, embedded mitigation, and additional proposed mitigation outlined in the EIAR, NIS, CEMP and Biodiversity Enhancement and Management Plan it has been shown that the Development can be constructed and operated without significant effects arising, demonstrating the acceptability of the proposal.

This chapter outlines how the Development is compliant with International, European and National policy on energy security, emissions reductions and renewable energy production. It has reviewed policy for the Southern region and local County Clare policies and finds the Development complies with key renewable energy and environmental policy objectives.

In summary the Development would:

- Contribute to the 45% overall renewable energy target for the EU introduced by the REPowerEU Plan in light of the war in Ukraine.
- Contribute to assisting Ireland to increase from 42% electricity produced by renewable sources in 2020 to 80% by 2030 to meet the national target.
- Contribute towards the National Development Plan 2021-2030's National Strategic Outcome number 13 to diversify away from fossil fuels to green energy which includes wind.
- Contributes towards climate change mitigation as specified in the National Planning Framework's National Policy Objective 54.

- Contribute toward renewable energy use and generation as specified in the National Planning Framework's National Policy Objective 55.
- Contribute 16-20MW of renewable wind energy to the national CAP2023 target of 9GW by 2030 helping to reduce the current 4.7GW shortfall.
- Comply with the Regional Spatial and Economic Strategy for the Southern region's goal of producing renewable energy to tackle climate change, meet predicted growth in demand and provide energy security.
- Support the local Clare County Development Plan policy on promoting appropriate renewable energy development and assist the county in achieving its goal of being the national leader in renewable energy generation to facilitate a low carbon future.
- Contribute 16-20MW of renewable wind energy to the Clare County Development Plan target of 550MW by 2030, helping to reduce the current 397MW shortfall.
- Contribute to rural economic development in line with the Clare County Development Plans and of the RSES.

The Development is aligned to all the relevant planning policies identified throughout this chapter, and it will contribute to achieving renewable energy and reduction in emissions targets locally, regionally and nationally.

5 POPULATION AND HUMAN HEALTH

5.1 INTRODUCTION

5.1.1 Background and Objectives

This Chapter of the EIAR assesses the impacts of the Project on population and human health. The Project refers to all elements of the application for the construction of the proposed Ballykett Wind Farm (**Chapter 2: Project Description**). Where negative effects are predicted, the chapter identifies appropriate mitigation strategies. The assessment considers the potential effects during the following phases of the Project:

- Construction of the Project
- Operation and maintenance of the Project
- Decommissioning of the Project

This chapter of the EIAR is supported by figures provided in **Volume III**. A glossary of common acronyms can be found in **Appendix 1.4** in **Volume IV** of this EIAR.

5.1.2 Statement of Authority

This chapter has been prepared by Jennings O'Donovan & Partners Limited. It was prepared by Ms. Sarah Moore with the assistance of Ms. Shirley Bradley and Mr. Darren Timlin.

Sarah Moore is an Environmental Scientist in JOD with over 17 years of environmental consultancy experience. She has obtained a MSc in Environmental Engineering from Queens University, Belfast, and a BSc in Environmental Science from University of Limerick. Since joining JOD, Sarah has been involved as a Project Environmental Scientist on a range of renewable energy, wastewater, structures and commercial projects. She has experience in the preparation of Appropriate Assessments, Ecological Impact Assessments, Environmental Impact Assessments and Geographic Information Systems.

Shirley Bradley is an Environmental Scientist with 2 years' experience in environmental consultancy. She graduated with a First-Class Honours Degree (BSc. Hons) in Environmental Science from the Institute of Technology, Sligo. She was also awarded with the Governing Body award for a BSc in Environmental Protection. Shirley's key capabilities include project management; using software such as WindPRO 3.6 and ArcGIS Pro; and the preparation of planning applications including the preparation of EIARs; CEMPs and management plans relating to surface water, spoil and waste; planning appeals; and responding to requests for Further Information.

Mr. Darren Timlin is a Graduate Environmental Scientist and holds a Bachelor (Hons.) Degree in Environmental Science from the Atlantic Technological University. He forms part of the Environmental team responsible for preparing the EIAR Chapters. Darren has experience drafting EIAR's and Screening Reports, Appropriate Assessments for Wind Farms, Hydrogen Plants and Power Generation Plants. He has experience in the use of ArcGIS Pro and AutoCAD 2D.

5.1.3 Relevant Legislation and Guidance

The population and human health section of this EIAR is carried out in accordance with legislation and guidance contained in **Chapter 1: Introduction** and **Chapter 4: Planning and Policy**.

The design and construction of the Project including the installation of associated equipment such as switchgear, upgrade of the Electrical Substation etc. is governed by the Safety, Health and Welfare at Work Act 2005 (as amended), the Safety, Health and Welfare at Work (General Application) (Amendment) (No. 2) Regulations 2021and also by the Safety, Health and Welfare at Work (Construction) Regulations 2013(as amended).

The Revised EIA Directive Consultation (rEIA Directive 2011/92/EU as amended) (Section 1.2.2) States that:

"It is intended that the consideration of the effects on populations and on human health should focus on health issues and environmental hazards arising from the other environmental factors, for example water contamination, air pollution, noise, accidents, disasters, and not requiring a wider consideration of human health effects which do not relate to the factors identified in the Directive".

5.1.4 Assessment Structure

In line with the EIA Directive, as amended and current EPA guidelines the structure of this chapter is as follows:

- Assessment Methodology and Significance Criteria – a description of the methods used in desktop surveys and in the assessment of the significance of effects.
- Baseline Description – a description of the socio-economic profile of the local area of the Project i.e., local electoral areas and County Clare, based on a desk-based study using Central Statistics Office (CSO) data.
- Assessment of Potential Effects –identifying the ways in which the population and human health of the area could be affected by the Project.

- Mitigation Measures and Residual Effects – a description of measures recommended to avoid, prevent, reduce or, if necessary, offset any potential significant adverse effects and a summary of the significance of any residual effects of the Project after mitigation measures have been implemented
- Cumulative Effects – identifying the potential for effects of the Project to combine with those from other existing, permitted and/or proposed projects to affect the population and human health.
- Summary of Significant Effects.
- Statement of Significance.

With respect to the EIA Directive as amended, Section 1.2.2 (outlined in section 4.1.3) amalgamates the findings of other assessments as part of the EIA process. Limited interactions with Human Health are possible and consideration has been given to the findings of the following assessments:

- Soils and Geology: Chapter 8;
- Hydrology and Hydrogeology: Chapter 9;
- Air and Climate: Chapter 12;
- Noise and Vibration: Chapter 10;
- Shadow Flicker and Electromagnetic Interference: Chapter 13;
- Traffic and Transportation: Chapter 16.

Where appropriate, mitigation measures have been proposed to avoid, prevent, reduce or, if necessary, offset any identified significant adverse effects.

All activities carried out by the appointed contractor on the Project will be in accordance with the requirements of the Safety, Health and Welfare at Work Act 2005 as amended and Regulations made under this Act.

5.1.5 Scope of the Assessment

The effect of a development on population and human health includes the following broad areas of investigation:

- Population and settlement patterns
- Economic activity and tourism
- Employment
- Topography and land use
- Health impacts of wind farms

- Property value
- Natural disaster and major accidents.

Where a significant negative impact can be foreseen, it is prevented, reduced, avoided or, if necessary, offset by way of practical mitigation measures.

This assessment considers the following criteria:

- Sensitive receptors in the area
- Existing land use in the area
- General amenities in the area
- Potential effects from water, noise, shadow flicker, air quality and traffic.

5.2 ASSESSMENT METHODOLOGY

In line with the EIA Directive as amended and current (draft) EPA guidelines this chapter includes the following elements:

- Details of methodologies utilised in the context of legal and planning frameworks
- Baseline descriptions
- Assessment of potential effects (construction, operational and Decommissioning stages)
- Detailed mitigation measures
- Assessment of cumulative impacts
- Summary of significant effects and statement of significance

A desktop study was undertaken using the Central Statistics Office (CSO) data along with the currently adopted Clare County Development Plan (CDP) 2023 - 2029. Consideration was also given to the 2015[1] report produced by the EPA entitled the *'Investigation into the Assessment of Health Impacts within National Environmental Regulation Processes'* that outlines how human health impacts are dealt with, throughout the European Union (EU) by environmental regulators with an emphasis on the role at the planning / environment interface.

5.2.1 Definition of Study Areas

Four geographical Study Areas have been outlined for this assessment. While the greater geographical Study Areas (3 and 4) provide a baseline of statistical data for this chapter, they are not considered for local impacts of this assessment. Note: Study Area 1 lies within

[1] Golder Associates (2015) *Investigation into the Assessment of Health Impacts within National Environmental Regulation Processes*. Available online at: http://www.epa.ie/pubs/reports/research/health/assessmentofhealthimpactsreport.html [Accessed 30/11/23]

Study Area 2 and information outlined for Study Area 2 incorporates data for Study Area 1. The four Study Areas are outlined below:

Study Area 1: The proposed Project area and Environs – District Electoral Divisions (DEDs) Clooncoorha, Kilrush Urban, Kilrush Rural, Cooraclare and Tullycreen (168.02km^2).

In order to make inferences about the population and other statistics in the vicinity, District Electoral Divisions (DEDs) were analysed. The entire Project falls under the Municipal District (MD), west Clare and Electoral Divisions (ED) Clooncoorha, Kilrush Urban, Kilrush Rural, Cooraclare and Tullycreen that can be separated into the distinct townlands Ballykett, Tullabrack West, Tullabrack East, Tullabrack, Gower South, Gowerhass, Tullagower and Derreen.

Study Area 1 is shown in **Figure 5.1:** in Volume III of the EIAR.

The location of the Site falls within the Clooncoorha DED, while the Proposed Grid Connection Route (GCR) located within Clooncoorha Rural DED and Kilrush Rural DED. The temporary works along the construction haul route fall within the Clooncoorha DED. The works along the Turbine Delivery Route (TDR) are located within Clooncoorha DED, Cooraclare DED and Tullycreen DED. Kilrush Urban DED has been included in the study area; although the Project infrastructure is not located in this DED it is likely construction traffic will use roads located therein.

Each DED can be separated into distinct townlands. The DEDs and townlands that have the potential to be affected as a result of the various elements of the Project are outlined in **Table 5.0**. The wind farm itself is predominantly situated within the townlands of Tullabrack East and Ballykett.

Table 5.0: DEDs and townlands that will be affected by the Project (See Chapter 2: Population and Human Health – Section 2.3.1)

Element of the Project	District Electoral Division (DED)	Townlands
Wind Farm Site		
Ballykett Wind Farm	Clooncoorha	Tullabrack East Ballykett
Grid Connection Route		
Ballykett Farm to Tullabrack Substation	Clooncoorha Kilrush Rural	Tullabrack West Tullabrack East Tullabrack

Element of the Project	District Electoral Division (DED)	Townlands
Construction Haul Route		
Temporary Road Widening Works	Clooncoorha	Tullabrack East
Turbine Delivery Route		
Temporary Road Widening and Verge Strengthening Works	Clooncoorha Cooraclare Tullycreen	Tullabrack East Gower South Gowerhass Tullagower Derreen
Vertical Realignment	Cooraclare	Gower South

Grid Connection route

A Grid Connection between the Site and the national electricity grid will be necessary to export electricity from the Development. It is intended that the Development will connect to the national grid via a 38kV Grid Connection cable to the existing Tullabrack 110kV Substation (Tullabrack Substation), located in the townland of Tullabrack, County Clare. The Tullabrack substation is located approximately 1km west/northwest of the Development at its closest point. The proposed Grid Connection route between Ballykett Wind Farm and Tullabrack 110kV substation is as an underground cable (UGC), utilising sections of cabling in public roads. The length of the Grid Connection is c. 1.84km. **See Figure 5.2**

The proposed Grid Connection route is shown in **Figure 5.2** in Volume III of the EIAR.

Turbine Delivery Route

It is proposed that the turbine nacelles, tower hubs and rotor blades will be landed at the port of Foynes County Limerick. From there, they will be transported to the Site via the N69 east onto the N18 and northwest via the Shannon tunnel, initially via the N18 in the Galway direction (via Junction 12 of the N18), unto the N85 Ennis Distributor Road. After accessing the N85 distributor road the haulage route will access the N68 in the direction of Kilrush and then onto the L6132 east to the new site entrance 450 metres east of Tullabrack Cross. The L6132 will require temporary localised widening and verge strengthening up to the junction with the N68 road at Derreen cross. Vertical realignment will also be required along the L6132, **See Figure 2.4** in Volume III**.**

Study Area 2: **Clare County** (3,450km^2).

Study Area 3: **The Midwest Region**: Clare, Limerick and Tipperary (8,248km^2)

Study Area 4: **Ireland** (70,273km^2).

Descriptive terminology for impact assessment, and the general framework for the assessment of significance of effects, follows the systematic method of description from the EPA Guidelines (**2022), as outlined in Chapter 1: Introduction, Table 1.5: Impact Classification Terminology (EPA Guidelines, 2022).**

5.2.2 Consultation

Consultation with relevant organisations was initiated during the initial stage of the EIA process to identify any effects (on human health) that could potentially result from the Project. A summary of the consultation responses is presented in **Table 5.1**.

Reason No. 2 as outlined in **Table 1.2: Outline of reasons for refusal by Clare County Council** is partially addressed in this chapter.

Table 5.1: Summary of Consultation response on Human Health

Consultee	Type and Date	Summary of Consultee Response
Environmental Health Service (Dept. of the HSE)	Letter in Response to Scoping Report received on 10/10/2022	Response Received 10/10/2022: Recommendations were made on *Assessment of, Siting and Location of Turbines, Noise and Vibration, Shadow Flicker, Air Quality, Surface & Groundwater Quality and Geological Impacts* (Addressed respectively in Chapters (3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 and 17 of the EIAR). The Environmental Health Service (EHS) recommended that the matters of Public Consultation and Decommissioning Phase were included and assessed in the EIAR (Addressed in Chapter's 1, and 2 of the EIAR). A section on *public consultation* further recommended that the applicant develop a dedicated website for the proposed wind energy project. All correspondence, maps, project updates and documentation, including the EIAR, should be uploaded to this site (Addressed in

Consultee	Type and Date	Summary of Consultee Response
		Chapter 1) & the recommendation to hold public consultations. A section on *Ancillary Facilities* recommended that the EIAR should include details of the location of all site office, construction compound, fuel storage depot, sanitary accommodation and canteen, First Aid facilities, disposal of wastewater and the provision of a potable water supply to the site canteen (Addressed in Chapter 2 of the EIAR). A section on *Cumulative Impacts* recommended that the EIAR should include a detailed assessment of any likely significant cumulative impact of the proposed renewable energy development (Addressed in Chapter 17 and in the relevant technical assessment chapters of the EIAR).

5.3 BASELINE DESCRIPTION

5.3.1 Population and Settlement Patterns

Study Area 1 Site and Environs (District Electoral Divisions) Clooncoorha, Kilrush Urban, Kilrush Rural, Cooraclare and Tullycreen (168.02km^2).

According to the 2022 census, there is one defined community settlement with a population greater than 4,586 people within a 10km radius of the Project. The town of Kilrush, the nearest urban settlement to the Project, is located approximately 3.5km southwest of the Site and has a population of 2,649[2] (CSO). The nearest major centre of population to the Site is Ennis, County Clare, which is located approximately 34km Northeast. According to the CSO, there were 27,923 persons living in Ennis, in 2022. The area surrounding the Site is largely rural, with a mixture of peatland, agricultural grassland, commercial forestry plantations, estuarine habitats, private roads and public roads. Isolated residences and farmsteads are also scattered throughout the area. Nearby settlements include the villages of Cooraclare 3km Northeast and Knockerra 3.37km Southeast.

[2] https://visual.cso.ie/?body=entity/ima/cop/2022&boundary=C04167V04938&guid=2ae19629-1fa8-13a3-e055-000000000001 – [Accessed 29/01/24]

Over the last five years, Clare County Council have granted planning permission in the Study Area 1 for development including one off housing, alterations to existing dwelling houses, agricultural buildings and commercial developments (including a car park and a solar PV energy Development). Planning permissions granted beyond the five years include a commercial wind farm (Tullabrack Wind Farm), and an electrical substation development[3]. The 2022 Census statistics note 1,782 occupied permanent residences in the Study Area 1.

There are 146 houses within 2km of the proposed turbines. All houses located within 2km of the proposed turbines are shown in **Figure 1.3**. The closest inhabited dwelling not connected with the Development is (H4) located 608m from the nearest turbine. There are three properties (H1 (560m), H2 (532m) and H5 (579m)) located less than 600m from proposed turbines. H2 is an old cottage that has been converted to a workshop and is not considered a sensitive receptor in this EIAR. H1 is a derelict house which still has an intact roof, so it has been included in the EIAR. H5 is an inhabited dwelling that is financially involved with the Project, and it has also been included in this EIAR.

The total population (2022 Census) in the Clooncoorha ED was 389, of which males numbered 188 and females were 201, in Kilrush Urban was 2,790, of which males numbered 1,348 and females were 1,442, in Tullycreen was 155, of which males numbered 74 and females were 81 and in Kilrush Rural was 738, of which males numbered 382 and females were 356 and in Cooraclare was 514, of which males numbered 257 and females were 257..

Grid Connection Route (GCR)

In order to assess potential impacts on human beings and human health along the Grid Connection Route (GCR), a review of properties and planning applications in the vicinity of the proposed works was carried out, with the majority of developments along the route comprising one-off houses. The land-use along the GCR comprises mainly transport, and surrounding land use is mainly agriculture with some areas of peat harvesting and forestry.

The construction works for the GCR will be small and temporary.

[3] Clare County Council. *Planning map Search* Available online at https://www.clarecoco.ie/services/planning/applications/view/ [Accessed 30/11/23].

Turbine Delivery Route (TDR)

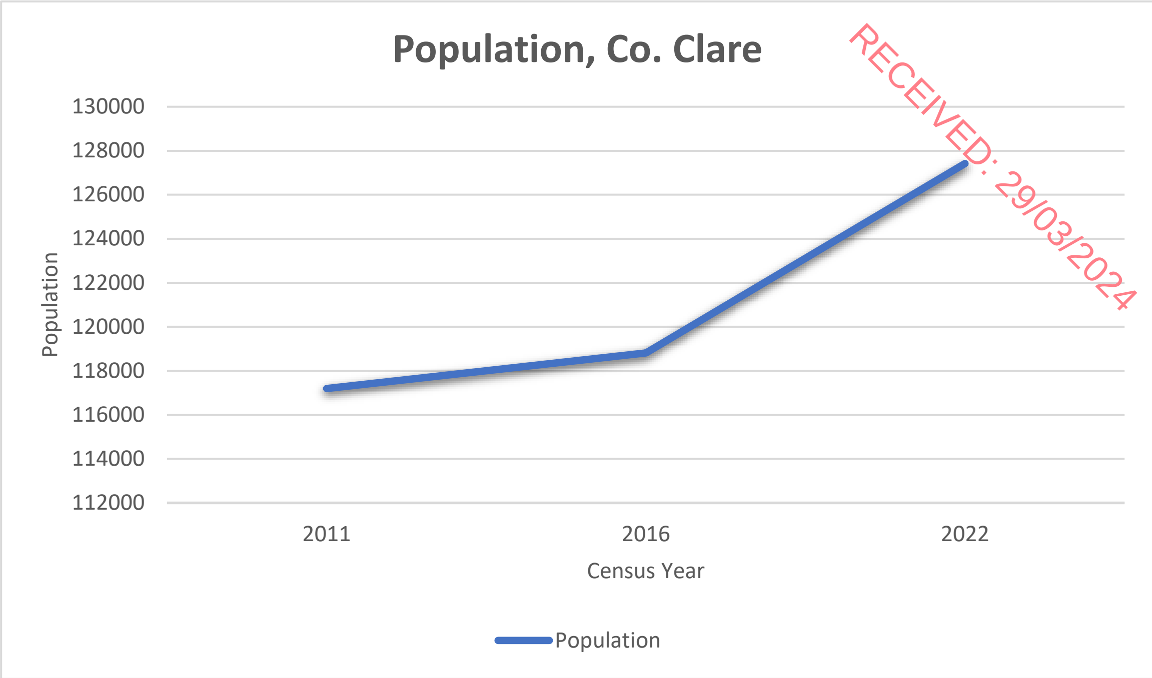
To assess potential impacts on human beings and human health along the Turbine Delivery Route (TDR), a review of properties and planning applications in the vicinity of the four areas which are planned to be the subject of temporary widening works along the TDR was carried out. The majority of development along the Turbine Delivery Route comprises rural farmstead properties and one-off housing. The land-use along the TDR is comprised mainly of transport infrastructure, and surrounding land use is mainly agriculture with some areas of peat harvesting and forestry.

The Turbine Delivery Route passes via five defined settlements, two in County Limerick (i.e., Foynes and Limerick City), and three in County Clare (i.e., Shannon, Ennis and Lissycasey) However, all proposed TDR works associated with the Project are located outside of defined settlement areas. The active construction areas for the road works along the Turbine Delivery Route will involve localised surface-level earthworks (removal of soil and unconsolidated rock) along the L6132 and will be temporary in nature. The permanent vertical realignment works on the L6132 in the townland of Gower South are small-scale, short-term works.

Study Area 2: Clare County (3,450km^2)

The total population in the 2022 CSO for County Clare was 127,419 of which males numbered 62,686 and females were 64,733. There has been a 7.24% increase in the population since 2016 as shown in **Figure 5.3**. The population density is 36.93 persons per square kilometre (km^2) in 2022 versus 34.44 per square kilometre in 2016 (CSO). The total number of households was 43,469 in 2016, a 1.9% increase since 2011[4].The average size of households (in persons) has generally remained the same at 3 persons per household based on 2011, 2016 and 2022 census results.

[4] Central Statistics Office (CSO), 'Census 2011 Reports'. Available at: https://www.cso.ie/en/census/census2011reports/ - [Accessed 29/01/24]



Graph 5.1: **Total Population trend for County Clare's in recent National Census years.**

County Clare is the seventh largest county in Ireland with a land mass of 3,450km². There are a number of small towns, and large and small villages geographically spread throughout the County. In total, there are 41 settlements and they provide essential services for the local communities and the rural hinterlands. The different settlement tiers perform differing roles with the result that no area in the county is significantly peripheral or isolated. This provides a reasonable platform upon which to build an integrated local economic and community plan and strong sustainable communities. The Draft Local Economic and Community Plan 2023-2029[5] (LECP) as set out in the County Clare Development Plan sets out the objectives and actions needed to promote and support the economic development and the local and community development of County Clare. The LECP is compiled by local community development committees of which there is one in each local authority area, established under the Local Government Reform Act 2014 (as amended).

The increase in rural population over a 6-year period from 2016 to 2022 in County Clare was 9,121[6]. The towns of Ennis (27,923), Shannon (10,256), Kilrush (2,649) and the village of Sixmilebridge (2,832) are the most populated within the county[7]. Ennis, is the County Town and the administrative centre of county Clare. It is an important residential, service

[5] Local Community Development Committees (LCDCs), on behalf of Clare County Council, '*Draft Clare Local Economic and Community Plan 2023-2029'* https://www.clarecoco.ie/services/community/lecp/#lecp23 – [Accessed 29/01/2024]
[6] Local Community Development Committees (LCDCs), on behalf of Clare County Council, '*County Clare Economic and Community Plan 2016-2021'* Published May 2016. Available at: https://www.clarecoco.ie/services/community/lecp/clare-county-local-economic-and-community-plan-2016-2021-23211.pdf - [Accessed 29/01/24]
[7] Central Statistics Office (CSO), 'Census 2016 Reports'. Available at: https://www.cso.ie/en/census/census2016reports

and commercial centre providing significant levels of employment[8]. According to the 2022 Census there are 13,510[9] people residing in the Ennis settlement. area who are classed as being '*At Work'*.

Study Area 3: Midwest Region (as part of the Southern Region Assembly)

The Regional Spatial and Economic Strategy (RSES) for the Southern Regional Assembly 2040[10] outlines the assembly's aim of reversing of town/village and rural population decline, by encouraging new roles and functions for buildings, streets and sites. The National Planning Framework (NPF)[11] projects a population growth for the southern region of between 340,000 to 380,000, during this period, with an additional 225,000 people in employment.

RSES notes that the population living in '*aggregate rural area'* (i.e. persons living in the open countryside or in settlements of less than 1,500) are home to almost 49.15% of this region's population, and as such represent a sizeable cohort of the population. Population growth needs to be matched by the delivery of critical enabling infrastructure and services, thus ensuring that these places grow as successful significant employment centres and service locations not only for the urban areas themselves but, importantly, for their extensive hinterlands that include smaller towns, villages and rural areas. The RSES outlines the importance for the energy sector being a regional driver of the rural economy (White Paper-Irelands transition to a Low Carbon Energy Future 2015-2030). The RSES outlines a key objective relating to supporting enterprise and employment in rural areas, as set out in the Department of Heritage, Regional, Rural and Gaeltacht Affairs Action plan for Rural Development, which includes the support of sectoral growth through roll out of initiatives to develop the renewable energy sector in rural Ireland.

Study Area 4: Ireland

Ireland has experienced rapid population growth in recent years with an improved standard of living and infrastructure growth resulting in a net inflow of population. The country has seen a population increased by 8% since 2016 from 4,761,865 to 5,149,139 as per the 2022

[8] Clare County Council, '*The Clare County Development Plan 2023-2029'*. Available at: https://www.clarecoco.ie/services/planning/ccdp2017-2023/ - [Accessed 29/01/24]
[9] Western Development Commission, '*Travel to Work and Labour Ctachments in the Western Region, Ennis Labour Catchment'*. Available at: https://westerndevelopment.ie/wp-content/uploads/2020/09/TraveltoWork_LabourCatchments_WesternRegion2016_Ennis.pdf - [Accessed 29/01/24]
[10] Southern Regional Assembly, *'Regional Spatial & Economic strategy 2020-2040 (RSES)'*. Available at: http://www.southernassembly.ie/regional-planning/rses - [Accessed 29/01/24]
[11] The Department of Housing Planning and Local Government, on behalf of the Government, 'Project Ireland 2040 - The National Planning Framework' published February 2018. Available at: https://npf.ie/project-ireland-2040-national-planning-framework/ [Accessed 29/01/24]]

census[12]. The Irish population is at its highest figure since 1841, and it is the first time the population has been recorded over 5 million since 1851[14]. The National Planning Framework (NPF)[13] (2018) has set out its intention to facilitate a significant growth in Ireland's population by 2040. Full achievement of the targets set out in the 'Project Ireland 2040 National Planning Framework'[14] would accommodate around 1.1 million additional people residing in Ireland by 2040.

5.3.2 Economic Activity

5.3.2.1 Primary sectors

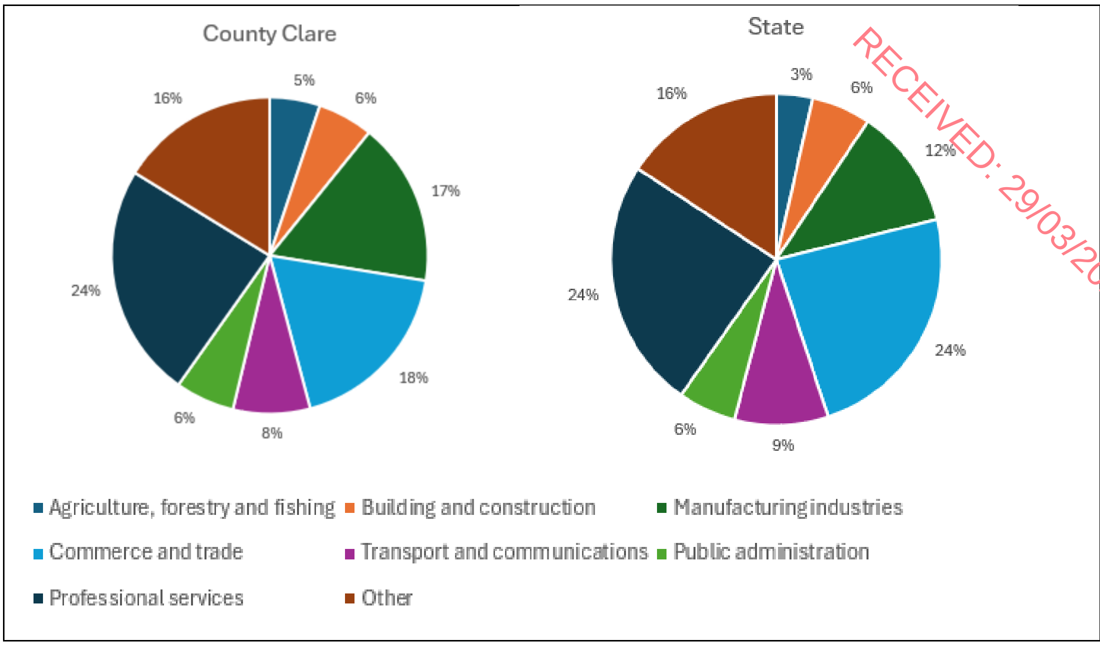
Study Area 1: Study Area 1 Site and Environs (District Electoral Divisions) Clooncoorha, Kilrush Urban, Kilrush Rural, Cooraclare and Tullycreen (168.02km^2).

The main sectors in this Study Area are agriculture, commerce and trade, tourism (Wild Atlantic Way) and professional services.

Study Area 2: Clare County

The economy of County Clare is broadly based and diverse with strengths in the areas of industry, health, wholesale retail, hospitality/tourism and education. County Clare in 2022, as a mostly rural constituency, has slightly more residents working in agriculture, forestry or fishing than nationally (5% in Clare compared to 4% nationally). There is a higher percentage of County Clare residents working in manufacturing and industry (17% compared with 12% nationally). Also, County Clare has less workers in commerce and trade (18% in County Clare compared to 24% nationally), and a slightly lower proportion of residents working in transport and communications (8% in County Clare when compared (9% nationally). However, there is a higher rate of workers in skilled trade occupations (16%) than nationally (13%). Furthermore, County Clare has slightly less workers in professional occupations (19% compared to 20% nationally) and sales and customer service occupations (5% compared to 6% nationally) than the corresponding national share[15].

[12] Central Statistics Office (CSO), 'Census 2022 Reports'. Available at: https://www.cso.ie/en/statistics/population/censusofpopulation2022/censusofpopulation2022-summaryresults/ - [Accessed 29/01/24]
[13] The Department of Housing Planning and Local Government, on behalf of the Government, 'Project Ireland 2040 - The National Planning Framework' published February 2018. Available at: https://npf.ie/project-ireland-2040-national-planning-framework/ - [Accessed 03/02/24]
[14] The Department of Housing Planning and Local Government, on behalf of the Government, 'Project Ireland 2040 - The National Planning Framework' published February 2018. Available at: https://npf.ie/project-ireland-2040-national-planning-framework/ - [Accessed 03/02/24]
[15] Library and Research Service Houses of the Oireachtas, *'Dáile Éireann Consituency Profile Clare*' published January 2020 Available at: https://data.oireachtas.ie/ie/oireachtas/libraryResearch/2020/2020-02-09_clare-constituency-profile_en.pdf - [29/01/24]



Graph 5.2: Economic Activity

5.3.3 Employment

5.3.3.1 Primary sectors

Study Area 2: Clare County

According to the CSO 2022 there were 56,144 persons over 15 years of age at work in Clare County, an increase of 6,633 people (+13%) between 2016 and 2022. Nationally, there was an increase of over 16% of people over 15 years of age at work.[16]

The leading employment sectors in County Clare are Professional Services (24%) and Commerce and Trade (18.3%)[17]. Of the 46,796 persons aged 15 years and over who were outside the working population, 25% were students, 14% were looking after the home/family and 39% were retired. **Table 5.2** sets out employment status in Clare County in 2022.

Table 5.2: Clare County Labour Force Status (2022)

Principal Economic Status	No. Persons
At work	56,144
Looking for first regular job	813
Short term unemployed	1,669

[16] CSO, Census 2022 Summary Results Clare Available at: https://www.cso.ie/en/csolatestnews/pressreleases/2023pressreleases/pressstatementcensusofpopulation2022-summaryresultsclare/#:~:text=There%20were%2056%2C144%20people%20(aged,%25)%20between%202016%20and%202022. [Accessed online 09/02/2024]

[17] CSO, Census 2022 Available at: https://visual.cso.ie/?body=entity/ima/cop/2022&boundary=C03789V04537&guid=2ae19629-14a2-13a3-e055-000000000001&theme=13 [Accessed 03/02/24]

Principal Economic Status	No. Persons
Long term unemployed	2,485
Student	11,726
Looking after home/family	6,565
Retired	18,317
Unable to work due to permanent sickness or disability	4,462
Other	759
Total	**102,940**

5.3.4 Land Use and Topography

5.3.4.1 Study Area 1 Site and Environs (District Electoral Divisions) Clooncoorha, Kilrush Urban, Kilrush Rural, Cooraclare and Tullycreen (168.02km^2).

County Clare is located in the Southern Region Assembly and is bordered by counties Limerick, Tipperary and Galway. Due to the expanse and variety of the county Clare landscape there are 26 landscape character types (LCT's) across the county. According to the Landscape Character Assessment (LCA) for county Clare the site is at the juncture of three LCT's;

1. LCT 4 - '*Coastal Plain and Dune'*;
2. LCT 9 - '*Farmed Rolling Hills'*; and,
3. LCT 10 - '*Flat Estuarine Farmland and Islands'*.

The Project is mainly located within a single Landscape Character Area (LCA) categorised as "*Kilrush Farmland*" but also straddling an LCA categorised as *"Shannon Estuary Farmland"*. According to the county Clare Development Plan 2023 – 2029 Wind Energy Strategy' both these LCA's retain medium sensitivity to small – medium sized Wind Farm Development[18].

Per the County Clare LCA the Development also is set within an area identified as a '*Settled Landscape'* and one described as "*Areas where people live and work*". This is a more robust landscape designation in terms of policy than '*Heritage-landscape'*, but it still retains more sensitivities overall than the other remaining category i.e., '*Working Landscape*'.

[18] Clare County Council, '*The Clare County Development Plan 2023-2029, Clare Wind Energy Strategy'.* Available at: https://clarecdp2023-2029.clarecoco.ie/stage3-amendments/adoption/volume-6-clare-wind-energy-strategy-clare-county-development-plan-2023-2029-51390.pdf – [Accessed 13/02/24]

The majority of the project is enclosed within an area identified as an area '*Open to Consideration'* for Wind Energy development and with areas identified as Acceptable in Principle nearby to the northwest and southeast of the site.

"Landscape values were derived for each landscape character area by consideration of environmental and cultural benefits e.g. aesthetics, ecological, historical, socio-economic, religious, mythological etc. The values were given a score ranging from low, medium, high to outstanding."

Landscape Sensitivity

"The sensitivity of a landscape to development and therefore to change will vary according to its character and to the importance which is attached to any combination of landscape values. The sensitivity of the character areas was derived by consideration of designations such as Special Protection Areas, Natural Heritage Areas, National Parks, by information such as tourist maps, guidebooks, brochures and by evaluation of indicators such as uniqueness, popularity, distinctiveness and quality of the elements of the area."

(Low to high sensitivity = 1-3, Special to Unique = 3-5 & Unique = 5)

The Site is currently used mainly for agricultural livestock grazing, farmland, bog and conifer forestry plantation. The Site is situated on relatively low and level ground, at elevations ranging between 32m and 34m AOD. The highest point of the Site is located between the Townlands of Tullabrack East and Ballykett, toward the northern portion of the Site with an elevation of 34m AOD.

Grid Connection Route (GCR)

The proposed GCR is from the Development to Tullabrack 110kV Substation.

According to the Landscape Character Assessment (LCA) in the Clare County Development Plan 2017-2023, the GCR is located within two landscape character types:

- Coastal Plain and Dunes
- Farmed Rolling Hills

The Grid Connection is proposed to be an UGC, utilising sections of cabling in public roads, primarily regional public roads, as well as private third-party lands. Given the underground nature of this grid route, there will be no significant impact on the landscape and landscape value of the area once the cable ducting has been laid.

Turbine Delivery Route (TDR)

To assess potential impacts on human beings and human health along the Turbine Delivery Route, a review of landscape values and sensitivity in the vicinity of the areas which will be subject to temporary works along the Turbine Delivery Route was carried out. According to the Landscape Character Assessment for county Clare (LCA, 2004), the TDR works will be located within two designated landscape character types:

- Coastal Plains and Dunes; and,
- Farmed Rolling Hills

The temporary road works along the Turbine Delivery Route will involve only minor surface-level earth works. At intervals where the paved road surface narrows to less than 2.5 metres width, temporary road surfacing will be applied, in the form of compacted gravel Clause 804 stone, inside the road verge to safely facilitate turbine component deliveries. This will be a temporary feature and road verge will be reinstated following completion of turbine component deliveries to the Site. The proposed Turbine Delivery Route works associated with the Project will not have any long-term negative impacts on the landscape or landscape value.

5.3.5 Tourism

5.3.5.1 Tourist Attractions

Study Area 1: Study Area 1 Site and Environs (District Electoral Divisions) Clooncoorha, Kilrush Urban, Kilrush Rural, Cooraclare and Tullycreen (168.02km^2).

There are a number of tourist attractions within a 10km radius of the Project.

The nearest tourist attraction is the JJ Corry Irish Whiskey Experience which is located 1.2km northeast of the Site Redline Boundary. This attraction is located on a family farm where they facilitate a tour and tasting experience of their whiskey facility.

A popular tourist attraction located approximately 3.7km southwest of the Site is the Vandeleur Walled Garden. It opened in 2000 and is located within a 170-hectare area of native woodland.

The Scattery Island Visitor Centre is a tourist attraction located in Kilrush, approximately 4km southwest of the Site. It facilitates boat trips to Scattery Island and guided tours of the historic monastery on Scattery island. The visitor centre is also comprised of an information centre, restaurant and coach parking.

Scattery Island itself is a popular tourist attraction located approx. 7km southwest of the project site. It was awarded The European Destination of Excellence for 2017 (EDEN). There are a number of built and cultural heritage sites on the island including five churches, a cathedral, a round tower, a Napoleonic era war artillery battery and a working lighthouse.

"*The Flying Alpaca*" is an alpaca farm located 8.5km southwest of the project Site. This farm accommodates alpaca trekking.

Shannon Dolphin and Wildlife Centre is located in the town of Kilrush approx. 4.1km southwest of the Site. It is open every year from mid-May until mid-September. It provides free guided tours from marine biologists where you can learn about the valuable ongoing research on the Shannon Estuary bottlenose dolphin population and whale & dolphin species in Irish waters.

The West Clare Railway and Heritage Centre is located 5km west of the Site. The West Clare Railway and Heritage Centre provides visitors and enthusiast alike with a look into the railway history of Ireland. The West Clare Railway Heritage Museum and Railway is currently closed to the public until further notice.

Study Area 2: Clare County

The tourism industry is critical to the economy of county Clare. The county is one of the leading tourist counties in Ireland and attracts significant domestic and foreign investments annually. Many areas that are important to the tourist industry of county Clare owe their attraction to their abundance of tourism resources, including natural and cultural attractions, vibrant towns and villages and contrasting landscapes, all of which are easily accessible to both national and international visitors[19]. For example, the Cliffs of Moher are located approximately 34km north of the Site. It features cliffs which rise 120m above the Atlantic Ocean at Hag's Head and reaches its maximum height of 214m just north of O'Brien's Tower and views of the Aran Islands in Galway Bay on a clear day. The Cliffs of Moher are home to one of the major colonies of cliff nesting seabirds in Ireland. The area is a Special Protected Area (SPA) for Birds under the EU Birds Directive in 1986 and as a Refuge of Fauna under the Refuge of Fauna (Cliffs of Moher) Designation Order, 1988. There are a number of objectives and preferred development options outlined in the Clare CDP (2023-2029) which seek to promote tourism in the county. The CDP (2017) states; *"a County Clare in which tourism growth continues to play a major role in the future development of the*

[19] Clare County Council, '*The Clare County Development Plan 2017-2013'.* Available at: https://www.clarecoco.ie/services/planning/ccdp2017-2023/ - [Accessed 29/01/24]

County, adapting to the challenges of competing markets by maximising the development of a high-quality diverse tourism product". Objective CDP9.17 – Development Plan Objective: Sustainable Tourism states the goal of the CDP to *"support the sustainable and responsible tourism initiatives across County Clare in order to ensure that on-going growth in the tourism industry is balanced with the long-term protection of the natural environment and cultural density of the County".*

5.3.5.2 Tourism: Numbers and Revenue

Study Area 2: Clare County

The Mid-West Region includes the counties of Clare, Limerick and Tipperary. The region has a wealth of natural, cultural and heritage assets of national importance and is a significant tourist destination. Ireland's Mid-West Region benefits annually from an influx of foreign and domestic visitors with this market proving particularly important for the region's tourism and hospitality sectors. Prior to the Covid-19 pandemic, the region benefited from approximately 1.4 million overseas visitors each year, and over 900,000 domestic tourists, which when combined contributed over €600m annually to the regional economy. [20].

County Clare is home to a number of nationally renowned visitor attractions including; the Cliff of Moher, Lough Derg, Bunratty Castle & Folk Park, Craggaunowen, the Burren – UNESCO World Heritage Site, the Poulnabrone Dolmen, the Loop Head Peninsula, Fanore Beach, Aillwee & Doolin Caves and also Scattery Island. The Cliffs of Moher was the second most visited fee charging attraction in Ireland in 2019, with 1,600,000 visitors.

County Clare's coast is also included in the '*Wild Atlantic Way*" which is one of the longest defined costal routes in the world. It was devised as a new '*experience*' and '*destination*' by Fáilte Ireland to present the west coast of Ireland as a compelling international tourism product. It has become an over-arching brand which individual destinations and businesses can trade collectively under with much greater potential visibility and clarity of message in the international marketplace[21].

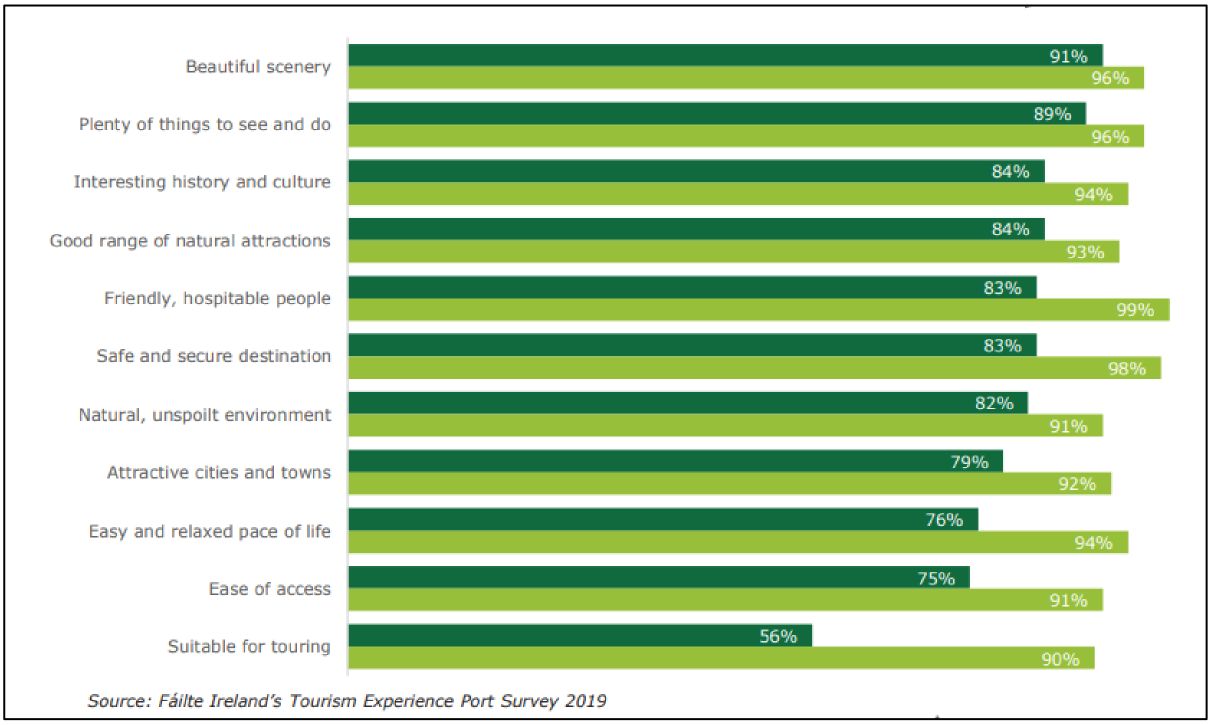
5.3.5.3 Visitors Attitudes to Windfarms

The first wind farm in Ireland was completed in 1992 at Bellacorrick, Co. Mayo and since then wind farms have elicited a range of reactions from Irish people (Fáilte Ireland, 2012). In 2002, Sustainable Energy Ireland (SEI) - now the Sustainable Energy Authority of Ireland

[20] Regional Enterprise Plan to 2024 Mid-West, https://enterprise.gov.ie/en/publications/publication-files/mid-west-regional-enterprise-plan-to-2024.pdf, [accessed 09/02/24]
[21] Wild Atlantic Way Regional Development Strategy 2023-2027, , https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/Wild%20Atlantic%20Way/Wild-Atlantic-Way-Regional-Tourism-Development-Strategy.pdf, [accessed 09/02/24]

(SEAI) - commissioned a survey aimed at identifying public attitudes to renewable energy, including wind energy in Ireland[22]. The 2002 survey found that, in general, Irish people are positively disposed towards the development of wind farms. However, the survey also indicated that people will not accept wind farms everywhere and that special care should be taken so that wind farm development be cognisant to contextual landscape characteristics.

Ireland's scenery has been a cornerstone of international tourism marketing campaigns for decades. The future sustainability of Ireland's tourism industry is therefore inextricably linked to the maintenance of the character and scenic qualities of the Irish landscape. **Graph 5.3** from Fáilte Ireland shows the importance of visual amenity to tourists visiting from overseas.



Graph 5.3: Importance and rating of destination issues among overseas holidaymakers (%) from Fáilte Ireland[23]

Fáilte Ireland, in association with the Northern Ireland Tourist Board (NITB), decided in 2007 to survey both domestic and overseas holidaymakers to Ireland to determine their attitudes to wind farms. The survey drew on many aspects of the original SEI survey in particular, the landscape types that were used to elicit a reaction from respondents. The purpose of the

[22] Sustainable Energy Ireland (2003), Attitudes towards the Development of Wind Farms in Ireland, Dublin
[23] Fáilte Ireland (2021) Key Tourism Facts 2019
https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/KeyTourismFacts_2019.pdf?ext=.pdf Accessed 06/02/2024

survey was to assess whether or not the development of wind farms would impact on the visitors' enjoyment of Irish scenery.

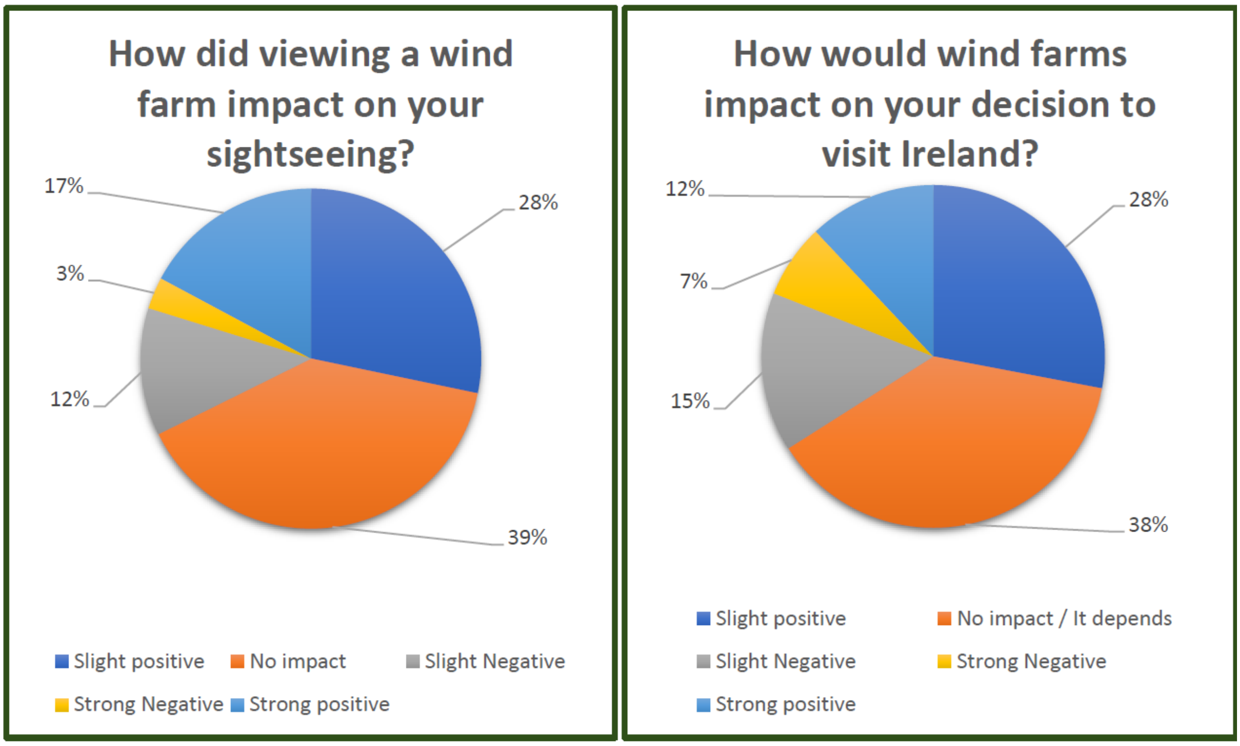
In 2012, this research was updated by Millward Browne Landsdowne on behalf of Fáilte Ireland to determine if there was any change in visitor attitudes during this period.

The 2012 research indicated that 47% of visitors felt an increased positive impact on landscape, compared to 32% in 2007. Negative responses also increased, showing 30% in 2012 against 17% in 2007. However, 49% of visitors felt that wind farms had no impact on the landscape in 2007 in comparison to 23% in 2012. It was notable that those interviewed who did not see a wind farm during their trip held more negative perceptions and opinions on wind farms to those that did.

Despite the fact that there has been an increase in the number of visitors who have seen at least one wind farm on their holiday, there was also a slight increase (from 45% in 2007 to 48%) in the number of visitors who felt that this had no impact on their sight-seeing experience. Importantly, and as has been seen in the previous research, the type of landscape in which a wind farm is sited can have a significant impact on attitudes.

Visitors were again asked to rate the beauty of five different yet typical Irish landscapes: coastal, mountain, farmland, bogland and urban industrial land, and then rate the scenic beauty of each landscape and the potential impact of siting a wind farm in each landscape. The results indicated that each potential wind farm and site must be assessed on its own merits, due to the scenic value placed on certain landscapes by the visitor and the preferred scale/ number of wind turbines within a wind farm. Looking across all landscapes, wind farms are seen to have an enhancing effect on the landscapes seen as less beautiful, particularly urban/ industrial and bogland. Coastal areas (91%) followed by mountain moorland (83%) and fertile farmland (81%) continue to be rated as the most scenic, and resistance is greatest to wind farms in these areas. There was a greater relative negativity expressed about potential wind farms on coastal landscapes (40%), followed by fertile farmland (37%) and mountain moorland (35%). Less than one in four were negatively disposed to the construction on bogland (24%) or urban industrial land (21%). Most visitors also still favour large turbines (47%) over small turbines (28%), and in smaller numbers, with the option of five turbines proving the most popular, followed by two clusters of ten and finally wind farms of 25 turbines.

Seven out of ten (or 71%) visitors claim that potentially greater numbers of wind farms in Ireland over the next few years would have either no impact or a positive impact on their likelihood to visit Ireland (**Graph 5.4**). Of those who feel that the potentially greater number of wind farms would impact positively on future visits, the key driver is support for renewable energy, followed by potential decreased carbon emissions. Given the scenario where more wind farms will be built in Ireland in the future, the most widely held view is that this will not impact their likelihood to visit the area again, with a slightly greater majority saying that this would have a positive rather than a negative impact.



Graph 5.4: Visitors Attitudes on the Environment – Wind Farms. Source: Fáilte Ireland (2008)

Fáilte Ireland carried out research on overseas holidaymakers' attitudes to Ireland in 2018. It noted holiday makers choice is based largely on *beautiful scenery* (93%), followed closely by *plenty to do and see* (91%) and *friendly people* and *natural attractions* (88%).

BiGGAR Economics carried out research in Scotland on 28 wind farms and tourism trends (2017)[24].

[24] BiGGAR (2017) Wind Farms and Tourism Trends in Scotland. Available online at: https://biggareconomics.co.uk/wp-content/uploads/2020/01/Wind-farms-and-tourism-trends-in-Scotland.pdf Accessed 09/02/2024

No pattern emerged that would suggest that onshore wind farm development has had a detrimental impact on the tourism sector, even at a very local level. No relationship was identified between the development of onshore wind farms and tourism employment at the level of the Scottish economy, at local authority level nor in the areas immediately surrounding wind farm development.

Attitudes to wind power were found to be 54% strongly in favour in November 2018. While favourability towards wind continued to consolidate (compared to 47% in October 2017), the total number in favour remained steady at just over 4 in 5, there was a 7% shift in Irish adults from 'tending to favour' wind power into being 'strongly in favour'. [25]

Matters relating to turbine height and landscape have been addressed in other sections of this EIAR (e.g. **Chapter 11: Landscape and Visual**). The setback distance makes the apparent scale of the turbines similar to the other turbines in the area, and therefore, the proposed turbines is not considered overbearing.

5.3.6 Human Health

Common concerns around wind farms in terms of human health are generally associated with issues such as electromagnetic interference, shadow flicker and noise. These topics are considered in this EIAR in addition to air quality and water contamination.

5.3.6.1 General Health of Population

Human health of communities can vary greatly owing to a number of factors including susceptibility to disease, location, income inequality, access to health care etc. The Department of Health routinely publishes a review of Irish public health indicators derived from several areas, including demographics, population health, hospital and primary care, employment and expenditure. In 2021 it published "*Health in Ireland – Key Trends 2021*" which indicates a generally positive picture of decreasing mortality rates set against high self-perceived health over the past decade. According to this report, Ireland has the highest self-perceived health status in the EU area, with 83.9% of people rating their health as good or very good[26].

The 2022 census data for the general health of the population as shown in **Table 5.3** indicates the health status across three of the Study Areas as "*Very Good*" to "*Good*". The

[25] IWEA Public Attitudes Monitor 2018, Irish Wind Energy Association. Available online: https://windenergyireland.com/images/files/iwea-report-2018.pdf [Accessed 09/02/2024]
[26] The Department of Health (2021) – "*Health in Ireland: Key Trends 2021"* Available at: https://www.gov.ie/en/publication/350b7-health-in-ireland-key-trends-2021/

health status of the Site and environs is very similar to that of county Clare as a whole. Both these areas are in line with the national average. The "*Very Good*" health status for county Clare at 58% is 1% lower than the national average.

Table 5.3: Population by General Health (2022)

General Health	The Site & Environs (10km)	County Clare	Ireland
	Percentage (%)		
Very good	45.3	51.6	53.2
Good	32.1	31.0	29.7
Fair	13.5	9.0	8.6
Bad	2.5	1.4	1.4
Very bad	0.5	0.3	0.3
Not stated	6.1	6.6	6.7

Note: The Site & Environs (10km) Population by General Health is based of the average population by General Health for each Electoral Division Area within 10km of the Site.

5.3.6.2 *Electromagnetic Interference*

Electromagnetic fields ("*EMF*") are invisible lines of force that surround electrical equipment, power cords, wires that carry electricity and outdoor power lines. Electric and magnetic fields can occur together or separately and are a function of voltage and current. When an electrical appliance is plugged into the wall, an electric field is present (there is voltage but no current); when that appliance is turned on, electric and magnetic fields are present (there is both voltage and current). Both electric and magnetic fields decrease with distance. Electric fields are also dissipated by objects such as building materials. On a daily basis, people are exposed to extremely low frequency ("*ELF*")) electric and magnetic fields (EMF) as a result of using electricity.

National and international health and scientific agencies have reviewed more than 35 years of research including thousands of studies. None of these agencies has concluded that exposure to ELF-EMF from power lines or other electrical sources is a cause of any long-term adverse effects on human, plant, or animal health. The International Commission on Non-Ionising Radiation Protection (ICNIRP) Guidelines give a limit of 100µT for sources of AC magnetic fields. This compares to 0.13µT for 110kV underground cable when directly above it, 1.29µT for 220kV underground cable when directly above it and 11.4µT for 400kV AC underground cable that is one metre deep and measured directly above it. The ESB published an information booklet in 2017 called "*EMF & You*" which provides information about Electric & Magnetic Fields and the electricity network in Ireland[27].

In 2014 a scientific study was undertaken in Canada[28], measuring electromagnetic fields around wind farms and their impact on human health. This study concluded the following: *"There is nothing unique to wind farms with respect to EMF exposure; in fact, magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices and were well below any existing regulatory guidelines with respect to human health"*.

5.3.6.3 Shadow Flicker

Chapter 13 provides the full assessment of shadow flicker of the Project for this EIAR.

5.3.6.4 Noise

Chapter 10 provides an assessment of noise in relation to the Project.

5.3.6.5 Air Quality

The Irish Environmental Protection Agency (EPA, 2022)[29], EU and World Health Organisation (WHO, 2014) reports estimate that poor air quality accounted for premature deaths of approximately 600,000 people in Europe in 2012, with 1,200 Irish deaths attributable to fine particulate matter ($PM_{2.5}$) and 30 Irish deaths attributable to exposure to ozone (O_3)[30] [31]. These emissions, along with others including nitrogen oxides (NO_x) and sulphur oxides (SO_x) are produced during the burning of fossil fuels for energy generation, transport or home heating. There are no such emissions associated with the operation of wind turbines.

Some level of traffic disruption to the public during the construction and Decommissioning phases of the Project is likely. Transport accounts for a significant portion of pollutants in the atmosphere.

Chapter 12 provides an assessment of air quality in relation to the Project.

[27] EMF & You, ESB, 2017 - https://esb.ie/docs/default-source/default-document-library/emf-public-information_booklet_v9.pdf?sfvrsn=0, accessed 09/02/2024

[28] Lindsay C McCallum, *et al*. (2014) *Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern?*

[29] Air Quality in Ireland, EPA 2022.

[30] *www.euro.who.int/en/health-topics/environment-and-health/air-quality/news/news/2014/03/almost-600-000-deaths-due-to-air-pollution-in-europe- new-who-global-report,* accessed 29/01/24

[31] Irelands Environment 2016 – An Assessment', EPA, 2016, accessed 29/01/24

5.3.6.6 Water Quality

Contaminants such as sediments arising from the Project have the potential to cause negative ecological effects. Mitigation proposals set out in **Chapter 9: Hydrology and Hydrogeology** will prevent and reduce risk of contamination of waterbodies. The drainage design and surface water network are considered in terms of assimilative capacity, that is to dilute contaminants in receiving waterbodies as a '*last line of defence'*. Any contaminants will be treated when water is abstracted for drinking water purposes. This is further detailed in the Construction Environmental Management Plan (**Appendix 2.1**).

Consultation with the Geological Society of Ireland (GSI) well database indicates there are no mapped wells within the Redline Boundary. Governing industry guidelines stipulate a buffer zone of 250m is required of from boreholes used for drinking water abstraction. The closest mapped wells are greater than 250m from the Redline Boundary of the Site with several wells less than 2km from the Redline Boundary of the Site (EIAR Section 9.3.10). All houses are over 600m from the Developable Area, therefore, it can be considered outside the 250m buffer zone distance.

Chapter 9 provides a hydrological assessment for the Project, including the proposed mitigation measures to prevent potential effects on water quality (see also **Appendix 2.1**).

5.3.6.7 Traffic

Chapter 16 provides an assessment of traffic in relation to the Project.

5.3.6.8 Health Impact Studies

There are anecdotal reports of negative health effects on people who live near wind farms, however, there are no peer reviewed scientific research to support these views. Several peer reviewed scientific research publications are outlined below.

The National Health and Medical Research Council (NHMRC), Australia's leading medical research body, have concluded that there is no reliable or consistent evidence that wind farms directly cause human health problems as part of their Systematic Review of the Human Health Effects of Wind Farms published in December 2013. The review was commissioned to determine whether there is a direct association between exposure to wind farms and negative effects on human health or whether the association is casual, by chance or bias.

Objectors to wind farms often refer to 'Wind Turbine Syndrome' as a condition that can be caused by living in close proximity to wind farms. The symptoms allegedly include sleep deprivation, anxiety, nausea and vertigo. It has been rejected by the wind industry and is further refuted by a review carried out by the NHMRC that wind turbines cause this sort of symptoms. The review began in late 2012 and included a literature and background review of all available evidence on the exposure to the physical emissions produced by wind turbines. These emissions were noise, shadow flicker and electromagnetic radiation produced by wind turbines. The review concludes that the evidence considered does not support any direct association between wind farms and human health problems and that bias and confounding could be possible explanations for any reported association.

The international scientific journal "*Frontiers in Public Health*" published a study[32] in 2014 on the subject of wind turbines and human health. This review completed a bibliographic-like summary and analysis of the science around this issue, specifically in terms of noise (including audible noise, low-frequency noise, and infrasound), EMF, and shadow flicker. The study concluded as follows:
"The available scientific evidence suggests that EMF, shadow flicker, low-frequency noise, and infrasound from wind turbines are not likely to affect human health; some studies have found that audible noise from wind turbines can be annoying to some. Annoyance may be associated with some self-reported health effects (e.g., sleep disturbance) especially at sound pressure levels >40 dB(A). Because environmental noise above certain levels is a recognized factor in a number of health issues, siting restrictions have been implemented in many jurisdictions to limit noise exposure. These setbacks should help alleviate annoyance from noise. Subjective variables (attitudes and expectations) are also linked to annoyance and have the potential to facilitate other health complaints via the nocebo effect. Therefore, it is possible that a segment of the population may remain annoyed (or report other health impacts) even when noise limits are enforced." Based on the findings and scientific merit of the research conducted to date, it is our opinion that the weight of evidence suggests that when sited properly, wind turbines are not related to adverse health effects. This claim is supported (and made) by findings from a number of government health and medical agencies and legal decisions".

In general, there are no specific health and safety considerations in relation to the operation of a wind turbine. The area surrounding the turbine base will still be available for use as normal.

[32] L. D. Knopper, *et al*. (2014) *Wind turbines and human health*.

The potential effects of Noise is discussed in **Chapter 10,** and the potential for Shadow Flicker from the Project is assessed in **Chapter 13**.

5.3.6.9 Turbine Safety

The Department of the Environment, Heritage and Local Government (DoEHLG)'s '*Wind Energy Development Guidelines for Planning Authorities 2006'* state that there are no specific safety considerations in relation to the operation of wind turbines. Fencing or other restrictions are not necessary for safety considerations. People or animals can safely walk up to the base of the turbines. The DoEHLG Guidelines state that there is a very remote possibility of injury to people from flying fragments of ice or material from a damaged blade. However, most blades are composite structures with no bolts or separate components and the danger is therefore minimised. The wind turbines will be fitted with anti-vibration sensors, which will detect any imbalance caused by icing of the blades. The sensors will prevent the turbine from operating until the blades have been de-iced.

Turbine blades are made of fibre-reinforced polymer (FRP's) or unsaturated polyester, a non-conducting material which will prevent any likelihood of an increase in lightning strikes within the Site or the local area. Lightning protection conduits will be integral to the construction of the turbines. Lightning conduction cables, encased in protection conduits, will follow the electrical cable run, from the nacelle to the base of the turbines. The conduction cables will be earthed adjacent to the turbine bases. The earthing system will be installed during the construction of the Turbine Foundations. In extremely high wind speed conditions, (usually at Beaufort Storm Force 10 or greater) the turbines will shut down to prevent excess wear and tear, and to avoid any potential damage to the turbine components.

5.3.7 Property Value

There are currently no Irish studies undertaken to assess the impact of wind farms on property prices. However, a number of studies have been undertaken in the United Kingdom (UK), with findings set out in **Table 5.4**.

The largest study of the effects of wind farms on property prices was conducted in the USA by Hoen *et al*[33] for the US Department of Energy. This study in the USA used data from 7,500 of homes located within 10 miles (c.16km) of 24 existing wind farms in nine States over a 10-year study period. The findings are drawn from eight different pricing models,

[33] https://www.researchgate.net/publication/242582095_The_Impact_of_Wind_Power_Projects_on_Residential_Property_Values_in_the_United_States_A_Multi-Site_Hedonic_Analysis [accessed 29/01/24]

together with repat sales and sales volume models. None of the models found conclusive evidence of the existence of widespread effects on property values of properties surrounding wind farms. The study also found that neither the view of the turbines or the distance of the property to the turbines had any consistent, measurable and statistically significant effect on property prices in that area. The article does state that the analysis cannot dismiss the possibility that individual properties, or small numbers of properties could potentially be negatively affected, although if there are such properties, they are either too small or too infrequent to result any widespread, statistically observable effect.

The study outlined above was updated in 2013[34] where data was collected from 50,000 house sales in 27 counties in nine states across the USA. The properties were within 10 miles (16km) of 67 wind farms. Of these, 1,198 sales were of properties within one mile (1.6km) of a wind turbine. The data covers the period from before wind farms were consented in the areas to after their construction and into the operation phase. The authors used Ordinary Least Squares (OLS) and spatial process difference-in-difference hedonic models to make an estimation of the effects on house prices from wind farms. Regardless of the model used, the study found no statistical evidence that property prices near turbines were affected in the pre-planning/pre-construction or post construction periods. The research suggests that the effects of wind turbines on property prices is likely to be small, if there is any effect at all.

A study undertaken in 2014 by the Centre of Economics and Business Research for Renewable UK found that house prices were driven by the property market and not the presence or absence of wind farms[35]. The study analysed house prices at 7 sites across England and Wales at either planning, construction or post construction. The report concluded that:

"We can conclude that local house price growth at these sites is best explained by variations in the county level property market. When homebuyers came to purchasing a property in areas within 5km of wind farm sites, it appears that other factors that determined demand for property, such as the supply of new housing and the condition of the local economy, were more influential than the fact that a wind farm was located nearby. This resulted in properties on average retaining their value."

Another study was undertaken in 2014 by the London School of Economics and it did find the presence of wind farms negatively impacted property values within 2km of very large

[34] https://eta-publications.lbl.gov/sites/default/files/lbnl-6362e.pdf [accessed 29/01/24]
[35] https://cdn.ymaws.com/www.renewableuk.com/resource/resmgr/publications/reports/ruk-cebr-study.pdf [Accessed 03/02/2024]

wind farms[36]. In 2016, following on from the contrasting results of the 2014 studies ClimateXChange carried out their own research in Scotland. The ClimateXChange study found no significant effect on the change in price of properties within 2km or 3km of studied wind farms and found the property values trended in a positive direction in most cases[37]. The ClimateXChange study also found that some wind farms can provide economic and amenity benefits to an area.

In the absence of any peer reviewed/published evidence to the contrary, the above studies provide some context from the international perspective and indicate that wind farms do not affect property/ house value.

In addition to this, the additional energy security, community benefits (EIAR Section 1.7.2) and creation of jobs throughout the construction, operational and decommissioning phases of the proposed development will contribute to the sustainable growth of property values.

Table 5.4: Summary of research finding between wind farms and property values

Year	Country	Research Group	Finding
2009 and 2013	USA	LBNL	Analysed nearly 7,500 home sales near wind farms and found no consistent negative impact on property prices. They found no statistical evidence of wind farms affecting home prices before or after construction.
2014	UK	Centre of Economic Research	In summary the analysis found that country-wide property market drives local house prices, not the presence or absence of wind farms; and The econometric analysis established that construction of wind farms at the sites examined across England and Wales has not had a detectable negative impact on

[36]http://eprints.lse.ac.uk/58422/1/__lse.ac.uk_storage_LIBRARY_Secondary_libfile_shared_repository_Content_SERC%20discussion%20papers_2014_sercdp0159.pdf [Accessed 03/02/2024]
[37] Heblich, D. S., Olner, D. D., Pryce, P. G. & Timmins, P. C., 2016. *Impact of wind turbines on house prices in Scotland,* Scotland: ClimateXChange - https://www.climatexchange.org.uk/media/1359/cxc_wind_farms_impact_on_house_prices_final_17_oct_2016.pdf [Accessed 29/01/24]

Year	Country	Research Group	Finding
			house price growth within a 5km radius of the sites.
2014	UK	London School of Economics	There was an average reduction in the value of houses (based on 125,000 house sales between 2000 and 2012) of between 5% and 6% within 2km of very large wind farms.
2016	UK (Scotland)	ClimateXChange	Following a wide range of analyses, including results that replicate and improve on the approach used in the 2014 study by London School of Economics, the study did not find a consistent negative effect of wind turbines or wind farms when averaging across the entire sample of Scottish wind turbines and their surrounding houses. Most results either show no significant effect on the change in price of properties within 2km or 3km or find the effect to be positive. Some wind farms provide economic or leisure benefits (e.g., community funds or increasing access to rural landscapes through providing tracks for cycling, walking

5.3.8 Natural Disasters and Major Accidents

A wind farm is not a recognised source of chemical pollution. Should a major accident or natural disaster occur, the potential sources of pollution onsite during both the construction and operational phases are limited. Sources of pollution with the potential to cause significant environmental pollution and associated negative effects on health include bulk storage of hydrocarbons or chemicals and storage of wastes. The Site is not regulated under the Control of Major Accident Hazards Involving Dangerous Substances Regulations[38] i.e., "*SEVESO sites*" due to there being none of these sites in proximity of the Project, therefore there is no potential effect envisaged from this source.

[38] S.I. No. 209/2015 - Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 - https://www.irishstatutebook.ie/eli/2015/si/209/made/en/print [Accessed 03/02/2024]

5.3.8.1 Natural Disasters

There is limited potential for significant natural disasters to occur at the Site. Ireland is a geologically stable country with a mild temperate climate. The potential natural disasters that may occur are therefore limited to peat-slide, flooding and fire. The risk of peat-slide is addressed in **Chapter 8: Soils and Geology**.

There is a portion of the Site within a low probability flood plain within the Site. This is limited to a portion of new site access track and a new watercourse crossing. The Project will include in its design and use the latest best practice guidance to ensure that flood risk within or downstream of the Site is not increased as a function of the Project, i.e., a neutral impact at a minimum. The risk of flooding is addressed in **Chapter 9: Hydrology and Hydrogeology** and a Stage 1 and 2 Flood Risk Assessment is also included as **Appendix 9.1** to the EIAR.

It is considered that the risk of significant fire occurring, affecting the Project and causing the Project to have significant environmental effects is limited. As described earlier, there are no significant sources of pollution associated with the Project with the potential to cause environmental or health effects. Also, the spacing of the turbines and distance of turbines from any properties limits the potential for impacts on human health. The issue of turbine safety is previously addressed in **Section 5.3.6.9**.

In relation to earthquake risk, there are several fault lines across East-Clare with none documented in West-Clare; the Site is not located on any fault line[39]. There are no historical records of any earthquake causing serious damage in County Clare, the surrounding counties or on the Island of Ireland.

5.3.8.2 Major Accidents

The duties on designers and manufacturers of machinery including wind turbines are set out in the Machinery Directive, which has been transposed into national law by the 2008 European Communities (Machinery) Regulations as amended[40]. Properly designed and maintained wind turbines and associated infrastructure are a safe technology. A suitable separation distance from turbines and other key infrastructure to properties has been embedded in the Project design. These outlined measures will minimise the risk to humans. Overall impacts associated with weather, including extreme winds, lightning strikes, ice-

[39] Geological Survey Ireland (2023) Geological Survey Ireland Spatial Resources. Accessed: 29/01/24. Available online at: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 [Accessed: 03/02/2024]
[40] European Communities (Machinery) Regulations (2008) Statutory Instrument (S.I.) No. 407 of 2008 as amended by S.I. 310 of 2011 and S.I. 621 of 2015.

throws, heat waves and structural failure have been removed or reduced through inbuilt turbine mechanisms in modern machinery and have been scoped out of the assessment. Potential health impacts are therefore related to Decommissioning/construction related impacts and operational impacts on residential amenity.

With mitigation measures in place, it is considered unlikely that the impacts on population and human health (from a pollution perspective, environmental hazards or visual amenity) would be significant and can be ruled out and are therefore not discussed further in this chapter.

5.4 ASSESSMENT OF POTENTIAL IMPACTS

5.4.1 Population and Settlement Patterns

The Project does not contain a housing or services element and is not considered to have any direct positive or negative impact on the local or regional population levels. There is however, the benefit which would accrue to the region in terms of the ability to provide electricity to industry and business in a high-quality supply. This will lead to the region becoming more attractive to business with the subsequent benefit of increased employment opportunities in the region. A renewable, green energy supply could potentially be attractive for companies looking to develop in County Clare and be located in the vicinity of the Site. However, construction workers who are not based locally may temporarily relocate to the region, this is more likely for the initial construction and Decommissioning phase than for the operational phase and would be a direct effect in terms of influencing change in local population dynamics. Overall, it is the likely effect in terms of population dynamics considered to be **imperceptible**.

The predicted effect on the immediate settlement patterns and social patterns is also **slight to non-existent**.

During the construction phase there is the potential for limited impacts on the residential amenity of the local population. These would be short-term impacts relating primarily to an increase in construction traffic causing noise, dust, and an increase in traffic volume. These potential effects are assessed in EIAR **Chapter's 10**, **12** and **16**: **Noise**, **Air Quality and Climate** and **Traffic and Transport** respectively. The levels been defined as **slight negative** in the construction and Decommissioning phases and **imperceptible i**n the operational phase.

While this is not likely to result in a marked increase in settlement in the area, or a change in social patterns in the area, it should provide the provision of a secure, renewable energy source which would prove attractive to industry. This is dependent on national and global economic conditions, as well as the types of industry which may locate in the region.

The overall impact of the construction phase is predicted to be **slight positive and short-term** in nature should construction workers relocate to the area for the duration of these phases. The overall impact is predicted to be **slight positive** at the local level in terms of settlement patterns where increased business is attracted to the area during the operational phase.

5.4.2 Economic Activity

During the construction phase, there would be economic effects resulting from the expenditure on items such as Site preparation, site access roads, purchase and delivery of materials, plant, equipment and components. Information provided by the Developer on experience at other wind farms indicates that there is expected to be a peak onsite workforce of approximately 25 workers. Some of these workers will be sourced from the local labour market in Study Area 2. However, professional and skilled personnel may be required to be sourced from areas inclusive of Study Area 4 or even further afield.

During the initial Decommissioning and construction phase, jobs are likely to be created. Local employment will be provided, as well as employment on local, national and international levels both directly and indirectly. Throughout the Project lifetime, employment will be both created and maintained on local, regional, national and international levels.

It is envisaged that labour and materials will be sourced from the local area during construction where possible (on-site borrow pit). Ready-mix concrete and crushed stone will also be sourced from a local supplier, again subject to authorisation, and to quality and quantity being available.

Employees involved in the construction of the Project will most likely use local shops, restaurants and hotels/accommodation. Therefore, overall, there will be a **slight, positive impact** on employment in the Study Areas. Employees also involved in the subsequent operation of the Development will use local shops, restaurants and hotels/accommodation.

Clare County Council will benefit from payments under both the Development Contribution Scheme and from the annual rate payments. The Developer is also committed to a

'*Community Benefit'* package. This package will be advertised annually and managed by the local community, or an independent body appointed by the local community. The purpose of the community fund is to enable the local community to share in the benefits of the Project. The Developer's community benefit funds typically support local projects, with funds allocated to projects from all aspects of the community.

The overall impact is predicted to be a **moderate, positive, short-term** impact during the construction phase of the Project and **moderate, positive and long-term** during the operational phase.

5.4.3 Employment

The employment effects that are attributable to the Project can be outlined as direct, indirect and induced.

Direct: Employment and other economic outputs that are directly attributable to the delivery of the Project. These include any new jobs that are created to manage and supervise the construction phase, operational and Decommissioning phases of the Project and that are filled by employees of the Developer or the appointed contractor (or sub-contracted employees).

Indirect: Employment and other outputs created in other companies and organisations that provide services to the Project, (i.e., procurement and other supply chain effects). Most manufactured materials like towers, blades and subcomponents are assumed to be imported (import intensity of 66%) with major infrastructure delivery through Foynes Port, Co. Limerick; fewer indirect manufacturing jobs will be generated domestically in Ireland.

Induced: Additional jobs and other economic outputs that are created in the wider economy, as a result of the spreading of employee incomes and other ripple effects that occur as a result of the direct and indirect effects of the Project.

The Proposed Development will create local employment opportunities throughout the construction, operational and decommissioning phases. These opportunities include local contractors being employed, local suppliers being sourced when possible, and the use of hotels and other services.

In 2014, Siemens[41] published a report analysing the job creation potential of the wind sector in Ireland in conjunction with the Irish Wind Energy Association. The report states that:
'*A major programme of investment in wind could have a sizeable positive effect on the labour market, resulting in substantial growth in employment.'*

Direct employment identified in the report includes; Installation, Development, Planning, Operation and maintenance, Investor Activity, Grid network employment and potential Turbine Manufacturing employment.

The 2021, Wind Energy Ireland report; Economic Impact of Onshore Wind in Ireland42, notes that the onshore wind sector employed approximately 5,130 people in 2020, not including employment in grid development. This includes significant employment in rural communities. The majority (62%) of income generated is in the sectors supply chain, showing that the sector acts as a catalysis for wider employment. In the SEAIs Wind energy Roadmap 2011-2050[43], it is estimated that onshore and offshore wind could have an investment potential of €6 million to €12 million by 2040 and create 20,000 direct installation and operation/maintenance jobs.

In terms of its capacity to capture capital investment domestically, Ireland has strong indigenous feasibility, planning, foundations and engineering expertise, with the skills and knowledge base to potentially supply niche markets in controls and instrumentation, albeit the bulk of heavy manufacturing (blades, towers) is imported. Similarly, the Irish supply chain is very well positioned in all the preliminary design and operational aspects of the electricity grid, providing a significant boost to local employment. However, some manufactured materials such as cables, underground pipes, insulators and conductors are sourced from abroad. According to SEAI, there are approximately 0.34 new long-term jobs per MW, which falls in line with European Wind Energy Association (EWEA) estimates for direct employment in Europe. In the case of the Proposed Development, this translates to 6 new long-term jobs for the 20 MW wind farm.

According to the Institute for Sustainable Future Documents (2015)[44], 3.2 jobs are created per MW of wind energy development during the construction and installation phase, the

[41] Siemens. (2014). An Enterprising Wind. https://www.esri.ie/publications/an-enterprising-wind-an-economic-analysis-of-the-job-creation-potential-of-the-wind Accessed 13/02/2024
[42] WEI. (2021). Economic Impact of Onshore Wind in Ireland. https://windenergyireland.com/images/files/economic-impact-of-onshore-wind-in-ireland.pdf
[43] SEAI. (2011). Wind Energy Roadmap 2011-2050 https://www.seai.ie/publications/Wind_Energy_Roadmap_2011-2050.pdf Accessed 13/02/2024
[44] Institute for Sustainable Futures, Calculating Global Energy Sector Jobs – 2015 Methodology Update, 2015. [Accessed Online_13/02/2024]
Available:https://opus.lib.uts.edu.au/bitstream/10453/43718/1/Rutovitzetal2015Calculatingglobalenergysectorjobsmethodology.pdf

report assumes a 2-year construction period. Using this figure, a projection of between 26 – 32 jobs could be created as a result of the construction phase of the Project (for an installed capacity of 16 – 20 MW and a construction phase period of 1 years).

The SEAI' 2015 report '*A Macroeconomic Analysis of Onshore Wind Deployment*'[45] puts direct construction jobs from wind farm developments at 1.07 jobs per MW based on 1 year of construction. Using this figure, a projection of between 17 and 21 jobs could be created as a result of the construction of the Project (for an installed capacity between 16 – 20 MW and a construction period of 1 years). Therefore, considering the minimum and maximum figures, it is estimated that between 17 and 32 direct and indirect jobs could be created during the construction phase of the proposed project. It is not expected that all of these jobs will be based at the wind farm Site, however, the employment of tradespeople, labourers, and specialised contractors for the construction phase will have a direct, short-term significant, positive impact on employment in the Study Area.

An estimated breakdown of the potential construction employment is as follows:

Table 5.5: Estimated Employment breakdown during the construction phase of the Project

Occupation/Task	No. of People	Employment Period
Foundation team	8	12 weeks
Tracks & Hardstands (truck drivers)	8	36 weeks
Plant drivers	4	45 weeks
Foreman	1	50 weeks
Engineer	1	50 weeks
Engineer	2	10 weeks
Electrical Substation (Civils)	10	10 weeks
Electrical Substation (Electrical)	16	16 weeks
Foreman	2	16 weeks
Turbine Delivery, Installation and Commissioning	11	8 -10 weeks
Turbine Commissioning	3	8 weeks
General operatives	3	45 weeks

[45] Sustainable Energy Authority Ireland (SEAI) (2015), A Macroeconomic Analysis of Onshore Wind Deployment to 2020. : https://www.seai.ie/publications/A-Macroeconomic-Analysis-of-Onshore-Wind-Deployment-to-2020.pdf [Accessed : 13/02/2024].

Approximately 25-43 persons will be employed during the peak of the construction phase during the civil engineering of site access tracks, Turbine Hardstands, Turbine Foundations, and Electrical Substation construction. These numbers will be somewhat less for the turbine delivery, assembly, commissioning and Decommissioning activities. A mixture of skills will be required, including unskilled/semi-skilled/skilled manual (construction labour and machine operators), non-manual (administration roles), managerial and technical (civil, electrical, mechanical technical and engineering) and professional roles (legal, business and accounting). The manual roles will be Site-based with the other roles being predominately office-based, with Site visits as and when required. During construction, personnel will be at the Site over a number of months and during these times will likely use local accommodation and restaurants and other facilities.

Anecdotal evidence received by the Developer on other wind farm construction projects shows that local businesses such as accommodation providers welcome the enhanced level of occupancy that is achieved due to the construction contractors using their accommodation on a year-round basis, including periods of the year that are traditionally considered *'low season*'.

The benefits of increased business, although temporary, can allow businesses to invest in improvements that would not otherwise be affordable, leading to a long-term enhancement.

Whilst overall effects on the tourism economy are considered to be negligible and not significant, the benefits to individual businesses will be substantial and significant.

The Project will create approximately two full-time jobs during the operational phase. In addition to these jobs, various personnel will be required for the successful and continued operation of the wind farm. During the operation phase of the wind farm, the operation and reliability, maintenance (turbines, civil works and electrical infrastructure) finance, ongoing compliance with permissions and permits, safety, security, community relations and benefits and land-owner agreements must be continually managed. These requirements are widely distributed over various employment sectors and are an integral part of the ongoing operation of the Development and will provide continuous employment for the lifetime of the wind farm. A general outline of the employment associated with the operational phase of the wind farm is outlined in **Table 5.6.**

Table 5.6: Stakeholders involved during the operational phase[46]

Maintenance Contracts	Financial and Services Contracts	Other Stakeholders
Project Manager	Lenders	Local Community
Asset Management	PPA Provider	Local Authority (incl. rates payments)
Turbine Contractor • Transport Companies • Crane Hire • Plant and Vehicle Hire • Site Facilities	Landowner Agreements	Construction and Maintenance material suppliers: • Local shops • Food providers • Accommodation providers
	Insurance	Plant Hire companies
	Accountancy	Telecom provider
	Safety Consultants	
	Community Liaison Officer	
Electrical Works Contractor	Environmental Monitoring • Noise • Ornithology • Habitat Management	
Civil Works Contractor		
Utility		

The persons fulfilling these roles may live and work anywhere in Ireland, visiting the Site as and when required, to operate and maintain the plant and equipment. During major service operations, personnel may be at the Site over several days and during these times may use local accommodation and restaurants.

Therefore, overall, there will be a **slight positive short-term** impact on employment in the area.

[46] Irish Wind Energy Association (2019) *Life-cycle of an Onshore Wind Farm.* Ionic Consulting. Available online at: https://www.iwea.com/images/files/iwea-onshore-wind-farm-report.pdf [Accessed 29/01/24]

5.4.3.1 Embedded measures

The Developer has a proven track record of developing renewable energy development and operation. The company has played a key role in the development of over 150MW of renewable energy projects in Ireland.[47]. The Developers experience from previous wind farm construction projects is that expenditure in local goods and services is widely spread and makes a difference to existing businesses. The Developer is committed to employing good practice measures with regard to maximising local procurement and will adopt measures such as those set out in the Renewables UK Good Practice 2014: *'Local Supply Chain Opportunities in Onshore Wind*' (Renewables UK, 2014).

The Developer will work with a variety of contractors who will be actively encouraged to develop local supply chains throughout the local area, and work with subcontractors to invest in training and skills development.

At this stage in the Project process, it is not possible however, to quantify economic benefits in respect of individual supply chain companies, as contracts would not be let until consent is granted. However, it is evident from the Developer's recent experience that local and regional suppliers of a wide range of goods and services will benefit from such a Project (in this case, county Clare, Limerick and Ireland as a whole).

5.4.4 Land Use and Topography

Chapter 8: Soils and Geology concludes that providing the mitigation measures proposed are fully implemented and best practice, as described, is followed on Site, it is not expected that there will be any significant impacts associated with the Project. It is recommended that suitable monitoring programmes are proposed and implemented to see that there is adherence to the CEMP and to the mitigation measures outlined here during construction, operation and Decommissioning of the wind farm.

5.4.5 Tourism

Fáilte Ireland were consulted in the scoping process of this Project and their guidelines '*EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects'*, which describes the effects of projects on tourism, were considered in this assessment. Many of the issues covered in the report are similar to those covered in this EIAR, for example, scenery is assessed in **Chapter 11: Landscape and Visual Amenity**.

[47] https://greensource.ie/

The 2017, BiGGAR Economics[48] study found that sustainable tourism appeared to perform better in areas surrounding wind farms compared to tourism at the level of the local authority area.

Fáilte Ireland published a study on '*Visitor Attitudes on the Environment'* in 2012[49] to assess the perceived impacts of wind farms on potential future visits to an area. The study found that 12% of those surveyed, responded that wind farms would have 'a strong positive impact' on their decision to visit Ireland, with 27% responding it would have a 'slight positive impact', whilst 38% said it would have 'no impact'. 7% of respondents stated it would have a 'strong negative impact' and 15% stated it would have a 'slight negative impact'. The survey also found that wind farms were noted as more favourable than other forms of development such as housing, mobile phone masts or electricity pylons.

Attitudes to wind power were found to be 54% strongly in favour in November 2018. While favourability towards wind continued to consolidate (compared to 47% in October 2017), the total number in favour remained steady at just over 4 in 5, there was a 7% shift in Irish adults from 'tending to favour' wind power into being 'strongly in favour'. [50]

Based on the findings of the collective Tourism and Economics studies referenced in **Section 5.4.5 and 5.3.5.3**, it is considered that the Project will not give rise to any significant effects on tourism resource potential. Overall effects of the Project with regards to tourism are considered to be, **slight, negative** during the construction, operational and Decommissioning phases.

5.4.6 Human Health

5.4.6.1 Electromagnetic fields

Electromagnetic fields from wind farm infrastructure, including the Grid Connection to the Tullabrack 110kV substation, are very localised and are considered to be **imperceptible, long-term** impact. EIAR **Chapter 13: Shadow Flicker and EMI** details how the potential effects of electromagnetic fields have been assessed in further detail.

[48]BiGGAR. (2017). Wind Farms and Tourism Trends in Scotland. https://biggareconomics.co.uk/wp-content/uploads/2020/01/Wind-farms-and-tourism-trends-in-Scotland.pdf Accessed 13/02/2024
[49] Fáilte Ireland (2012) Visitors Attitudes on the Environment – Wind Farms - https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/WindFarm-VAS-(FINAL)-(2).pdf?ext=.pdf [Accessed on 09/02/2024]
[50] IWEA Public Attitudes Monitor 2018, Irish Wind Energy Association. Available online: https://windenergyireland.com/images/files/iwea-report-2018.pdf [Accessed 09/02/2024]

5.4.6.2 *Shadow flicker*

Chapter 13 provides an impact assessment of the potential for shadow flicker effects from the Project incorporating pre and post mitigation assessment conclusions.

5.4.6.3 *Noise*

There is likely to be some noise and vibration from traffic within the vicinity of the Turbine Delivery Route and the Construction Haul Route which may cause disturbance to residents. However, the effects are not predicted to be significant. This is detailed in EIAR **Chapter 10: Noise.**

Operational noise, designed to meet the limits in the 2006 Wind Energy Development Guidelines will have a residual effect within the guideline limits and can be described as Not Significant. This is detailed in EIAR **Chapter 10: Noise**.

Noise effects during Decommissioning of the Project are likely to be of a similar nature to that during construction but of shorter duration. This is detailed in EIAR Chapter 10: Noise. Existing site access tracks and Turbine Foundations (excluding plinths) will be left in place and naturally vegetated over. Any legislation, guidance or best practice relevant at the time of Decommissioning will be complied with.

A baseline assessment of the existing background noise conditions was carried out, the results of which are presented in **Chapter 10: Noise**.

5.4.6.4 *Air Quality*

Chapter 12: Air Quality and Climate provides an assessment of air quality and climate related effects resulting from the Project. The assessment concluded that the Project has the potential to result in slight, negative, temporary/short-term effects during construction.

Potential cumulative effects were assessed as being of a **slight, negative, short-term** impact. Given that only effects of significant impact or greater are considered "significant" in terms of the EIA Regulations, the potential effects of the Project on air quality are considered **not significant**.

5.4.6.5 *Water Contamination*

Chapter 9 Hydrology and Hydrogeology provides an assessment of the hydrological effects in relation to the Project, including the potential for water contamination. The conclusion is referenced at **Section 9.6** and states that the Project as a whole, including the Turbine Delivery Route and Grid Connection Route are not likely to significantly affect groundwater quantities, quality or availability. Implementation of the control measures outlined in this EIAR will result in a robust environmental management plan which will target and mitigate likely sources and pathways of contaminants arising at the Site.

5.4.6.6 Traffic

Chapter 16 Traffic and Transport provides an assessment of the traffic effects in relation to the Project. The conclusion is referenced at **Section 16.10** and states that the Project has generally been assessed as having the potential to result in effects of a negative, slight/moderate, direct, short-term, high probability effect or lower during the construction and Decommissioning phase only. After mitigation, the residual effects have been assessed as imperceptible/slight, negative and short-term in nature.

5.4.6.7 Accidents/Disasters (incorporating Health & Safety)

As with any Project of this type, there is the potential for accidents to occur. In the context of human health and safety, these will be addressed under two main headings, accidents to personnel and accidents to plant and equipment ('infrastructure').

Accidents to Personnel

Risks present during the construction, operation and Decommissioning phases of the Project, which have potential to cause injury to personnel, may include but are not limited to:

- Burial under earthfalls / falling into bog holes or soft peat areas.
- Falling from height
- Work which puts personnel at work at risk from chemical or biological substances
- Work which involves energies – utilities such as electricity, gas, water, pressurized equipment.
- Work exposing personnel to the risk of drowning.
- Work involving the assembly or dismantling of heavy prefabricated components.
- Construction activities which have potential to cause accidents/incidents.
- Use of vehicles or mobile plant / machinery / equipment

Accidents to Infrastructure

Potential risk to infrastructure, again for the construction, operation and Decommissioning phases include but are not limited to:

- Burial under earthfalls / falling into bog holes or soft peat areas which impact the ground conditions of nearby structures, collapse of structures.

- Falling from height causing damage to property
- Work which puts personnel at work at risk from chemical or biological substances
- Work which involves energies – utilities such as electricity, gas, water, pressurised equipment which have potential to cause damage through fire, explosion, pressure release etc.
- Work involving the assembly or dismantling of heavy prefabricated components.
- Construction activities which have potential to cause accidents/incidents.
- Use of vehicles or mobile plant / machinery / equipment – failure of plant/machinery/equipment, loss of control.

The above health and safety risks are addressed within the CEMP (**Appendix 2.1**). Emergency response protocols are also set out within the CEMP documentation. In terms of significance of effects, the risk potential for accidents and disasters on site has been evaluated in Section 5.3.8 and is further addressed within Section 5.5.7 below and in **Chapter 15: Material Assets.**

5.4.7 Property Value

The effects to Property values have been reviewed and assessed within Section 5.3.7. Based on the evidence from a number of these published studies, the operation of a wind farm at the Site is considered to not significantly affect property values in the area. The Project will have a medium-long-term, imperceptible impact on property values.

5.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

Although no negative impact of significance has been established, there are a number of measures, which may be implemented for the safety of workers and the public during the construction, operational and Decommissioning phases.

5.5.1 Embedded Mitigation

The Project, as described in **Chapter 2: Project Description**, incorporates good practice measures for limiting the adverse effects of the construction works. The principal potential effects arising from works relate to construction traffic affecting the use of National Roads, local primary roads and access roads by the general public. Measures are set out in **Chapter 10: Noise** and **Chapter 16: Traffic and Transport** relating to how construction work and delivery of materials, goods and services would be managed to minimise impacts. Embedded mitigation measures have also been developed for both the operational and decommissioning stages of the project and outlined in the referenced chapters. The proposed mitigation measures have been further developed in the CEMP (**Appendix 2.1**).

5.5.2 Population and Settlement Patterns

Given that no negative impacts have been identified, no additional mitigation measures are proposed.

5.5.3 Economic Activity

Allowing for the implementation of embedded mitigation, no significant effects have been identified in respect of socio-economic receptors arising from the construction of the Project and therefore no mitigation measures are required to reduce or remedy any adverse effect.

5.5.4 Employment

Given that potential impacts of the Project at construction, operation and Decommissioning phases are predominantly positive in respect of socioeconomics, employment and economic activity, no mitigation measures are considered necessary.

5.5.5 Land Use and Topography

Given that no negative impacts have been identified, no mitigation measures are proposed (other than embedded mitigation of minimising land take).

5.5.6 Tourism

Allowing for the implementation of embedded mitigation, no significant effects have been identified in respect of tourist receptors arising from the construction of the Project and therefore no mitigation measures are required to reduce or remedy any adverse effect.

5.5.7 Human Health

5.5.7.1 Accidents/Disasters (incorporating Health & Safety)

Accidents to Personnel

Potential risks to personnel are discussed in **Section 5.4.6**.

Current legislation relating to the Safety, Health and Welfare of persons at work and industry specific Codes of Practice / Guidance documents, are designed to assist in the management of risks associated with the construction, operation, maintenance and Decommissioning phase of wind farm projects.

The construction, operation and Decommissioning of the Project shall be managed in accordance with the Safety, Health and Welfare at Work Act 2005 (as amended), the Safety, Health and Welfare at Work (General Application) Regulations 2007 (as amended), and the Safety Health and Welfare at Work (Construction) Regulations 2013 (as amended).

As required under the Safety, Health and Welfare at Work (Construction) Regulations 2013, the Developer shall appoint a Project Supervisor for the Design Process (PSDP) and a Project Supervisor for the Construction Stage (PSCS). The PSDP shall compile a Preliminary Safety and Health Plan (PSHP), which details general information about the Project and envisaged health and safety risks. The PSHP shall be made available to the PSCS. The PSCS shall develop a Construction Stage Health and Safety Plan (CSHSP) which incorporates the information contained in the PSHP and details how safety and health will be managed during the construction of the Project. The PSCS may also develop the following documents during the pre-construction stage of the Project, for implementation during the construction stage:

- Construction and Environmental Management Plan (updated from the outline CEMP in **Appendix 2.1**)
- Emergency Response Plan
- Detailed Traffic Management Plan

Accidents to Infrastructure

The PSDP shall see that the General Principles of Prevention, outlined under the safety design advice provided by the Health and Safety Authority (HSA) are taken into account for all designs relating to the project.

On very rare occasions, the structural integrity of wind turbines has failed. This is an extremely rare occurrence and given that the turbines will be designed and installed by an experienced turbine contractor and are located well away from public roads and dwellings in line with the Wind Energy Development Guidelines (2006), it is not considered (in the unlikely event of an accident of this type) that it would result in any significant impacts to population or human health.

Potential accidents, such as a risk of incident during transport, a fire on site or the risk of a turbine structural failure is assessed to be a **slight, negative, long-term** effect.

5.5.7.2 Operation

For operation and maintenance staff working at the proposed wind farm, appropriate site safety measures will be utilised during the operational phase by all permitted employees. All personnel undertaking works in or around the turbines will be fully trained and will use appropriate Personal Protective Equipment (PPE) to prevent injury.

Equipment within high voltage substations presents a potential hazard to health and safety. The proposed Electrical Substation will be enclosed by palisade fencing and equipped with intruder and fire alarms in line with ESBN and EirGrid standards.

All electrical elements of the proposed Development are designed to ensure compliance with electro-magnetic fields (EMF) standards for human safety.

All on-site electrical connections are carried by underground cable and will be marked out above ground where they extend beyond the site access track or Turbine Hardstand surface extents. Details of cables installed in the public road will be available from ESBN.

Lightning conductors will be installed on each turbine as all structures standing tall in the sky require this protection. Turbines specifically require this to prevent power surges to electrical components. Turbines will be fitted with ice detection systems which will stop the turbine from rotating if ice is forming on a turbine blade and this helps to prevent ice throw.

Rigorous statutory and engineering safety checks imposed on the turbines during design, construction, commissioning and operation will ensure the risk posed to humans is negligible. 24-hour remote monitoring and fault notifications are included as standard in the Turbine Operations and Maintenance Contracts. A Supervisory Control and Data Acquisition ("SCADA") system will monitor the Development's performance. If a fault occurs, then a message is automatically sent to the operations personnel preventing emergency situations.

In addition to scheduled maintenance, the maintenance contracts will allow for call out of local engineers to resolve any issues as soon as they are picked up on the remote monitoring system.

Access to the turbines inner structure will be locked at all times and only accessed by licenced employees for maintenance.

In line with the Health Service Executive's Emergency Planning recommendations, any incident which may occur at the Site which requires emergency services, incident information will be provided in the 'ETHANE' format:

- Exact location
- Type of incident
- Hazards Access and egress

- Number of casualties (if any) and condition
- Emergency services present and required

The design of the Project has considered the susceptibility to natural disasters. The proposed Site drainage (detailed in **Appendix 2.1**) will mitigate against any potential flooding risk due to run off with the use of Sustainable Drainage Systems (SuDS). Construction drainage will be left in-situ for the lifespan of the Project through to Decommissioning.

The Contractor's fire prevention/management plans will be reviewed and updated on a regular basis. A nominated competent person shall carry out checks and routine maintenance work to ensure the reliability and safe operation of firefighting equipment and installed systems such as fire alarms and emergency lighting. A record of the work carried out on such equipment and systems will be kept on Site at all times.

Detection systems and turbine control software will be installed on all turbines to (i.e. permit remote shutdown as necessary) prevent shadow flicker on nearby receptors.

The wind farm system shall include a system over-ride switch that can be operated at any time, to facilitate manual shutdown in case of an emergency.

5.5.7.3 Residual Risk

Once the mitigation established for the construction, operation and Decommissioning stages of the project, as detailed in this Chapter of the EIAR and other EIAR chapters, namely Chapter **10 (Noise)**, **12 (Air Quality and Climate)**, **13 (Shadow Flicker and EMI)**, **15 (Material Assets and other issues)** and **16 (Traffic and Transport)** are taken into account, the residual risk on population and human health is assessed to be an **imperceptible, long-term** effect.

5.5.8 Cumulative Effects

The nearest operational wind farm to the Project is Ballykett Wind Farm comprising of seven wind turbines located 1.75km to the west of the Site. The next nearest operational wind farm to the Project is Tullabrack Wind Farm comprising of six turbines located 2.73km to the northwest of the Site.

The Project, along with Moanmore and Tullabrack wind farms and other Irish renewables generation, is considered a fundamental change in the climate effects of Ireland's energy supply. They are an important, positive effect that is significant under the EIA Directive and will contribute to Ireland's legally binding CO_2 emission reduction targets. The Project will also contribute to the offset of burning of fossil fuels which has the potential to positively impact human health.

Human health was assessed in section 5.4.6 for the Project during the various stages of the Project. Chapter's **10: Noise**, **12: Air Quality and Climate**, **13: Shadow Flicker and EMI**, **15: Material Assets and Other Issues**: and **16: Traffic and Transport** include specific assessments which include the assessment of cumulative effects. These EIAR chapters also conclude the cumulative effects of the Project is considered to be **not significant**.

The Landscape and Visual Impact Assessment is contained in **Chapter 11: Landscape and Visual Amenity** (**Section 11.4.5**) and details the effects of the setback distance which makes the apparent scale of the turbines similar to the other turbines in the area, and therefore, the proposed turbines are not to be considered overbearing. This confirms that the cumulative effects of the Project in terms of visuals and tourism are considered to be **not significant**.

The cumulative effects of the Project can be predicted to be a **small, short-term negative** impact on overall tourism and amenity during construction. There is predicted to be a **short-term, moderate positive** effect in terms of employment from the Project.

It is not predicted that the cumulative effect of this Project will have an impact on population or settlement patterns, nor will it have a significant impact on industry sectors in the three study areas.

5.6 SUMMARY OF SIGNIFICANT EFFECTS

The assessment has not identified any likely significant effects from the Project on population and human health.

5.7 STATEMENT OF SIGNIFICANCE

This chapter has assessed the significance of potential effects of the Project on population and human health. The Project has been assessed as having the potential to result in effects of a **slight positive, long-term impact** overall. Cumulative effects are predicted as unlikely.

6 BIODIVERSITY

6.1 INTRODUCTION

This chapter assesses the likely significant effects that the Project may have on Terrestrial Ecology, namely habitats, flora, mammals and birds, and sets out the mitigation measures proposed to avoid, reduce or offset any potential significant effects that are identified. The residual effects on terrestrial ecological interests are then assessed. The Project refers to all elements of the application for the construction and operation of Ballykett Wind Farm (as described in detail in **Chapter 2: Project Description**). The assessment considers the potential effects during the following phases of the Project:

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

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

- **Appendix 6.1** Total plant species list for habitats encountered within the Site for the proposed wind farm.
- **Appendix 6.2** Bat Survey Report, Ballykett Proposed Wind Farm. O'Donnell Environmental, December 2023.
- **Appendix 6.3** Bird Survey – Desktop Study and Survey Methodology, Proposed Ballykett Wind Farm, Co. Clare. Malachy Walsh and Partners, November 2022.
- **Appendix 6.4** Bird Survey Appendices 6.4.1 - 6.4.10. Malachy Walsh and Partners, November 2022.
- **Appendix 6.5** Collision Risk Modelling Report. Prepared by Dr Tom Gittings, January 2023.
- **Appendix 6.6** Biodiversity Enhancement and Management Plan (BEMP).
- **Appendix 7.1** Freshwater Pearl Mussel Survey

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

6.1.1 Assessment Structure

In line with the revised EIA Directive and current EPA guidelines the structure of this Biodiversity chapter is as follows:

- Details of the assessment methodology utilised for desk and field studies, in the context of legal and planning frameworks.
- Description of baseline ecological conditions at the Site.
- Identification and assessment of impacts to ecological interests associated with the Project at all stages of the project life cycle i.e., construction, operation and decommissioning phases of the Project.
- Identification of alternatives to prevent/mitigate effects.
- Identification and assessment of residual impact of the Project considering mitigation measures.
- Identification and assessment of cumulative impacts, if and where applicable.

6.1.2 Outline Project Description

Planning Permission is being sought by the Developer for the construction of 4 wind turbines, permanent met mast, on-site electrical substation and all ancillary works. The Redline boundary for the project is shown in **Figure 1.2** of Volume III.

The Development will consist of the following main components (refer to **Chapter 2: Project Description** for details):

- Erection of 4 no. 4-5MW wind turbines with an overall ground to blade tip height of 150 m. The candidate wind turbine will have a rotor diameter of 136 m and a hub height of 82 m.
- Construction of site access tracks, Turbine Hardstand areas and Turbine Foundations.
- Construction of new site entrance with access onto the adjoining local road network (L6132).
- Construction of one no. Temporary Construction Compound with associated temporary site offices, parking areas and security fencing
- Installation of one no. permanent Met Mast of 82 m overall height.
- Construction of new internal site access tracks and upgrade of existing site track, to include all associated drainage including new clear span bridge crossing of the Moyasta 27_010 watercourse.
- Development of a site drainage network.
- Construction of one no. Electrical Substation.
- 2. no permanent spoil storage areas.
- All Wind Farm Internal Cabling connecting the wind turbines to the Electrical Substation.
- Ancillary forestry felling to facilitate construction of the Development.

- All works associated with the permanent connection of the wind farm to the national electricity grid comprising a 38 kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation and to the existing Tullabrack 110kV ESBN Substation.
- Vertical realignment of an existing crest curve on the L6132 local road in order to prevent grounding of abnormal load vehicles during delivery of turbine component.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

In addition, the EIA also assesses localised improvements and temporary modifications to the existing public road infrastructure to facilitate delivery of abnormal loads and turbine delivery. The red-line boundary and all works assessed as part of the Project are shown on **Figure 2.1**.

6.1.2.1 Turbine Delivery Route (TDR)

It is proposed that the turbine nacelles, tower hubs and rotor blades will be landed at the port of Foynes, County Limerick. From there, they will be transported to the Site via the N69 east onto the N18 and northwest via the Shannon tunnel or Limerick City via the R510/R527/R445. After exiting the N18 the route will follow the N68 road to Kilrush as far as the junction with the L6132 and then travel west on the L6132 road to the site entrance (refer to **Figure 2.4 in Chapter 2: Project Description**).

Road widening, verge strengthening and vertical realignment of the L6132 local road is required to facilitate the delivery of turbine components using abnormal load vehicles (see Chapter 2: section 2.5.5). Road widening between Tullabrack Cross and the wind farm site entrance will be carried out to accommodate the HGV vehicles associated with the construction of the wind farm. The road widening and verge strengthening are temporary works; the vertical realignment works will be permanent.

There are three watercourse crossings along the L6132. At these three locations steel plates will be placed on the road verges for 10 m each side of watercourse crossings to avoid excavation and disturbance of the existing ground. Upon completion of the wind farm construction the L6132 verge will be reinstated by removing approximately 150 mm of granular material from widened sections and replaced with topsoil, steel plates will also be removed from the verge at this stage.

Road widening works will be carried out in the existing road verge to increase the running width of the L6132 local road to 4.0 m and 5.5 m at passing locations. The works will involve excavating a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers.

Vertical realignment of the L6132 will be required at one location between the N68 and the wind farm site entrance. Realignment works will involve reducing the road level by approximately 150 mm at an existing crest curve to reprofile the road for abnormal vehicles, maintain axle loading and prevent grounding. Realignment works will be carried out in the existing road boundary with surfacing to match the existing L6132. Realignment works at this location will remail *in-situ* following the construction of the wind farm.

Traffic and transportation details have been assessed in **Chapter 16: Traffic and Transport** and details of proposed works along the TDR are detailed in drawings as part of **Appendix 16.1**.

6.1.2.2 Grid Connection Route (GCR)

Connection will be sought from the grid system operators by application to ESB Networks Limited. Ballykett Green Energy has assessed possible connection options for the Project and found that a 1.84 km 38kV connection to Tullabrack 110kV substation is the most expedient option, both environmentally and economically, subject to the substation having grid off-take capacity. The Grid Connection can be summarised as follows:

- Underground Cable (UGC) single 38kV circuit from Ballykett wind farm utilising sections of UGC primarily public roads, regional roads, and private lands to Tullabrack substation. [approx. 1.84 km]

The route of the Grid Connection Route is shown in **Figure 2.10,** with full details in **section 2.5.11.**

The GCR will be constructed to the requirements and specifications of ESB Networks Limited.

Cable Joint Bays

Joint Bays are pre-cast concrete chambers where individual lengths of cable will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay will typically be 6 m long x 2.5 m wide x 2.3 m deep. They will be pre-cast, reinforced, concrete structures installed below finished ground level.

The joint bay locations have been dictated by suitable terrain and access to facilitate the operation of cable pulling equipment at any phase of the Project and future operation of the installation in accordance with the ESB Networks Limited specifications.

Watercourse Crossings

There are six watercourse crossings required for the Site access tracks, see **Chapter 9: Hydrology and Hydrogeology** - **Figure 9.2a**. One river crossing (WCC2) will comprise a clear span bridge over a tributary of the Moyasta river. The remaining five no. water crossings (WCC 1, 3, 4, 5 and 6) are small streams or drainage channels on the Site. These water crossings will be constructed using precast bottomless culverts. Proposed crossing designs are shown on **Figures 2.6 (a), (b), (c) and (d)**.

There are no watercourse crossings along the proposed Grid Connection Route to the Tullabrack 110kV substation, and no directional drilling work is anticipated to be carried out.

6.1.3 Project Team

This Biodiversity chapter has been prepared by Dr Brian Madden (BioSphere Environmental Services) and is informed by ecological survey data and relevant reports from various ecologists as listed in **Table 6.1** below.

Table 6.1: Personnel involved in Terrestrial Ecological Assessment.

Project Team Member	Qualifications & Experience	Role
Dr Brian Madden, BioSphere Environmental Services	BA. Mod. (Hons), PhD, MCIEEM Brian graduated in Natural Sciences from the University of Dublin in 1984 and earned a Ph.D. degree in 1990 from the National University of Ireland for his research on ecosystem processes in raised bogs. Since 1994, Brian has been the principal ecologist with BioSphere Environmental Services. Brian has carried out botanical surveys and habitat assessments for most terrestrial habitats which occur on the island of Ireland. He is also an experienced ornithologist, with particular interests in birds of prey and wetland birds. He has published a range of peer-reviewed research papers. Examples of energy projects that Brian has been involved in include: Grousemount Wind Farm, Cos. Cork/Kerry, Oweninny Wind Farm Phases 1 & 2, Co. Mayo, Castlepook Wind Farm, Co. Cork, Letteragh Wind Farm, Co. Clare, Kiltumper Wind Farm Co. Clare,	Preparation of EIAR Chapter 6; habitat assessment; terrestrial mammal survey

Project Team Member	Qualifications & Experience	Role
	Eglish Wind Farm, Co Tyrone, Connemara 110kV Overhead Line Reinforcement Project (40 km from Barna to Maam Cross and to Screeb Bay in Connemara.	
Dr John Conaghan, Enviroscope Environmental Consultancy	BSc, PhD, MCIEEM John has over 25 years' experience of working on botanical projects throughout Ireland. He is a habitat specialist, with particular expertise in peatland and wetland habitats, as well as rare plants. John has worked with Coillte on their LIFE funded habitat restoration programme - he regularly contributes this expertise to Species and Habitat Management Plans. Examples of energy projects that John has been involved in include: Oweninny Wind Farm Phases 1 & 2, Co. Mayo, The Galway Wind Park, Grousemount Wind Farm, Cos. Cork/Kerry, Castlepook Wind Farm, Co. Cork, BGE Corrib Gas Pipleline from Bellanaboy, Co. Mayo to Craughwell, Co. Galway,	Habitat and botanical surveys; Report input
Tom O'Donnell, Principal Ecologist with O'Donnell Environmental	BSc, MSc, MCIEEM Tom is an experienced ecologist, with over 15 years professional experience in the environmental industry, including working on projects such as wind farms, overhead power lines, roads, cycleways and residential developments. Tom has particular experience in bat survey and is licensed by NPWS for roost disturbance (Ref: DER/BAT 2023-16) and to capture bats (C25/2023).	Implementation of Bat Survey for project, analysis of data and preparation of risk assessment and mitigation requirements
John Murphy, formerly Malachy Walsh and Partners Now leading the Irish Ornithological Survey Group	John Murphy is a senior ornithologist (formerly with Malachy Walsh and Partners) and now leads the Irish Ornithology Survey Group as the Principal Ornithologist. He is highly experienced having worked in the field of ornithology and ecology since 1982 and has extensive knowledge of the Irish landscape with regard to bird populations. Examples of energy projects that John has provided ornithological surveys for include: Booltiagh Wind Farm, Co. Clare, Galway Wind Park, Barranstook Wind Farm, Co. Clare, Meenadreen Wind Farm, Co Donegal, Cusailling Wind Farm, Co. Offlay, Sheskin South Wind Farm, Co. Mayo.	Project ornithologist; Field Survey Team Lead; Report Input
Austin Cooney, Malachy Walsh	Austin Cooney has more than 35 years of bird surveying experience both in Ireland and abroad and has worked on a variety of projects in many locations	Bird field surveys

Project Team Member	Qualifications & Experience	Role
and Partners	around Ireland. He is proficient in Vantage Point surveys, Transect Surveys, Point Count surveys, Hinterland surveys, Merlin surveys and Red grouse surveys.	
Dr Tom Gittings Ecological Consultant	BSc, PhD, MCIEEM Tom has 27 years' experience in professional ecological consultancy work and research. He has specific experience in ornithological assessments for wind energy projects – his input includes field surveys, analysis of survey data sets and collision risk modelling.	Compilation of Collision Risk Modelling Report for project

6.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

6.2.1 Purpose of the Report

The purpose of this report is to:

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

6.2.2 Relevant Legislation and Policy

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

- The Wildlife Acts 1976 – 2022 as amended
- The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) as amended
- The Birds Directive (Council Directive 2009/147/EC) as amended
- European Communities (Birds and Natural Habitats) Regulations 2011 - 2021
- Flora (Protection) Order, 2022 (S.I. No. 235 of 2022)

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

- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022).
- European Commission (2017) Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report. (Directive 2011/92/EU as amended).
- NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes.
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- Scottish Natural Heritage (2016). *Assessing Connectivity with Special Protection Areas (SPAs).* Version 3. Scottish Natural Heritage.

- Scottish Natural Heritage (2017). *Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms*. Version 2. Scottish Natural Heritage.

6.2.3 Zone of Influence and the Study Area

The study area is defined by the zone of influence of the Project with respect to the ecological receptors that could potentially be affected.

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

The ZoI in relation to direct impacts on habitats and flora as a result of the proposed project will be confined largely to the area within the Redline Boundary of the Development, including the grid connection route to Tullabrack substation.

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

The ZoI of potential impacts on surface water quality in the receiving environment, and associated aquatic flora and fauna, could extend downstream for up to 15 km (following UK guidance, Scott Wilson *et al.* 2006) but possibly more.

For habitats and flora species, the main study area is all land within the Redline Boundary. However, consideration is given to the potential for sensitive habitats, such as bogs, fens, springs etc., or protected or rare plant species (including bryophytes), to a distance of up to 1 km of the Redline Boundary but more should ecological or hydrological connectivity exist. Such habitats may be part of designated sites at a national or international level (Department of Environment, Heritage and Local Government 2010). In the present assessment the study (or survey) area was taken to include all land within the Redline Boundary as well as the original bog basin in which the four proposed turbines are located. The bog basin is now largely planted with conifers though a substantial area of unplanted cutover bog still exists.

For terrestrial mammal species, badger and otter are identified as the principal species likely to be affected by the construction of the Development. For badger, the main study area was a distance of approximately 100 m of the proposed turbine and associated infrastructure locations (after NRA 2006 & NRA 2009b). For otter, the main study area was a distance of at least 150 m upstream and downstream of the proposed road crossing point on the Moyasta River (after NRA 2008 & NRA 2009b), including the margins of the river to a distance of 10 m width. In practice, all of the section of river which passes through the site and skirts the eastern boundary was surveyed for otter presence. For watercourse crossings along the TDR, the potential to support otter was based on stream size and water quality.

For bats, the desk review study area for all bat records extended to a distance of up to 30 km from the proposed wind farm site. A habitat assessment for bat potential, including assessment of value of trees as bat roosts, was carried out to a distance of 268 m from the 'redline' boundary (as it relates to turbines) (following NatureScot 2021 guidance).

For bird activity surveys, the study area is the Development site within the Redline boundary and a 500 m buffer. The 500 m buffer is included to account for error when recording bird flight lines within the Redline Boundary (NatureScot 2017). Surveys were also carried out to a distance of approximately 5 km from the Redline Boundary for the checking of suitable habitats, especially wetlands, which may support target species that are likely to be impacted by the proposed wind farm development - this wider area of survey for birds is referred to as the Hinterland area. Suitable habitat for winter roosting by hen harrier was surveyed to a distance of between 2 km and up to 5 km from the Redline Boundary (NatureScot 2017).

The study area also included the routes for the Grid Connection to Tullabrack substation and the Turbine Delivery Route for the turbine components.

Table 6.2: Summary of Study Areas for Main Ecological Receptors.

Receptor	Study Area Definition	References
Habitats & Flora	Redline Boundary of site for core baseline survey; Extending to 1 km or beyond Redline Boundary for	Department of Environment, Heritage and Local Government 2010

Receptor	Study Area Definition	References
	sensitive habitats and plant species	
Badger	100 m (minimum) from works area	NRA 2006; NRA 2009b
Otter	150 m (minimum) upstream and downstream of watercourse crossing points	NRA 2008; NRA 2009b
Bats	268 m from Redline Boundary at turbine locations; Up to 30 km for bat desk review	Nature Scot 2021
Birds	Redline Boundary of site and 500 m buffer for activity surveys; Up to 5 km for hinterland surveys; Up to 2 km for hen harrier winter roost surveys	SNH (now NatureScot) 2017

6.2.4 Desk Study

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

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

For bats, the following information sources were examined:

- Known bat records within a 30 km radius of the proposed wind farm development site from the Bat Conservation Ireland database (conducted on 5th May 2023)
- Ad-hoc and observational bat records from the National Bat Database held by the National Biodiversity Data Centre (www.biodiversityireland.ie), with focus on existing species records for the 10 km square in which the study site in located (R05)
- Review of data held by National Parks and Wildlife Service relating to designated sites within a 15 km radius of the proposed wind farm development site where bats form part or all of the reason for designation (https://www.npws.ie/protected-sites).

In addition, a protected species data request was submitted to NPWS for information not otherwise publicly available regarding protected species such as the Annex II (EU Habitats Directive) listed Lesser Horseshoe Bat

- Review of relevant ecological reports and correspondence submitted as part of a previous planning application relating to the current site (Clare County Council Ref. 23/60219), including 'Bat Survey Report – Ballykett Proposed Windfarm, Co. Clare' (Eire Ecology, 2023).

For birds, a desktop study was conducted prior to the commencement of the field surveys. The following principal information sources were examined:

- Ordnance Survey Ireland (OSI) aerial photography and 1:50,000 mapping, and other sources of online aerial imagery (to assess physical features and habitats which may potentially support important bird species)
- Review of Bird Atlases: (especially Balmer *et al*. 2013).
- Review of Birds of Conservation Concern in Ireland (BoCCI) 2020-2026 (Gilbert *et al*. 2021).
- Review of BirdWatch Ireland I-WeBS (Irish Wetland Bird Surveys) site information.
- General ornithological information available from BirdWatch Ireland (www.birdwatchireland.ie).
- Irish Bird Reports and the journal *Irish Birds*, published by BirdWatch Ireland.
- Review of the 2015 National Survey of Breeding Hen Harrier in Ireland Report (Ruddock *et al*. 2016).

6.2.5 Consultation

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

- National Parks and Wildlife Services of the Department of Housing, Local Government and Heritage (response received 27th October 2022 – see **Table 1.7, Chapter 1**)
- BirdWatch Ireland (no response received)
- An Taisce (no response received)
- Irish Peatland Conservation Council (response received 10th January 2023 – see **Table 1.7, Chapter 1**)

6.2.6 Field Surveys

6.2.6.1 Habitats, vegetation and flora

The Site of the proposed Development was visited and a walkover survey of the habitats and flora was conducted on 24th May 2022. A further survey was carried out on 25th

October 2022. The field survey was mainly concentrated in areas in which it is proposed to locate wind farm infrastructure.

The Grid Connection Route was surveyed in October 2022 and April 2023. This comprised a survey by car, with stops at intervals to review habitats and flora present alongside the road and at watercourse crossing points.

The section of the Turbine Delivery Route along the local road (L6132) was surveyed in October 2022 and in November 2023. As with the grid connection cable route survey, this comprised a survey by car, with stops at intervals to review habitats and flora present alongside the road and at watercourse crossing points.

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

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

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

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

6.2.6.2 *Terrestrial fauna*

Multi-disciplinary walkover surveys were carried out on 25th May 2022, 25th October 2022 and 10th November 2023 in accordance with NRA guidelines on Ecological Surveying

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

Techniques for Protected Flora and Fauna during the planning of National Road Schemes (NRA, 2009b).

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

Survey for badger *Meles meles* was focused on the accessible parts of the conifer plantation on Site and on fields within and adjoining the proposed Development site. The areas were walked (as feasible) in October 2022 and November 2023 and checked for badger signs. Badger signs include setts, latrines, snuffle holes, prints, paths and tree scratching. The coordinates of any signs observed were noted along with details of the signs and any recent activity. Search for badger signs within the conifer plantations was facilitated by the cutting of brash along transect routes where peat probing was carried out in November 2023. These trackways through the conifer plantations were walked at a slow pace, with search focused on areas of drier bog.

Following a sighting of otter *Lutra lutra* in May 2022 within the Moyasta River which flows along part of the perimeter of the Site and through a section of the Site, surveys of this watercourse for signs of otter presence were made in October 2022 and again in November 2023. This involved a search for otter signs, such as spraints, prints, slides, trails and holts along both banks of the stream. The extent of the survey was where the stream skirts the Redline Boundary and passes through the site, and for 100 m upstream and downstream of this stretch. Particular focus was on the proposed crossing point north of the location for proposed Turbine no. 1. In addition to the width of the stream, a 10 m riparian buffer (both banks) was considered to comprise part of the otter habitat (NPWS 2009). The dedicated otter survey followed the guidance as set out in NRA (2008) *Guidelines for the Treatment of Otters Prior to the Construction of National Roads Schemes.*

Habitats within the study area were evaluated for their potential to support breeding amphibians, namely the common frog *Rana temporaria* and the smooth newt *Lissotriton vulgaris,* with any sightings recorded whilst carrying out the habitat and mammal surveys.

Habitats within the study area were evaluated for their potential to support the common lizard *Zootoca vivipara*. Potential suitable breeding habitat for common lizard includes cutover bog.

6.2.6.3 Bats

Full details of the methods used for the bat survey assessment are presented in **Appendix 6.2**; however, the following sections provide a summary of some key findings.

6.2.6.3.1 Potential roost assessment

Targeted surveys were carried out to determine the presence of bats or Potential Roosting Features (PRFs) where proposed works may impact a PRF directly or indirectly. Targeted day time surveys were carried out by Tom O'Donnell, Claire McCarthy and Colm Breslin on various dates between May and December 2023 to assess the potential of relevant features to support roosting by bats.

Potential roost assessment surveys were non-destructive, and relevant PRFs were visually inspected from ground level to identify any evidence of bat roosting. Further inspections of potential roosting features were carried out using a torch and endoscope and those at height were accessed using a 5-meter ladder where safely possible. Signs of bat use include bat droppings, feeding remains, potential bat access points identified by characteristic staining and scratches, noise made by bats etc.

The potential suitability of structures for roosting bats present at the proposed development site was classified according to the guidelines in Collins (2023) (see Table 2.1 in **Appendix 6.2**).

In line with Marnell *et al*. (2022), a risk-based approach was adopted in relation to survey of individual trees for the presence of PRFs. Marnell *et al.* (2022) recommends a risk-based approach, in which trees with a high probability of use by bats should be subject to survey. Factors listed as increasing the probability of trees being used by roosting bats include ancient woodland, large trees with complex growth form, visible damage etc. Factors listed as decreasing the probability of trees being used by roosting bats include "coniferous plantation with no specimen trees" and "young trees with simple growth form and little damage".

NatureScot (2021) recommends that key roosting features which could support maternity roosts and significant hibernation and / or swarming sites on the wind farm site be identified in a search area extending to 200 m plus one rotor radius from the "site boundary". The potential for significant roosts was also investigated within an area extending to a minimum of 268 m from the 'redline' boundary (as it relates to turbines). Features considered included bridges, buildings and trees.

In an Irish context, significant roosts are typically associated with man-made structures and underground features such as caves and mines. Features with potential to accommodate a significant bat roost were identified through examination of OSi historic 6" black & white mapping, aerial imagery and site walkovers. Information on known mines and caves was identified through the examination of publicly available information produced by Geological Survey Ireland. Trees were also considered during walkover surveys (see Appendix 6.2).

6.2.6.3.2 Passive bat activity surveys

In order to inform an assessment of the likely impacts of the proposed wind energy development on bats, surveys were carried out to characterise the importance of the habitats and features within the relevant survey area. An ultrasonic detector survey was carried out at the site to record bat activity in the area from which information on species composition, relative abundance and landscape usage could be derived. This multi-season passive detector survey was carried out from Spring 2023 until Autumn 2023 following NatureScot (2021) guidelines (with modifications for an Irish context) and NIEA (2022).

Passive bat detectors were deployed at four monitoring stations within the wind farm site for three seasonal periods to record general bat activity in locations corresponding to the proposed design available. Proxy locations were used for the proposed Turbines 1 and 3 across all survey periods as the exact locations proposed were located within commercial forestry and were not safely accessible at the time of the surveys. The detector deployment locations have covered both the commercial forestry habitat and the optimal forest hedge habitat for all three survey seasons.

The locations of detectors deployed are provided in **Table 6.3** below. Full details of the survey periods are presented **Appendix 6.2** (**Table 2.5).**

Table 6.3: Passive Bat Monitoring Survey Locations

Ref.	Latitude	Longitude
Bat_01	52.668700	-9.454734
Bat_02	52.665084	-9.456052
Bat_03	52.664116	-9.448765
Bat_04	52.667623	-9.510280

Individual bats of the same species cannot be distinguished by their echolocation alone and therefore 'bat registrations' are used as a measure of activity. A bat registration is defined as the presence of an individual species echolocation within a recording of maximum 15 seconds duration. All bat registrations recorded during this study follow these criteria, allowing comparison between monitoring stations.

As outlined in **Appendix 6.2**, a Davis 'EnviroMonitor' weather monitoring station was erected at a suitable location (52.662339, -9.510374), which was considered to record weather conditions representative of those at the proposed site. Relevant parameters (temperature, wind speed, rainfall) were to demonstrate that weather conditions on each survey night were suitable, as set out in the NIEA (2022).

Monitoring periods follow guidance in NatureScot (2021) and NIEA (2022) while an additional 5 nights of monitoring was carried out in autumn in anticipation of revised Bat Conservation Ireland guidance. The minimum number of good-weather survey nights for each of the three seasonal surveys was:

- Spring - 10 nights.
- Summer - 20 nights.
- Autumn - 15 nights.

NatureScot (2021) recommends the use of an online tool, 'Ecobat' to provide a measure of relative bat activity. The tool compares site specific inputted data to a comparator database to provide an interpretation of the level of bat activity compared to other sites in Britain. The tool is not considered to be appropriate for use as yet in an Irish context (data is heavily weighted by data collected in the UK where there are a different range of bat species and differing ecology). In relation to Ecobat, NIEA (2022) states that "caution should be exercised when using the tool as it has a significant bias towards results from Great Britain and there is a paucity of data from Northern Ireland or Ireland where we have a significantly different species assemblage. Therefore, it is currently unlikely to produce results which accurately reflect the species composition and bat activity levels normally encountered on wind turbine sites in Northern Ireland". At the time of writing, the EcoBat tool is offline and has been since June 2022. Interpretation of relative activity levels at the proposed site versus other similar sites in Ireland relies on the expertise and experience of the authors.

Assessment of vulnerability of bats to wind farms, including assessment of collision risk, generally follows the procedure outlined in NatureScot (2021) but with amendments in line with NIEA (2022) to reflect the Irish species assemblage and the different relative abundance of individual species (e.g. Leisler's Bat) in an Irish context.

6.2.6.3.3 Active bats transect surveys.

Active bat surveys were used to complement the information gained from passive bat monitoring. The aim of the surveys was to identify any flight-lines which may be apparent, and to identify emergence behaviour which would indicate the presence of a roost. Two active bat surveys were carried out at the proposed site for approximately 1.5 hours from dusk on 1st June 2023 and 31st August 2023. Active transects surveys were carried out on foot, during appropriate weather conditions following NIEA guidance (2022). Wildlife Acoustics full-spectrum Echo Meter Touch handheld detectors were used to perform the active surveys. The details of the active surveys carried out at the wind farm site are shown in **Table 6.4** below, while the locations of the survey routes within the wind farm site are shown in **Appendix 6.2 (Figure 2.1)**.

Table 6.4: Timings of transect routes for active bat surveys within the site for the proposed wind farm.

Date	Transect	Start	Finish	Temp/Wind/Rain	Notes
01/06/2023	A	21:50	22:30	18°C / F2 / Dry	Walked transect.
01/06/2023	B	22:45	23:25	18°C / F3 / Dry	Walked transect.
31/08/2023	B	20:30	21:30	15°C / F1 /Dry	Walked transect.
31/08/2023	A	21:40	22:10	14°C / F1 / Dry	Walked transect.

6.2.6.3.4 Data analysis

Species identification was aided by sonogram analysis using Wildlife Acoustics' Kaleidoscope Professional software (v. 5.4.8) and British Trust for Ornithology (BTO) 'Acoustic Pipeline' sound analysis tool. Automatic identifications were manually verified following the parameters set out in Russ (2012; 2021) and Middleton *et al.* (2014).

6.2.6.4 Birds

Initial recce walkovers were carried out at, and around the Site in October 2020 to assist in determining the scope and extent of the surveys. Field surveys were undertaken from October 2020 to September 2022[2] and were in accordance with Scottish Natural Heritage Guidance (2017).

[2] Field surveys have continued at Site since September 2022 to ensure up-to-date information is available

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

6.2.6.4.1 Vantage point surveys

Vantage point (VP) surveys were carried out on a monthly basis between October 2020 and September 2022 (see **Appendix 6.4.3** for details). The overall aim of these surveys was to quantify the level of target species flight activity within the flight activity survey area. The flight activity survey area was taken to be that area encompassing the potential Development area, extending out to approximately 500 m beyond the Redline Boundary.

Two Vantage Point locations (VP1 & VP2) were selected for coverage of the proposed Wind Farm Site (**Table 6.5**).

Table 6.5: Vantage point locations at the Site.

VP No.	Latitude, Longitude
1	52.669486, -9.4402428
2	52.659296, -9.4672430

Each VP was watched for a total of six hours per month. This resulted in a total of 12 survey hours per month and 72 survey hours in total over each season (2 summer & 2 winter seasons).

A viewshed analysis was carried out and the extent of coverage throughout the Site from each VP is shown in **Figure 6.1** below.

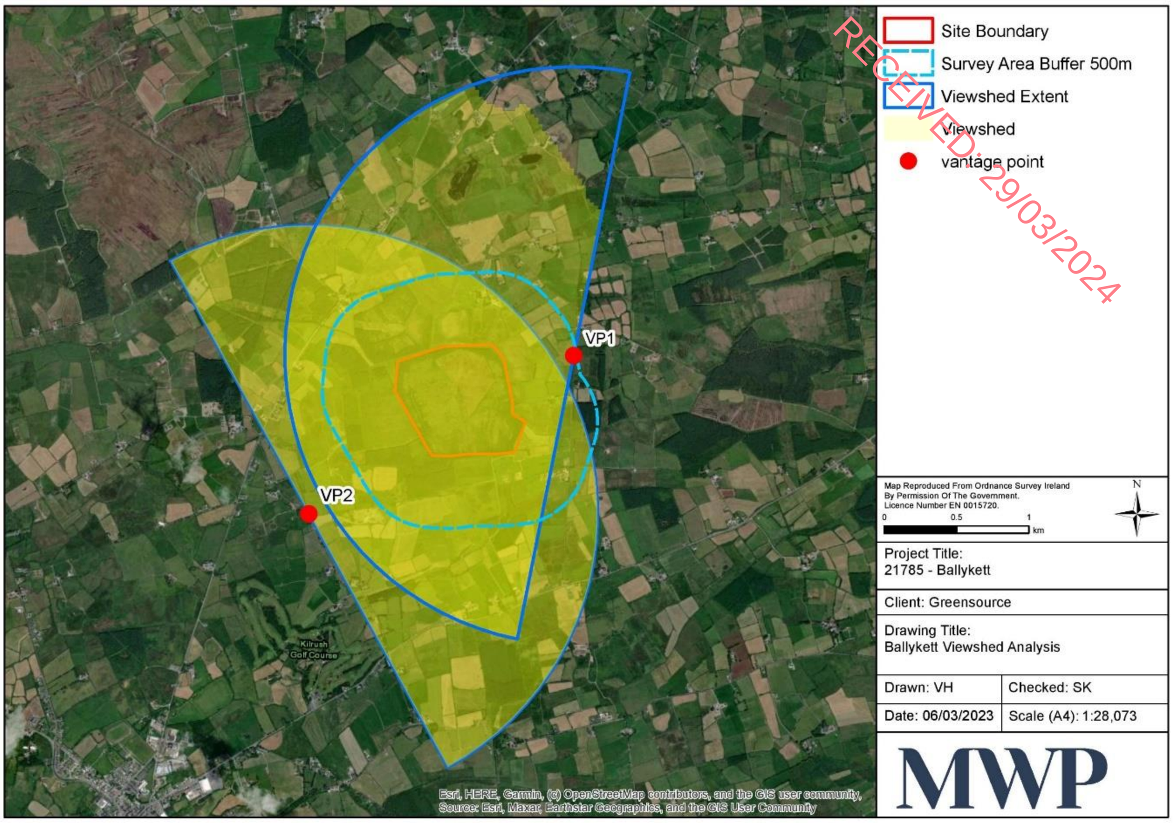

Figure 6.1: Vantage Point locations, with the flight activity survey area 500 m buffer, viewsheds from each VP and the Redline Boundary[3].

During VP surveys the flight behavior of target species was recorded. At the time of each species observation the following information was recorded:

- The time that the bird was detected.
- The flight duration(seconds) within various flight height categories (0-20 m, 20-50 m, 50-100, 100-180 m and >180).
- Sex and age of the bird(s) (adult/juvenile), where possible to determine.
- Type of activity/behavior such as hunting, flying, displaying etc.
- Estimation of actual flight height.
- Habitat(s) where the bird was observed.
- Weather conditions at time of sighting including wind speed, direction, degree of visibility.

[3] The Redline Boundary shown reflects the 'Site' at the commencement of bird surveys in 2019. Since then the Redline boundary has been adjusted (see Chapter 1 Introduction, Figure 1.2) to reflect the potential buildable area. However, the adjusted boundary is still within the viewsheds of the two Vantage Points.

Once an initial sighting was made, each target or secondary species was observed until lost from view, with the flight line mapped on enlarged Discovery series maps.

During the VP surveys, all other non-target/secondary species were also recorded, where recording did not infringe on recording of target species flight data.

6.2.6.4.1 Distribution and abundance surveys

The distribution and abundance surveys comprised the following:

- Walkovers transect surveys
- Hinterland surveys
- Wintering wildfowl surveys
- Hen Harrier roost watches

Transect survey

A transect survey is a survey along a defined route within the study area. The overall aim of the transect surveys was to assess general bird distribution throughout the Site and gather data on bird usage of the Site. Transect surveys were completed for breeding birds in summer 2021 and for wintering birds in winter 2021/22 (see **Appendix 6.4.7**) and were carried out as close as possible to Common Bird Census (CBS) methodology within the Site confines.

The transect route was selected to provide representative coverage of habitats occurring within the Redline Boundary, namely clear-fell forestry, young/mature forestry, scrub, improved agricultural grassland. The transect route followed an existing landowner access track through areas of forestry and scrub across the center of the subject Site.

During each transect survey, all passerine species and target species seen or heard, typically within 100 m of the route, were recorded, although the topography of the landscape often allowed for the detection of birds at greater distances. One transects route was used for the Site (see **Figure 6.2** below).

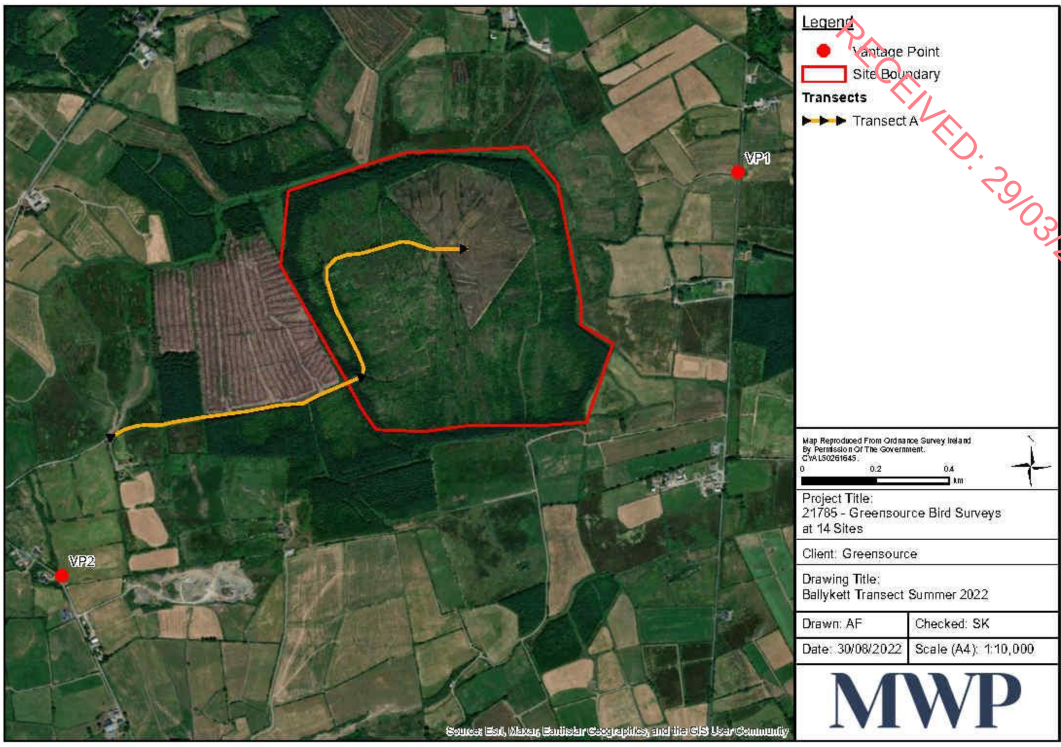

Figure 6.2: Transect survey route and the Redline Boundary (the Redline boundary shown reflects the 'Site' at the commencement of bird surveys in 2019).

Hinterland survey

A car based (driven) survey of the hinterland surrounding the proposed Development Site to approximately 5 km radius, was carried out over summer (April & July 2021) and winter (November 2021 & April 2022) seasons (see **Appendix 6.4.2**). Surveyors travelled roads throughout the region, regularly stopping at locations where the best views were afforded over potentially suitable habitats for birds of conservation importance and especially for waterbird species and birds of prey. However, during the surveys all bird species of interest around the Development were recorded. The purpose of these counts is to gain a better understanding of the birds utilising surrounding habitats outside of the Site and to gather data on those species frequenting the region which may or may not traverse the Site.

Winter wetland bird surveys

Wetland sites within 5 km of the proposed Development were surveyed during winters 2020-2021 and 2021-2022 (see **Appendix 6.4.9**). The survey area extended 5 km from the wind farm Site and exceeded the 500 m radius distance for foraging wildfowl and the 1 km radius recommendation for roosting wildfowl surveys stipulated by SNH (SNH, 2017).

The counts were undertaken during daylight hours at suitable vantage points for each of the selected wetland sites. The survey sites included in the surveys were as follows:

- Moyasta Creek - located in extreme northeast corner of Poulnasherry Bay and approximately 5.5 km westwards from the proposed Site for the wind farm.
- Farrihy Lough, - located approximately 11 km northwest from the proposed Site for the wind farm.
- Tullaher Lough - located approximately 7 km northwest from the proposed Site for the wind farm.
- Tullabrack Lough- located just over 1 km north from the proposed Site for the wind farm.
- Poulnasherry Bay - located approximately 6 km westwards from the proposed Site for the wind farm.

These surveys provide information on the distribution and abundance of wetland bird species within the wider region.

Hen Harrier roost survey

Hen Harrier Roost surveys were carried out over the winter seasons 2020-2021 and 2021-2022 at known historical roost sites within 5 km of the Site Redline Boundary (source of data Irish Hen Harrier Winter Survey). The methodology followed that used in the Irish Hen Harrier Winter Roost Survey (O'Donoghue 2019).

6.2.6.5 Marsh Fritillary

An assessment of the status of the food plant (devil's-bit scabious *Succissa pratensis*) of marsh fritillary *Euphydryas aurinia* was carried out at the time of the botanical survey of the site. This was in accordance with the following:

"Ireland's Butterfly Series: Habitat management for the Marsh Fritillary" (Phelan et al. 2021) – in this reference, the following is noted:

Habitats that are in good condition for Marsh Fritillary should have three or more well-developed Devil's-bit Scabious plants per square metre, across more than twenty percent of the habitat.

"Ireland's Butterflies: A Review" (Nash et al. 2012), in this reference, for marsh fritillary the following is noted (pg. 186):

"All 'good sites' should have a very substantial amount of Devil's- bit Scabious."

6.2.6.6 *Survey Limitations*

The information provided in this assessment accurately describes the baseline ecological environment at the site for the proposed Ballykett Wind Farm project.

The habitats and species on the site were readily identifiable and comprehensive assessments were made during the various field surveys. The specialist surveys, analysis and reporting have been undertaken in accordance with the appropriate guidelines and within the recommended seasonal time periods.

It is considered that the assessment as carried out on the baseline survey data provides an accurate prediction of the likely ecological effects of the proposed Development, prescribes best practice and mitigation as necessary (including monitoring), and describes accurately the residual ecological impacts. It is noted that should pre-construction surveys indicate a requirement for protection of relevant species, appropriate measures (as described in **Section 6.5**) will be taken to comply with all relevant legislation and best practice.

6.2.7 Assessment Approach

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

6.2.7.1 *Key ecological receptors*

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

6.2.7.2 *Determining importance of ecological receptors*

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

- International and European
- National

- County
- Local Importance (higher value)
- Local Importance (lower value)

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

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

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

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

6.2.7.3 Characterisation of Impacts and Effects

The impact assessment process involves the following steps:

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

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

- Positive or negative;

- Extent;
- Magnitude;
- Duration;
- Timing;
- Frequency; and
- Reversibility.

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

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

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

6.2.7.4 Significant Effects

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

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

6.2.7.5 Cumulative Effects

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

6.2.7.6 Avoidance, Mitigation, Compensation and Enhancement

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

Where potentially significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the EPA (2022) and CIEEM (2022) Guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of impacts where possible, the application of mitigation measures to minimise unavoidable impacts and then compensation for any remaining impacts. Once avoidance and mitigation measures have been applied residual effects are then identified along with any necessary compensation measures, and incorporation of opportunities for enhancement.
It is important for the impact assessment to clearly differentiate between avoidance mitigation, compensation and enhancement and these terms are defined here as follows:

- Avoidance is used where an impact has been avoided, *e.g.* through changes in scheme design;
- Mitigation is used to refer to measures to reduce or remedy a specific negative impact *in situ*;
- Compensation describes measures taken to offset residual effects, *i.e*. where mitigation *in situ* is not possible.

- Enhancement is improved management of ecological features or provision of new ecological features, resulting in a net benefit to biodiversity, which may be unrelated to a negative impact or is 'over and above' that required to mitigate/compensate for an impact.

6.3 BASELINE ECOLOGICAL CONDITIONS

6.3.1 Physical and General Ecological Description of Site

The Site is located 3.5 km north-east of Kilrush, Co. Clare, 3 km south-west of Cooraclare village, and 7.4 km north of the county boundary between Clare and Kerry. The Site is located within the townlands of Ballykett and Tullabrack East. The Project is situated within a landscape dominated by commercial conifer plantation, areas of cutaway bog and agricultural land (mainly used for livestock grazing). There are a number of established wind farms in the area, including Moanmore Wind Farm, located c. 1.3 km to the west and Tullabrack Wind Farm, located c. 1.5 km to the northwest of the Site.

From a conservation perspective, the River Shannon system is the dominant feature of the local area, with Poulnasherry Bay located approximately 5 km to the west-southwest of the Site and the Clonderalaw Bay inlet approximately 10 km to the southeast. Various small lakes and wetlands occur in the hinterland of the Site, including Tullabrack Lough, Gower Lough, Knockerra Lough, Tarmon Lough and Moanmore Lough.

There are two mapped geological formations underlying the Site, however both are a variation of sandstone and siltstone (see Chapter 8 for details). Soil type across the entire site is peat. Results of Peat Depth Probing surveys indicate that peat depths on Site were generally shallow (0.5-2.0 m) to moderately deep (2.0-3.5 m), with isolated pockets of deeper peat (see **Chapter 8**). The Site is a former raised bog of the 'Western' category. In a detail evaluation of raised bogs in Ireland, Cross (1990) refers to Co. Clare and writes "*Raised bogs occurred in two areas; small bogs in the undulating lowlands east of Tulla and an extensive tract near Kilrush at the mouth of the Shannon (Monmore Bog). All bogs have been largely cut away leaving a few very small remnants behind*."

The majority of the bog basin in which the proposed turbines are situated was planted with commercial conifer plantation in the early 1990s. An area immediately to the west had been planted earlier (probably early 1980s). The unplanted portion of the bog basin measures 9.66 ha and had been cut for turbary in the past but is now well revegetated.

The topography of the Site is relatively flat (as expected for a former raised bog) and lies at an altitude of between 30-40 m. The Site is located within the Shannon Estuary North catchment. Drainage of the Site is to the Moyasta River, which rises to the north-east of the Site and flows for a section through the Redline Boundary. The Moyasta river flows in a general westward direction before draining into Poulnasherry Bay. The section of the river which skirts part of the Site Redline Boundary has been dredged over the years and appears as a canalised watercourse (see **Plate 6.6**). In addition to the main Moyasta River, there are various natural and artificial drainage ditches located within the proposed Site and its surrounds (details in **Chapter 9: Hydrology and Hydrogeology**). Two of the Delivery Route, namely Tullagower River and Brisla East Stream, are within the Doonbeg River catchment. The Aquatic Ecology impact assessment report (**Chapter 7**) describes the streams in the Ballykett area as being characterised by slow flowing water, low discharge and muddy substrates, with moderate to poor water quality The Moyasta River and the Doonbeg River systems are examples of Depositing/lowland river (FW2). The afforested sections of the Site have an inserted drainage network.

Ecologically, the Site can be described as being dominated by Conifer plantation (WD4 of Fossitt 2000), with relatively small areas of Cutover bog (PB4) and Improved grassland (GA1).

6.3.2 Designated Sites

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

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are designated under the EU Habitats Directive as amended and EU Birds Directive as amended respectively and are collectively known as 'European Sites' or 'Natura 2000' sites. The potential for significant effects on the integrity of European Sites is fully assessed in the AA Screening Report and Natura Impact Statement that accompanies this application. As per EPA Guidance 2022, *"a biodiversity section of an EIAR, for example, should not repeat the detailed assessment of potential effects on European sites contained in documentation prepared as part of the Appropriate Assessment process, but it should refer to the findings of that separate assessment in the context of likely significant effects on the environment, as required by the EIA Directive".* Section 6.4.2 of this EIAR provides a summary of the key assessment findings with regard to European Designated Sites.

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

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

All designated sites that could potentially be affected were identified using a source-pathway - receptor model. To provide context for the assessment, European and national sites within a distance of 15 km surrounding the Development Site have been considered and are shown in **Figures 6.3 and 6.4** in Vol. III respectively. The distance of 15 km follows guidance from the Department of Environment, Heritage and Local Government (2010) and would be a conservative distance in many cases. However, sites that were further away from the proposed Development were also considered and no potential for impact was identified due to the absence of direct and indirect connections. Information on the identified sites according to the site-specific conservation objectives is provided in **Tables 6.4 and 6.5**.

No part of the Site is within an area, or adjoins an area, with a nature conservation designation. Sites with designations within a 15 km distance of the location of the proposed wind farm are listed in the following sections.

6.3.2.1 European designated sites

A total of seven European designated sites occurs within a 15 km distance of the Site (see **Figures 6.3 and 6.4** in Vol III**)**. These are listed in **Table 6.6**, along with the reasons for designation, the distance from the proposed wind farm site and whether any linkages or connectivity exist between the two locations.

The nearest designated European sites to the Development are the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. Both of these sites include Poulnasherry Bay, which receives drainage from the Ballykett area via the Moyasta River.

The Carrowmore Dunes SAC and the Mid-Clare Coast SPA are connected to the Project area by two watercourse crossings along the TDR (L6132 section), which are upper tributaries of the Doonbeg River. The Doonbeg River flows for approximately 13 km before entering Doonbeg Bay and the SAC and SPA (it is noted that the area of the Carrowmore Dunes SAC overlaps entirely with the Mid-Clare coast SPA).

For the other three listed sites, there are no ecological corridors or hydrological linkages with the Site for the proposed wind farm at Ballykett. The European sites are considered in detail in the AA Screening Report and NIS which accompany this application.

6.3.2.2 National designated sites

A single Natural Heritage Area (NHA) occurs within the 15 km radius of the Site (see **Figure 6.4** in Vol III and **Table 6.7**), namely Cragnashingaun Bogs NHA. This is approximately 14 km to the northeast of the Site and there are no ecological corridors or hydrological linkages with the Site.

6.3.2.3 Proposed designated sites

A total of 12 proposed Natural Heritage Areas (pNHAs) occur within a 15 km radius of the Site (see **Figure 6.4** in Vol III and **Table 6.7**). Proposed Natural Heritage Areas are sites of ecological interest though specific qualifying habitats or species have not as of yet been identified by NPWS.

The Poulnasherry Bay pNHA, which receives drainage from the Ballykett area via the Moyasta River, is the site in closest proximity to the Site for the proposed wind farm.

While a further five of the sites (Clonderalaw Bay, Scattery Island, Tarbert Bay, Ballylongford Bay, Beal Point) are located within or along the Shannon system, and could theoretically receive water emanating from the Site, it is considered that there is no realistic potential for these sites to be affected in any way by the Project in view of the vast dilution and dispersal that would occur within the Shannon estuary system.

For the remaining listed pNHA sites, ecological or hydrological connectivity with the Site has not been identified.

Table 6.6: Relevant European sites, reasons for designation, distances from subject site and summary of connectivity.

European Site	Reasons for designation (information correct as of 18th November 2023) (*denotes a priority habitat)	Distance from proposed Ballykett Wind Farm Site and summary of connectivity
	SPECIAL AREAS OF CONSERVATION	
Lower River Shannon SAC (site code 002165)	Sandbanks which are slightly covered by sea water all the time [1110] Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Coastal lagoons [1150] Large shallow inlets and bays [1160] Reefs [1170] Perennial vegetation of stony banks [1220] Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] Salicornia and other annuals colonizing mud and sand [1310] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] Margaritifera margaritifera (Freshwater Pearl Mussel) [1029] Petromyzon marinus (Sea Lamprey) [1095] Lampetra planeri (Brook Lamprey) [1096] Lampetra fluviatilis (River Lamprey) [1099] Salmo salar (Salmon) [1106] Tursiops truncatus (Common Bottlenose Dolphin) [1349] Lutra lutra (Otter) [1355] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage and the Gaeltacht, 07 August 2012), for each of the listed Qualifying Interests, the Conservation Objective is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.	The proposed wind farm Site at Ballykett is just over 5 km north of the SAC site. Hydrological connectivity exists between the Lower River Shannon SAC and the proposed site via the Moyasta river. This water course skirts part of the Site for the proposed wind farm and flows for approximately 7.8 km to enter the Shannon system and SAC at Moyasta. The section of the Turbine Delivery Route (TDR) along the L6132 crosses 3 no. watercourses, two upstream of the Doonbeg River and one on the Moyasta River. The Moyasta crossing (Gowerhass stream), is upstream of the Development Site. Hence, hydrological connectivity exists between the TDR component of the Project and the SAC. It is concluded that hydrological connectivity exists between the Project area and the SAC.
Tullaher Lough and Bog SAC	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120]	The proposed wind farm Site is approximately 6 km

European Site	Reasons for designation (information correct as of 18th November 2023) (*denotes a priority habitat)	Distance from proposed Ballykett Wind Farm Site and summary of connectivity
(site code: 002343)	Transition mires and quaking bogs [7140] Depressions on peat substrates of the Rhynchosporion [7150] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage Regional, Rural & Gaeltacht Affairs, 6th December 2016) for each of the listed Qualifying Interests, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	east-southeast of the SAC. There are no ecological corridors or hydrological connectivity between the two areas.
Carrowmore Dunes SAC (site code:002250)	Reefs [1170] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with Ammophila arenaria (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130] Vertigo angustior (Narrow-mouthed Whorl Snail) [1014] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage and the Gaeltacht, 4th March 2014) for each of the listed Qualifying Interests, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The proposed wind farm Site is approximately 8 km (straight-line distance) southeast of the SAC. There are no ecological corridors or hydrological connectivity between the wind farm site or the grid connection routes and the SAC. The section of the Turbine Delivery Route (TDR) along the L6132 crosses 3 no. watercourses, two upstream of the Doonbeg River (Tullagower river & Brisla East stream) and one on the Moyasta River. The Doonbeg River flows in a west to northwest direction for approximately 13 km before entering Doonbeg Bay and the SAC. Hence, hydrological connectivity exists between the TDR component of the Project and the SAC.
Carrowmore Point to Spanish Point and Islands SAC	Coastal lagoons [1150] Reefs [1170] Perennial vegetation of stony banks [1220] Petrifying springs with tufa formation (Cratoneurion) [7220]	The proposed wind farm Site is approximately 11 km south-southeast of the SAC

European Site	Reasons for designation (information correct as of 18th November 2023) (*denotes a priority habitat)	Distance from proposed Ballykett Wind Farm Site and summary of connectivity
(site code: 001021)	According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage and the Gaeltacht, NPWS 7th April 2014) for each of the listed Qualifying Interests, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	There are no ecological corridors or hydrological connectivity between the two areas.
Kilkee Reefs SAC (site code 002264)	Large shallow inlets and bays [1160] Reefs [1170] Submerged or partially submerged sea caves [8330] According to this SAC's site Conservation Objectives document (NPWS 6th August 2014, Conservation objectives for Kilkee Reefs SAC [002264]. Version 1.0. Department of Arts, Heritage and the Gaeltacht) for each of the listed Qualifying Interests, the Conservation Objective is to maintain the favourable conservation condition of the Annex I habitats and/or the Annex II species for which the SAC has been selected.	The proposed wind farm Site is approximately 8 km southeast of the SAC. There are no ecological corridors or hydrological connectivity between the two areas.
	SPECIAL PROTECTION AREAS	
River Shannon and River Fergus Estuaries SPA (site code: 004077)	Cormorant (Phalacrocorax carbo) [A017] Whooper Swan (Cygnus cygnus) [A038] Light-bellied Brent Goose (Branta bernicla hrota) [A046] Shelduck (Tadorna tadorna) [A048] Wigeon (Anas penelope) [A050] Teal (Anas crecca) [A052] Pintail (Anas acuta) [A054] Shoveler (Anas clypeata) [A056] Scaup (Aythya marila) [A062] Ringed Plover (Charadrius hiaticula) [A137] Golden Plover (Pluvialis apricaria) [A140] Grey Plover (Pluvialis squatarola) [A141] Lapwing (Vanellus vanellus) [A142] Knot (Calidris canutus) [A143] Dunlin (Calidris alpina) [A149] Black-tailed Godwit (Limosa limosa) [A156] Bar-tailed Godwit (Limosa lapponica) [A157] Curlew (Numenius arquata) [A160] Redshank (Tringa totanus) [A162] Greenshank (Tringa nebularia) [A164] Black-headed Gull (Chroicocephalus ridibundus) [A179] Wetland and Waterbirds [A999] According to this SPA's site Conservation Objectives document, Conservation Objectives Series: River Shannon and River Fergus Estuaries SPA 004077. Version 1.0, 17th September 2012, Department of Arts, Heritage and the Gaeltacht), for each of the	The proposed wind farm Site at Ballykett is just over 5 km north of the SPA site. Hydrological connectivity exists between the two areas via the Moyasta river. This water course skirts part of the Site for the proposed wind farm and flows for approximately 7.8 km to enter the Shannon system and SPA at Moyasta. The section of the Turbine Delivery Route (TDR) along the L6132 crosses 3 no. watercourses, two upstream of the Doonbeg River and one on the Moyasta. The Moyasta crossing (Gowerhass stream) is upstream of the Development Site. Hence, hydrological

European Site	Reasons for designation (information correct as of 18th November 2023) (*denotes a priority habitat)	Distance from proposed Ballykett Wind Farm Site and summary of connectivity
	listed SCIs, the Conservation Objective is to maintain the favourable conservation condition of the species for which the SPA has been selected.	connectivity exists between the TDR component of the Project and the SPA. The wind farm Site does not provide suitable ex-situ habitat to support any of the SCIs of the SPA. It is concluded that hydrological connectivity exists between the Project area and the SPA.
Mid-Clare Coast SPA (code 004182)	Cormorant (Phalacrocorax carbo) [A017] Barnacle Goose (Branta leucopsis) [A045] Ringed Plover (Charadrius hiaticula) [A137] Sanderling (Calidris alba) [A144] Purple Sandpiper (Calidris maritima) [A148] Dunlin (Calidris alpina) [A149] Turnstone (Arenaria interpres) [A169] Wetland and Waterbirds [A999] According to this SPA's site Conservation Objectives document, Conservation Objectives Series: Mid-Clare Coast SPA 004182. Version 1.0, 8th September 2014, Department of Arts, Heritage and the Gaeltacht), for each of the listed SCIs, the Conservation Objective is to maintain the favourable conservation condition of the species for which the SPA has been selected.	The proposed wind farm Site at Ballykett is just over 8 km (straight-line distance) southeast of the SPA site. There are no ecological corridors or hydrological connectivity between the Site of the wind farm or the grid connection routes and the SPA. The section of the Turbine Delivery Route (TDR) along the L6132 crosses 3 no. watercourses, two upstream of the Doonbeg River (Tullagower river & Brisla East stream) and one on the Moyasta. The Doonbeg river flows in a west to northwest direction for approximately 13 km before entering Doonbeg Bay and the SPA. Hence, hydrological connectivity exists between the TDR component of the

European Site	Reasons for designation (information correct as of 18th November 2023) (*denotes a priority habitat)	Distance from proposed Ballykett Wind Farm Site and summary of connectivity
		Project and the SPA. The wind farm Site does not provide suitable ex-situ habitat to support any of the SCIs of the SPA.

Table 6.7: Relevant sites designated under Irish legislation, reasons for designation, distances from subject site and summary of connectivity.

Site	Reasons for designation (information correct as of 18th November 2023)	Distance from proposed Ballykett wind farm site and summary of connectivity
NATURAL HERITAGE AREAS		
Cragnashingaun Bog NHA (site code: 0001382)	Peatlands (4)	The pNHA site is located approximately 15k m to the northeast of the Site for the proposed wind farm. There are no ecological or hydrological linkages between the NHA and the wind farm Site.
PROPOSED NATURAL HERITAGE AREAS		
Derrygeeha Lough pNHA (site code 000050)	Not Stated	The proposed wind farm Site at Ballykett is approximately 13 km west of the pNHA. There are no linkages, ecological or hydrological, between the pNHA and the wind farm Site.
Clonderalaw Bay pNHA (site code: 0027)	Not stated.	The proposed wind farm Site at Ballykett is approximately 7 km west-northwest of the pNHA. There are no ecological links between the two areas. As the Site for proposed wind farm drains to the Shannon system, there exists a hydrological linkage with pNHA.
St Senan's Lough pNHA (site code: 0001025)	Not stated.	The proposed wind farm Site at Ballykett is approximately 5 km northwest of the pNHA. There are no linkages, ecological or hydrological, between the pNHA and the wind farm Site.
Scattery Island pNHA (site code 001911)	Not stated.	The proposed wind farm Site at Ballykett is approximately 6 km east northeast of the pNHA.

Site	Reasons for designation (information correct as of 18th November 2023)	Distance from proposed Ballykett wind farm site and summary of connectivity
		There are no ecological linkages between the two areas. As the Site for proposed wind farm drains to the Shannon system, there exists a hydrological linkage with pNHA.
Tarbert Bay pNHA (site code: 001386)	Not stated.	The proposed wind farm Site at Ballykett is approximately 10 km northwest of the pNHA. There are no ecological linkages between the two areas. As the Site for the proposed wind farm drains to the Shannon system, there exists a hydrological linkage with the pNHA.
Ballylongford Bay pNHA (site code: 001332)	Not stated	The proposed wind farm Site at Ballykett is approximately 9 km north of the pNHA. There are no ecological linkages between the two areas. As the Site for the proposed wind farm drains to the Shannon system, there exists a hydrological linkage with the pNHA.
Beal Point pNHA (site code: 001335)	Not stated	The proposed wind farm Site at Ballykett is approximately 14 km northeast of the pNHA. There are no ecological linkages between the two areas. As the Site for the proposed wind farm drains to the Shannon system, there exists a hydrological linkage with the pNHA.
Poulnasherry Bay pNHA (site code: 0065)	Not stated	The proposed wind farm Site at Ballykett is approximately 5 km west-southwest of the pNHA. There are no ecological linkages between the two areas. As the Site for the proposed wind farm drains to Poulnasherry Bay via the Moyasta River, there exists a hydrological linkage with the pNHA.
Tullaher Lough Bog pNHA (site code: 0070)	Not stated	The proposed wind farm Site at Ballykett is approximately 6 km southeast of the pNHA. There are no linkages, ecological or hydrological, between the pNHA and the

Site	Reasons for designation (information correct as of 18th November 2023)	Distance from proposed Ballykett wind farm site and summary of connectivity
		wind farm Site.
Farrihy Lough pNHA (site code: 00200)	Not stated	The proposed wind farm Site at Ballykett is approximately 11 km southeast of the pNHA. There are no linkages, ecological or hydrological, between the pNHA and the wind farm Site.
White Strand/Carrowmore Marsh pNHA (site code: 001007)	Not stated	The proposed wind farm Site at Ballykett is approximately 8 km south of the pNHA. There are no linkages, ecological or hydrological, between the pNHA and the wind farm Site.
Carrowmore Point to Spanish Point and Islands pNHA (site code 001021)	Not stated	The proposed wind farm Site at Ballykett is approximately 11 km south of the pNHA. There are no linkages, ecological or hydrological, between the pNHA and the wind farm Site.

6.3.3 Habitats and Vegetation

The dominant habitat within the survey area is coniferous plantation (WD4), which occurs on peat. There is also an area of cutover raised bog (PB4) within the survey area. The other habitats which occur on Site are improved grassland (GA1) and depositing/lowland rivers (FW2).

In the following sections, the vegetation composition of these habitats is described, with a list of the plant species occurring presented in **Appendix 6.1**. The habitats which occur at the locations for the wind farm infrastructure are listed in **Table 6.6**. Habitats which occur on the Site are mapped in **Figure 6.5** in Vol III.

6.3.3.1 Coniferous plantation (WD4)

Conifer plantation is the dominant habitat within the survey area. The habitat occurs on peat soil (former raised bog), which generally varies between 2.0 and 3.5 m in depth. The main tree species is sitka spruce *Picea sitchensis,* with lodgepole pine *Pinus contorta* locally frequent. The trees were planted in the early 1990s and are of variable quality in terms of growth. In the northern half of the survey area the trees have grown well and are generally between 8 and 12 m tall. In these areas the ground layer is very species-poor being dominated by conifer needles along with occasional clumps of mosses such

Hypnum jutlandicum, Rhytidiadelphus loreus, Thuidium tamariscinum and *Plagiothecium undulatum* (see **Plate 6.1**). Vascular plant species have a very low cover, with purple moor-grass *Molinia caerulea* and broad buckler fern *Dryopteris dilatata* the only species which occur in any degree of abundance. In the southern half of the survey area conifers were planted on probably deeper peat and these trees have generally not grown well. The height of the tree canopy is mostly between 3 m and 6 m and in places the trees are sparse and stunted. In these areas a ground layer with a high cover of ling heather *Calluna vulgaris* still persists (see **Plate 6.2**). This high cover of ling heather indicates drying out of the peat surface due to drainage and tree growth. A number of narrow grassy tracks run through the plantation areas.

Plate 6.1 View of conifer plantation showing the species-poor ground layer dominated by conifer needles and mosses.

Plate 6.2. View of stunted conifers (sitka spruce) on peat in the southern half with abundant ling heather.

6.3.3.2 Cutover bog (PB4)

In the central/northeast sector of the survey area there is an area of cutover raised bog (estimated at 9.66 ha) now surrounded by conifer plantation. The area has been subject to peat-cutting in the past, as shown by the old cut banks throughout (see **Plate 6.3**). However, it appears that no cutting has taken place in recent decades and a former track into the bog is now partly overgrown. As a result of this abandonment the bog flora has regenerated well throughout (see **Plate 6.4**). Typically, the main plant species in the vegetation are ling heather *Calluna vulgaris*, many-flowered bog-cotton *Eriophorum angustifolium*, purple moor-grass *Molinia caerulea*, cross-leaved heath *Erica tetralix*, hare's tail bog-cotton *Eriophorum vaginatum* and the lichen *Cladonia portentosa*. Other locally frequent species include bog asphodel *Narthecium ossifragum*, deer grass *Trichophorum germanicum* and bog myrtle *Myrica gale*. In wetter areas of cutover bog bean *Menyanthes trifoliata* grows with a locally high cover of Sphagnum mosses.

The cover of mosses and lichens is generally well developed. *Hypnum jutlandicum* and *Sphagnum capillifolium* are the main moss species occurring, with a locally high cover of Sphagnum (mainly *Sphagnum cuspidatum* and *S. papillosum*) in wetter cutaway areas in the northern half of the cutover bog area.

Plate 6.3. View of old cut bank from previous turbary activities, October 2022.

Plate 6.4. View of well-vegetated cutover bog surface within the survey area, May 2022. The wet strip in the right of picture is a former drain.

Plate 6.5. Towards the drier margins of the bog, clumps of gorse are established, October 2022.

Towards the edges of the bog, gorse clumps are established in places (see **Plate 6.5**) indicating a drier bog surface as a result of local forest drains.

A further strip of cutover bog occurs along the wayleave for the overhead 110kV powerline through the plantation in the northern sector of the Site. This strip is disturbed as it had been formerly planted and the trees removed to facilitate the construction of the power line. However, bog vegetation has become established again (see **Plate 6.6**), though this is very much dominated by purple moor-grass with only scattered clumps of ling heather. The presence of gorse, bramble *Rubus fruticosus* and developing birch *Betula pubescens* and willow (*Salix* spp.) scrub reflects the disturbed character of the bog.

Plate 6.6. View of strip of cutover bog along the wayleave for the overhead 110kV power line, April 2023. This is former plantation and is now dominated by purple moor-grass, with patches of heather, gorse and willow scrub.

<u>Potential for linkages to EU Annex 1 Habitats</u>

The potential for the cutover raised bog habitat to have links with Annex I habitats was noted in the Scoping Opinion on the project issued by NPWS on 27th October 2022. Such potential is addressed in the following sections. It is noted that the Site does not support any fen or flush habitats (as referred to in the NPWS Opinion document).

Active Raised Bog (Natura 2000 code: 7110)

This habitat is associated with relatively intact high bog and is characterised by the presence of an active acrotelm and a surface which supports a high Sphagnum cover and a micro-topography of pools, hummocks and lawns. As the bog at Ballykett was cut in the past with much of the surface afforested, the acrotelm has been removed and thus it lacks a surface pattern with pools, hummocks and lawns – on this basis, it is clearly not active bog.

Degraded Raised Bog (Natura 2000 code: 7120)

In the description of degraded raised bog, NPWS (The Status of EU Protected Habitats and Species in Ireland, 2019) note the following:

"Degraded raised bog is characterised by the complete absence (or patchy thin cover) of an acrotelm, which is the living, actively peat-forming upper layer. Previously, all the vegetated areas of high bog that were not delineated as active raised bog were defined as

degraded raised bog, on the assumption that most of it could be restored to active peat-forming conditions after implementation of comprehensive restoration works. However, recent modelling techniques based on earlier research has allowed degraded raised bog to be delineated based on the premise that only areas with the right combination of physical conditions are ultimately capable of supporting active raised bog after restoration measures are implemented. To qualify as degraded raised bog, there must be a reasonable expectation that these areas are capable of natural regeneration to active bog within 30 years if their hydrology is repaired. The remainder of the high bog that is neither active nor degraded raised bog is now referred to as 'supporting raised bog habitat'."

This description infers that degraded raised bog is associated with high bog, *i.e*. bog which still has the peat mass intact (not cut) but which lacks an acrotelm. In the case of the bog at Ballykett, it is clear that the bog is not intact high bog as the acrotelm and upper peat layers have been lost due to past turbary activities as well as extensive drainage works and afforestation which took place in the 1990s.

The description also notes that degraded raised bog can be delineated based on the premise that *only areas with the right combination of physical conditions are ultimately capable of supporting active raised bog after restoration measures are implemented.* Notwithstanding the fact that the bog at Ballykett is not intact high bog due to previous cutting, drainage and afforestation, it is contended that repairing the hydrology of the bog so as to create '*the right combination of physical conditions*' is not practical as this would require removal of all the planted conifer trees from the original basin (which is demarcated by the Moyasta River to the east and north and a well-defined drain along the west boundary) and the subsequent blocking of all drains within the basin associated with both the forestry and turbary activities (see drain network in **Figure 9.2** of **Chapter 9**). The original raised bog basin has an area of 55.3 ha, of which 45.6 ha (or 82.5%) has been planted with conifers.

As the bog at Ballykett does not constitute intact high bog due to past cutting and extensive planting with conifers (only 9.66 ha of the original 55.3 ha within the basin remains unplanted), which makes restoration of the original hydrology very difficult and probably impractical, it is considered that the bog does not qualify as degraded raised bog capable of restoration according to the criteria of NPWS (2019).

Depressions on peat substrates (Rhynchosporian) (Natura 2000 code: 7150)

This habitat is considered to be an integral part and microhabitat of active raised bog and blanket bog. NPWS (2019) note that "*In raised bogs, Rhynchospora vegetation* *communities are considered to qualify as the Annex I habitat when they occur in their most developed from in the wettest sections of active raised bogs, corresponding with pools, Sphagnum lawns and hollows*."

As the bog habitat at Ballykett is not active and lacks a surface with pools, lawns and hollows, and considering that *Rhynchospora* species were not recorded within the Site during the baseline survey, it is concluded that this Annex I habitat is not represented at Ballykett.

6.3.3.3 Depositing/lowland river (FW2)

A section of the Moyasta River passes through the northwest sector of the Site and also skirts the eastern boundary of the Site (see **Plate 6.7**). This is approximately 5 m wide and appears several metres deep. It has clearly been deepened in the past and the bottom is dominated by a muddy, iron-stained soil. The steep banks are dominated by canary reed-grass *Phalaris arundinacea* with frequent common nettle *Urtica dioica*, creeping buttercup *Ranunculus repens* and Yorkshire fog *Holcus lanatus*. Other plant species noted growing in shallow water are floating sweet-grass *Glyceria fluitans* and bulrush *Typha latifolia*.

Plate 6.7. View of Moyasta River, which skirts the eastern boundary of the Site, October 2022**.**

6.3.3.4 Improved agricultural grassland (GA1)

The field at the south end of the Site (site for proposed borrow pit) is classified as improved grassland. The main species in the vegetation are typically Yorkshire fog *Holcus lanatus*, common meadow-grass *Poa pratensis*, white clover *Trifolium repens* and perennial rye-grass *Lolium perenne* and these species are usually accompanied by creeping buttercup *Ranunculus repens*, meadow buttercup *Ranunculus acris*, creeping thistle *Cirisum arvense* and common mouse-ear *Cerastium fontanum.*

Plate 6.8. View of field of improved grassland in southernmost part of site, May 2022.

6.3.3.5 Hedgerow (WL1)

The site entrance leading from the L6064 is lined by a hedge of approximately 6-7 m in height (see **Plate 6.9**). The hedge is dominated by willow, with dense bramble and some bracken in the ground layer. As the hedge adjoins a conifer plantation and is no longer managed as a field boundary, it has taken on a scrubby character.

Plate 6.9. View of hedgerow dominated by willow at access point from L6064 local road to site, November 2023.

Table 6.8: Summary of the main habitats occurring at wind farm infrastructure locations.

Structure	Main habitats occurring within wind farm footprint
Turbine no. 1	Conifer plantation (WD4)
Turbine no. 2	Conifer plantation (WD4)
Turbine no. 3	Conifer plantation (WD4)
Turbine no. 4	Cutover bog (PB4)
Substation	Conifer plantation (WD4)
Construction compound	Conifer plantation (WD4)
Borrow pit	Improved grassland (GA1)
Met Mast	Conifer plantation (WD4)

6.3.3.6 *Grid Connection route corridor description*

On leaving the Site for the proposed wind farm, the Grid Connection route follows the local road westwards towards Tullabrack crossroads – this stretch is edged mostly by low hedging on both sides, with hawthorn, blackthorn, willow and some ash. The route continues in a northwest and then southwest direction towards the existing Tullabrack 110kV Substation. Both sides of the carriageway are edges by grassy margins and low banks (see **Plate 6.10**). Low hedging, mostly of blackthorn and hawthorn, occurs along much of the route. Commercial plantation has been planted along almost the entire southern side of this road. The plantation is often edged by a strip of deciduous tree species, mainly alder and birch. Along the northern side, there are grassland fields mostly with a wet character.

Plate 6.10. View of a section of the Grid Connection Route leading towards Tullabrack Substation, looking westwards (April 2023). Grassy verges and banks occur along both sides of the carriageway. Much of the southern side has been planted with commercial forestry.

6.3.3.7 Turbine Delivery Route description

The Turbine Delivery Route will use existing public roads. Some works (permanent and temporary) will be necessary to accommodate the delivery of turbine components along the L6132 local road.

The local road is typically bounded by grass verges and ditches/banks, with associated hedgerows and/or treelines. The hedgerows are generally low in height (mostly less than 4-5 m) and composed mainly of willow (*Salix* spp.), hawthorn and blackthorn (see **Plate 6.11**). In places, hedging is absent or intermittent, with banks dominated by bramble and bracken *Pteridium aquilinum* (see **Plate 6.12**). Tree standards are scarce and are mostly low to medium sized ash and sycamore. Treelines are a feature near residences, with ash and sycamore the principal species, as shown in **Plates 6.13 & 6.14**)

The hedging is usually associated with ditches, some of which are substantial (>2 m width) with deep water and supporting aquatic plants such as reed canary grass *Phalaris canariensis*, bulrush *Typha latifolia* and yellow iris *Iris pseudacorus* (see **Plate 6.15**).

At the junction with the N68, there is an island surrounded by roads (part of which will be upgraded to support the delivery vehicles) - this is grassland with some low willow scrub and brambles (see **Plate 6.16**).

The stream crossings (no. 3) along the L6132 component of the TDR are described in detail in Chapter 7. These watercourses, which have been mostly channelised in the past (see **Plate 6.17**), are minor examples of the habitat Depositing/lowland rivers (FW2).

Plate 6.11. View of typical hedging along L6132 local road (looking eastwards). Willow is a frequent species, with hawthorn and blackthorn also present. (November 2023).

Plate 6.12. View of section of L6132 local road where hedging is largely absent - looking eastwards from near proposed site entrance. (November 2023).

Plate 6.13. View of typical section of L6132 local road (looking eastwards), with stands of tall trees associated with housing (November 2023).

Plate 6.14. View of treeline along L6132 local road (looking westwards). Species are mainly ash and sycamore (October 2022).

Plate 6.15. View of roadside ditch, with deep water and aquatic vegetation. Looking eastwards from near proposed site entrance (November 2023).

Plate 6.16. View of junction between N68 and local road showing grassy island with some scrub. Looking eastwards towards N68 (October 2022).

Plate 6.17. View of Moyasta River tributary stream (Gowerhass) along L6132 local road. This, as well as the other stream crossings along the L6132, are minor watercourses and are not suitable for supporting species such as otter (November 2023).

6.3.3.8 Invasive species

During the field surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 – 2021 was conducted. The main regulations influencing Ireland's invasive species lists are:

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

No species listed on this schedule were recorded during the ecology surveys within the Site, or along the route for the Grid Connection Route.

However, during the survey for freshwater pearl mussel *Margaritifera margaritifera* undertaken by APEM in October 2023 (see **Appendix 7.1**), Japanese knotweed *Fallopia japonica* was recorded along the channel of the Brisla East Stream to the south side of the L6132. This was located several metres upstream of the road crossing.

While a submission from the Development Applications Unit (24th July 2023) notes the presence of Gunnera less than 1 km east of the site, Gunnera was not recorded along the L6132 road during surveys for the Turbine Delivery Route.

6.3.3.9 Protected flora

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

There are no known previous records of legally protected plant species from within the survey area or from adjoining areas. The closest known site for such a species is to the north of Tullaher Lough, located approximately 7 km to the north-west of the survey area, which has a record dating back to between 1987 to 1999 for the legally protected species bog orchid (*Hammarbya paludosa*) (Conaghan, Roden and Fuller, 2006).

6.3.4 Mammals, Amphibians and Reptiles

Recent signs (feeding marks) of badger *Meles meles* activity were recorded in the grassland field immediately south of the field proposed for the borrow pit (see **Figure 6.6** in Vol III). The absence of signs of badger presence within the main area of the wind farm site is not surprising as this is largely conifer plantation on peat bog. Peat habitats provide poor habitat for badger as they normally require well drained soils to excavate setts and in Ireland sets are particularly associated with clay banks within hedgerows, native woodland and scrub (Smal 1991).

Fresh signs (droppings) of pine marten *Martes martes* were recorded during the October survey on a pine stump within the wayleave for the overhead line in the northern part of the Site (see **Figure 6.6** in Vol III) – from the coloration, it appeared that the animal had been feeding on berries. The preferred habitat of pine marten in Ireland is deciduous woodland or scrub with good ground cover, though mixed woodland and coniferous thickets are also used (Hayden and Harrington 2000). Pine martens may nest within larger trees with hollows, rock clefts or outbuildings. Taking into account the low suitability of the habitats within the Site for pine marten, including the absence of suitable nesting features, it is considered that the Site is likely to be within a pine marten territory (which can be up to 80 ha) but that breeding on site is not likely.

No evidence of the presence of red squirrel *Sciurus vulgaris* was recorded within Site and it is considered that the plantations are too young to support red squirrel on a regular basis.

An otter *Lutra lutra* was observed swimming in the Moyasta River on 24th May 2022 (see **Figure 6.7** in Vol III). While no signs of otter were found along the banks of the river in subsequent surveys, including the aquatic ecology survey (see **Chapter 7: Aquatic Ecology**), the sighting confirms that otter at times uses the Moyasta river system and may breed elsewhere along its course. However, it is noted that none of the three watercourses along the L6132 local road which would be crossed by the Turbine Delivery Route provide suitable habitat for otter due to their small size, i.e. little more than channels (see **Plate 6.16**). No signs of otter presence were recorded on the surveyed sections of these streams during the freshwater pearl mussel survey carried out by APEM in October 2023 (see **Chapter 7: section 7.3.2**).

Signs of fox *Vulpes vulpes* were observed at several locations along the margins of the conifer plantation. Deer have a presence in the area, with feeding marks observed in several locations within the conifer plantations. Based on the known distribution of deer in Ireland (Lysaght & Marnell 2016), these are likely to be fallow deer *Dama dama*.

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

The common frog *Rana temporaria* is widespread on site including within forest drains. As permanent freshwater ponds are absent from the Site, the site does not provide suitable habitat for the smooth newt *Lissotriton vulgaris*.

While not recorded, it is expected that the common lizard *Zootoco vivipara* would occur on the area of cutover bog within the Site.

6.3.5 Bats

6.3.5.1 Desk review results: historical records

The wind farm site itself is not located within 10 km of any internationally or nationally designated site which include bats in their conservation interests.

National Biodiversity Data Centre (NBDC) holds previous records of bat presence from within the 10 km square (R05) in which the proposed site is located. These records are for brown long-eared bat *Plecotus auritus*, Daubenton's bat *Myotis daubentonii*, Leisler's bat *Nyctalus leisleri*, common pipistrelle *Pipistrellus pipistrellus* and soprano pipistrelle *Pipistrellus pygmaeus*.

The overall bat suitability index value (*33.11*) according to 'Model of Bat Landscapes for Ireland' (Lundy *et al.* 2011) suggests the landscape in which the proposed site is located is of moderate to high suitability for bats in general. Species specific scores are provided in **Appendix 6.2 (Table 3.1**).

Available bat records were provided by Bat Conservation Ireland (BCI) from their database of roost locations and other bat records. The relevant search area consisted of a 30 km radius around the proposed wind farm site. Where roost locations occur in private dwellings the location shown refers to relevant 1 km grid square. Roost records are summarised **in Appendix 6.2 (Table 3.2)** and shown in **Figure 3.1**.

Consideration was given to the location of the proposed site relative to the 'Core Sustenance Zones' (CSZ) of all known bat roosts proximal to the site. In the absence of information specific to Ireland, CSZ distances provided in Collins (2023) are considered to be best available information. CSZ distances for species known to occur in Ireland range from 1 km to 4 km although these distances are based on limited information in some instances (Collins, 2023). Roost records were considered within a search area extending to 4 km from proposed turbine locations, and no roost records were identified within this 4 km radius.

The most proximal roost was recorded at Moneypoint, Co. Clare (R0352), approx. 7 km south-east of the proposed site. Species recorded at this roost location include brown long-eared bat, soprano pipistrelle, Natterer's bat and lesser horseshoe bat. The proposed wind farm site is located outside of the CSZs for the species of this roost (Collins, 2023).

BCI Volunteer based surveys and records submitted by Ecological Consultants (Ad-hoc records) were provided and analysed for the presence of the Annex II (EU Habitats Directive) listed Lesser Horseshoe Bat. An Ad-hoc record of common pipistrelle, soprano pipistrelle and lesser horseshoe bat was recorded south of Kilrush town centre, Co. Clare in 2019.

A protected species data request was submitted to NPWS and species records for the relevant area (10 km grid squares which the proposed site overlaps; Q85, Q86, Q94 Q95, Q96, R04, R05, R06, R15, R16) were received on 2nd November 2023 - no records were held for the Annex II listed Lesser Horseshoe Bat within the search area.

6.3.5.2 Potential roost assessment

Surveys were carried out to identify and investigate potential bat roosting features at the following locations:

- Proposed wind farm site
- Proposed grid connection route
- Proximal to the points of interest along the proposed TDR

During these surveys, all trees and bridges which might be impacted by the proposed design and structures which may potentially host significant bat roosts were inspected visually. Trees, structures (incl. bridges), where present, were considered and described according to Collins (2023).

6.3.5.2.1 Potential roosts at proposed wind farm site

A Ground Level Tree Assessment (GLTA) was carried out at the proposed wind farm site by Tom O'Donnell and Colm Breslin. All potential significant roosting features in an area extending to at least 268 m from the 'redline' boundary were taken into consideration. No contemporary or historic evidence of roosting by bats was found within the wind farm site boundary. No trees of PRF-M suitability (suitable to facilitate maternity roosting by bats) or structures of high suitability were recorded within the wind farm boundary. The trees present on site mainly consist of dense commercial coniferous forestry, which present negligible suitability for roosting bats and represents a typically low productivity foraging habitat. Following Marnell *et al.* (2022) coniferous plantations with no specimen trees have decreased probability of being used by roosting bats and such trees do not require individual assessment for roosting potential.

A portion of the spoil storage area and borrow pit are located within agricultural grassland adjacent to the commercial forestry but likewise contain no trees with suitable PRFs for roosting bats. The hardwood belts surrounding commercial forestry consisted primarily of stunted Willow (*Salix spp.*) with narrow diameter stems and no identifiable features that may be utilized by roosting bats.

EPA data regarding known locations of caves and historic mining operations was examined in order to identify the presence of any known underground features which could support a significant bat roost. No known underground sites are present within the relevant search area.

No structures were present within the proposed wind farm site and are thus not considered further. Structures identified from examination of OSi historic 6" mapping were no longer present.

6.3.5.2.2 Potential roosts along Grid Connection Route

Visual survey and inspection of Potential Roost Features (PRFs) which may be directly or indirectly impacted by the proposed grid connection route and access works was carried out following guidance set out in Collins (2023).

No evidence of roosting by bats was found along the GCR. However, four trees with PRF-I suitability for roosting bats were identified along the grid connection route (see **Appendix 6.2, Table 3.3**). These trees presented with minor roosting features as a result of tear offs and historic tree surgery but are otherwise unsuitable for roosting bats. Following Collins (2023), no further survey of PRF-I trees is warranted. The identified trees are not located within any area proposed for tree trimming works, with a single tree (T_04) located within the hedge trimming zone of works but will not be directly affected.

An unoccupied structure (see **Appendix 6.2, Figure 3.2**) was noted along the grid connection route and is conservatively assessed as being of 'high' suitability for roosting bats but the interior of this structure was not accessible. A number of private residential properties are also located along the grid connection route. The zone of influence of the proposed grid connection route along in-road sections is extremely limited, confined to the immediate works area and is temporary in nature. In the event a bat roost was present within such a structure, no potential impacts would arise during the construction or operation of the cable route.

6.3.5.2.3 Potential roosts along Turbine Delivery Route (TDR)

The section of the TDR relevant to the bat survey was the portion nearest to the site from the N68 to the site entrance along which facilitation works are proposed. Visual survey and inspection of PRFs which may be directly or indirectly impacted by the proposed works was carried out. The portion of the TDR assessed was generally characterised by sparse distributions of short-length mature treelines and was otherwise generally open and exposed in nature.

No evidence of roosting by bats was found along the turbine delivery route. A total of seven trees with bat roosting suitability were identified along the portion of the TDR necessitating facilitation works (see **Appendix 6.2, Figure 3.2**). Two of these trees displayed PRF-M suitability for roosting bats, with the potential to host multiple roosting bats. Neither of these trees, however, are located within areas designated for tree trimming but are both located within hedge trimming and verge strengthening areas. Given the lack of any direct impacts on PRF-M trees identified as a result of proposed hedgerow cutting, no further survey of PRF-M trees is considered warranted.

The remaining five trees displayed PRF-I suitability for roosting bats. Four of these trees are located within areas proposed for hedge trimming but none are located within tree trimming zones. Following Collins (2023), no further survey of PRF-I trees is warranted.

Three unoccupied structures were noted along the turbine delivery route (see **Appendix 6.2**, **Table 3.4**). These structures were visually assessed for bat roosting potential. These structures comprised a disused residence in structurally sound condition (S_02), dilapidated stonework agricultural shed (S_03), and derelict residence in poor structural condition (S_04). The mentioned structures displayed 'High', 'Low' and 'Moderate' bat roosting suitability respectively.

A number of private residential properties are also located along the TDR. The zone of influence of the proposed TDR is extremely limited, confined to the immediate works area and is temporary in nature. In the event a bat roost was present within such a structure, no potential impacts would arise during the facilitation works for the TDR or the delivery of the turbines.

Additionally, all watercourse crossings with stream crossing plates were assessed for bat roosting suitability. These crossings all consisted of narrow diameter concrete culverts that displayed no suitability for roosting bats due to the lack of crevices and inundation from water. Following Collins (2023), these features require no further consideration.

6.3.5.3 Bat activity surveys - passive survey

Ultrasonic detector surveys were carried out at the proposed wind farm site across three seasons to record bat activity in the area from which information on species composition, relative abundance and landscape usage could be derived.

Overall, a moderate level of activity was recorded at the site, and a high level of species diversity. A total of nine bat species were recorded (possibly ten as whiskered bats and Brandt's bats are indistinguishable through ultrasonic detection). The Annex II species lesser horseshoe bat was recorded once during the summer 2023 survey period at Turbine 4. The proposed wind farm site generally lacks bat roosting opportunities and primarily represents a low productivity foraging and commuting habitat.

Common pipistrelle was the most commonly recorded species across the entire survey period and accounted for 64.8% of all registrations across all turbine locations, while soprano pipistrelle accounted for 16.1% of all registrations, followed by Leisler's bat at 14.1%. The remaining species all comprise <1% of registrations respectively apart from Natterer's bat (3%).

The level of activity recorded at the proposed wind farm site varied according to season, location and species. The results of passive bat monitoring are presented in **Appendix 6.2**, **Table 3.4**. The highest level of bat activity was recorded at the monitoring station for Turbine 3, which accounted for 62% of all registrations recorded across the three survey seasons, followed by the Turbine 1 monitoring station, accounting for 24% of all registrations recorded. The highest proportion of registrations was recorded during the summer 2023 survey period accounting for 56.8% of all registrations recorded.

6.3.5.4 Bat activity surveys - active transect survey

Two active bat surveys were carried out at the proposed wind farm site, along two transect routes, for approximately 1.5 hours from dusk on 1st June and 31st August 2023.

Across both survey nights a low level of activity was recorded from a low to moderate diversity of species. The recorded species included common pipistrelle, soprano pipistrelle, Leisler's bat and Daubenton's bat.

All of the above species were also recorded during the passive bat detection surveys. The locations of the registrations recorded during the active bat surveys at the proposed wind farm site are shown in **Appendix 6.2, Figures 3.3 & 3.4**.

The initial active bat survey on 1st June 2023 was characterised by low levels of activity with a total of 29 registrations all attributed to common pipistrelle and soprano pipistrelle. Of these, soprano pipistrelle was most commonly recorded and accounted for 19 registrations, common pipistrelle accounted for 10 registrations, of which only a single common pipistrelle registration was recorded along Transect A.

On the night of 31st August 2023 activity was low and a total of 33 bat registrations were recorded. Of these, soprano pipistrelle was most commonly recorded and accounted for 17 registrations, common pipistrelle accounted for 11 registrations, Leisler's accounted for four registration and single Daubenton's bat registration was recorded.

While each individual survey represents only a 'snapshot', overall, data derived from active surveys broadly reflected the data derived from passive bat surveys in terms of species relative abundance as common pipistrelle and soprano pipistrelle were the most commonly recorded during the passive survey seasons. No activity indicative of emergence from (or proximal to) an active roosting location was observed. While individual observations were made of bats in flight, no patterns of behaviour were noted which would suggest the presence of important or significant commuting routes. It is likely that this habitat is simply used for foraging by a number of individuals. Both transects were located within edge feature habitats, occurring along old forestry paths and partially within agricultural grassland in the case of Transect A.

6.3.6 Birds

6.3.6.1 Desk review results

6.3.6.1.1 International sites

Sites designated as Special Protection Areas are described in section 6.3.2.1 above (see **Table 6.6**).

The desk-top review concluded that there are no sites designated as Wetlands of International Importance under the Ramsar Convention within 20 km of the site boundary.

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[4]. The desk-top review concluded that there are two IBA sites within 20 km of the Site Redline Boundary: 'West Clare Uplands', approximately 8.7 km northeast of the Site, and 'Shannon and Fergus Estuaries', approximately 5.6 km southwest of the Site. The West Clare Uplands IBA is of importance for breeding hen harrier, while the Shannon and Fergus Estuaries is of importance for wetland bird species.

6.3.6.1.2 Irish Wetland Bird Survey sites

The Irish Wetland Bird Survey (I-WeBS) monitors wetland bird populations in Ireland. There are four I-WeBS sites within 20 km of the Development Site (see **Table 6.9** below).

Table 6.9: I-WeBS sites within 20 km of the proposed wind farm site.

I-WeBS Site	Site code
Shannon & Fergus Estuary Aerial	0H410
Tullaher Lough	0H008
Mid-Clare Coast (Mal Bay - Doonbeg Bay)	0H902
Farrihy Lough	0H007

6.3.6.1.3 BirdWatch Ireland Bird Sensitivity Tool

The Bird Sensitivity Mapping Tool for wind energy development provides a measured spatial indication of where protected birds are likely to be sensitive to wind energy developments (McGuinness *et al*. 2015).

[4]http://www.birdlife.org/worldwide/programmes/important-bird-and-biodiversity-areas-ibas

A review of this mapping tool determined that no bird sensitivity ratings, as above, have been assigned to the area within which the proposed wind farm is encompassed.

6.3.6.2 *NPWS Rare and Protected* ***Species*** *Database*

An information request requesting records from the Rare and Protected Species Database for the hectad R05 encompassing the Site resulted in records for hen harrier and peregrine (18th November 2022). The following information was provided in relation to peregrine:

- Peregrine falcon: Two occupied nest sites were recorded during the 2017 National Peregrine Survey. These nest sites were not recorded/unknown in the previous National Survey in 2002.

6.3.6.2.1 Identification of target species

Target species are typically those species which are afforded a higher level of legislative protection, or which are considered to be more sensitive to potential impacts from wind farm developments by virtue of their behaviour (SNH 2017).

The results of the comprehensive desk-top study, in conjunction with a site reconnaissance survey prior to the commencement of any surveys, were used to identify target bird species which were considered likely to occur in the study area. These target species formed the main focus of the bird surveys undertaken.

In conjunction with the findings of the desk-top study, which includes review of results for the relevant hectad (R05) from previous Bird Atlas projects (see **Appendix 6.3**), the target species list was drawn from:

- Annex I of the Birds Directive as amended.
- Species protected under the Fourth Schedule of the Wildlife Acts 1976-2022(buzzards, eagles, falcons, harriers, hawks, kites, osprey, owls).
- Red-listed birds of Conservation Concern (Gilbert *et al.* 2021).
- Special Conservation Interest (SCI) species of SPAs within a 20 km radius of the Site.

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 were included as secondary species. It is generally considered that passerine species are not significantly impacted by wind farms (SNH, 2017); however, their presence was recorded to provide a complete picture of bird usage of the Site.

Table 6.10 lists the species which were identified as target species for the study area. The conservation status for each species is given (it is noted that all wild birds in Ireland are legally protected under the Wildlife Acts as amended).

Table 6.10: Target species identified for proposed Ballykett Wind Farm Study Area.

Target Species	Conservation Status	Target Species for Site Y/N
Barn Owl (*Tyto alba*)	BoCCI Red-listed	Y
Buzzard (*Buteo buteo*)	BoCCI Green-listed	Y
Cormorant (*Phalacrocorax carbo*)	BoCCI Amber-listed	Y
Curlew (*Numenius arquata*)	BoCCI Red-listed/SCI	Y
Golden Plover (*Pluvialis apricaria*)	Annex I EU Birds Directive/ BoCCI Red-listed/SCI	Y
Hen Harrier (*Circus cyaneus*)	Annex I EU Birds Directive/ BoCCI Amber-listed/SCI	Y
Kestrel (*Falco tinnunculus*)	BoCCI Red-listed	Y
Kingfisher (*Alcedo atthis*)	Annex I EU Birds Directive/ BoCCI Amber-listed	Y
Lapwing (*Vanellus vanellus*)	BoCCI Red-listed/SCI	Y
Long-eared Owl (*Asio otus*)	BoCCI Green-listed	Y
Merlin (*Falco columbarius*)	Annex I EU Birds Directive/ BoCCI Amber-listed	Y
Peregrine Falcon (*Falco peregrinus*)	Annex I EU Birds Directive / BoCCI Green-listed	Y
Snipe (*Gallinago gallinago*)	BoCCI Red-listed/SCI	Y
Sparrowhawk (*Accipiter nisus*)	BoCCI Green-listed	Y
Whooper Swan (*Cygnus cygnus*)	Annex I EU Birds Directive/ BoCCI Amber-listed/SCI	Y
Woodcock (*Scolopax rusticola*)	BoCCI Red-listed	Y

6.3.6.3 Field survey results

6.3.6.3.1 Presentation of results

In the following sections, results from the various surveys which were carried out over the 24-month period from October 2020 to September 2022 are summarised. Full results are given in **Appendix 6.4**.

There then follows a discussion of the conservation importance of the Site for birds.

6.3.6.3.2 Flight activity surveys

Results from the vantage point surveys are tabulated for each species in **Appendix 6.4.4**, with corresponding flight lines plotted in **Appendix 6.4.5**.

Hen harrier

There was one hen harrier flight line within the survey area – an immature male bird was recorded flying northwards and hunting over grassland approximately 250 m to the east of the Site on 6th April 2021.

Sparrowhawk

Sparrowhawk flightlines were recorded on four occasions during the summer surveys and on three occasions during the winter surveys. All records involved single birds flying and/or hunting. Only one of the records, a female on 6th April 2021, was from within the Site of the proposed wind farm. Most of the records were from over grassland fields to the east and the southwest of the wind farm location. In addition, there was a record of a bird perched in conifers to the southwest of the wind farm site.

While there was no evidence of sparrowhawk nesting within the Site of the proposed wind farm, the pattern of records through the year suggests a breeding territory in the near vicinity of the site for the proposed wind farm.

Buzzard

Buzzard flightlines were recorded on 11 occasions during the summer surveys and on six occasions during the winter surveys. All records, apart from one (see below), involved single birds and most were of birds merely flying over the Site of the proposed wind farm or over adjoining areas. Soaring and/or circling birds were recorded on four occasions, including a party of three birds over the northeast sector of the site on 8th March 2022. In addition, there were three records of buzzard perched on the ground – in a young conifer plantation to the east of the Site (April 2021 & April 2022) and in rough grassland to the north of the survey area (September 2022).

While buzzard was not suspected of nesting within the Site, the pattern of records through the year suggests a breeding territory in the near vicinity of the Site.

Merlin

There was one merlin flight line over the Site – a female bird was recorded flying through the Site, from west to east, on 3rd February 2021. The bird continued east of the Site but close to the forest edge in a southerly direction.

Kestrel

Kestrel was the most frequently recorded bird of prey species throughout the study. There was a total of 12 flightlines during the summer surveys and nine during the winter surveys. Only three of the records were from within the Site, with the majority over the surrounding conifer plantations, scrub and grassland fields. All involved single birds, apart from two birds together on 8th October 2021 and on 2nd September 2022. Records involved birds flying and/or hunting. In addition, perched birds were recorded on occasion.

While kestrel was not suspected of nesting within the Site, the pattern of records through the year suggests a breeding territory in the near vicinity of the wind farm.

Cormorant

There was one cormorant flight line over the Site – one flew west to east over the northern sector of the survey area on 13th October 2020.

Grey heron

Grey heron was recorded in the survey area on two dates as follows: one flying southwards to the east of the Site on 13th October 2020, and three records on 2nd September 2022, one of which flew across the Site.

Mallard

There was one mallard flight line over the Site – a pair to the west of the site on 2nd February 2021 continued in a westward direction.

Golden plover

There was one golden plover flightline within the survey area as follows: a party of five birds to the northeast of the Site on 5th January 2021. The birds flew low over grassland fields and continued in a northerly direction.

Snipe

Snipe were recorded on two dates in a field to the west of the survey area as follows: 16 on 6th October 2021 and four on 2nd November 2021.

It is noted that the vantage point survey method does not reliably sample snipe flight activity. SNH (2017) notes "*Snipe are very difficult to detect on standard VP watches and are unlikely to be meaningfully recorded*."

Whimbrel

There was one whimbrel flightline within the survey area as follows: a party of nine birds flew northwards over the extreme eastern sector of the Site on 4^{th} May 2021.

Herring gull

Herring gull flightlines were recorded on eight occasions during the summer surveys and on three occasions during the winter surveys. Most of the records, apart from two, were outside of the area of the proposed wind farm off-Site. The records were largely of single birds, though five were recorded on 3^{rd} February 2021 and four on 8^{th} June 2021.

Lesser black-backed Gull

Lesser black-backed gull flightlines were recorded on ten occasions during the summer surveys. The absence of records in winter reflects the status of the species in Ireland as mainly a summer visitor. The records were mostly along the eastern margin of the Site and over the fields to the east. The records were of single birds or small parties (up to 7). Birds were also recorded in silage fields to the southeast of the Site on 6^{th} July 2022.

Great black-backed Gull

There were three flightlines in winter 2020/21 (13^{th} October) and winter 2021/22 (6^{th} December & 11^{th} January). All involved single birds flying southwards. One of the flightlines was over the Site.

6.3.6.3.3 Transect surveys.

Full results from the transect surveys are presented in **Appendix 6.4.8**. The surveys give an overview of the breeding and wintering species which are associated with the principal habitats on the Site, namely conifer plantation and cutover bog.

Breeding birds

The conifer plantation supports a range of passerine species, which reflects the varying age structure of the stands. Species recorded include coal tit, blue tit, dunnock, song thrush, blackbird, mistle thrush, robin, wren, goldcrest, blackcap, willow warbler, whitethroat, redpoll, siskin and chaffinch. Several of these species (namely coal tit, goldcrest, redpoll, siskin), along with jay, are particularly associated with conifer plantation.

The cutover bog supports relatively few breeding birds, with meadow pipit (Red-listed) and skylark the most frequent. A jack snipe in May was likely to be a bird on migration (main status in Ireland is as a winter visitor).

A grey wagtail (Red-listed) was likely a local breeding bird associated with the Moyasta River.

Winter birds

The winter surveys recorded fewer bird species than in summer (26 compared to 53). As well as the characteristic species of conifer plantation as present in summer, crossbill was recorded. Crossbill is a species that is almost entirely confined to conifer plantation.

Meadow pipit was also recorded in winter on the cutover bog, along with snipe (Red-listed). Skylark was absent for the main winter period, recorded in March as returning breeding birds.

6.3.6.3.4 Hinterland surveys

Full results from the hinterland surveys are presented in **Appendix 6.4.2**, with mapped routes and species recorded also shown.

The four surveys carried out recorded a range of bird species, including the following:
Sparrowhawk – singles on 27.04.21 & 17.07.21
Buzzard – singles on 23.11.21 & 22.04.21
Peregrine – one on 27.04.21
Kestrel – four on 27.04.21, one on 17.07.21 & two on 23.11.21
Whimbrel – 76 on 27.04.21 & 1 on 22.04.22

However, the surveys did not locate any habitats which were of high importance for breeding and/or wintering birds. It is noted that the various small lakes and wetland which occur in the hinterland, notably Tarmon Lough, Knockerra Lough, Gower Lough and Moanmore Lough are not of any importance for supporting breeding or wintering wetland birds. [Tullabrack Lough was surveyed as part of the Winter Wildfowl Survey – see following section]

6.3.6.3.5 Winter Wildfowl Surveys

Full results from the winter wildfowl surveys are presented in **Appendix 6.4.9.** There follows a summary of the results for each site.

Moyasta Creek

This estuarine creek supported a range of wintering wetland birds, including wigeon, teal, pintail, shoveler, mallard, little egret, lapwing, dunlin, snipe, redshank and curlew. It is an important site and an integral component of the Poulnasherry Bay and Shannon Estuary system.

Poulnasherry Bay

The bay is an important part of the Shannon Estuary system, a site of International Importance for wintering wetland bird species. As expected, significant numbers of wintering species were recorded during the surveys, including shallow bay species such as great northern diver, velvet scoter, red-breasted merganser and goldeneye.

Tullaher Lough

This lake and bog system is an important site for wintering Greenland white-fronted geese. 15 geese were present on 14th January 2021 and eight there on 23rd November 2021.

Farrihy Lough

Farrihy Lough is a brackish wetland system located approximately 1 km from the coastline. Seven pink-footed geese were recorded on 5th January 2021, and nine whooper swans and four Greenland white-fronted geese on 9th November 2021.

Tullabrack Lough

Tullabrack Lough, a small lake system located just over 1 km north of the site for the proposed wind farm, supported small numbers of waterfowl species, as follows:

Whooper swan – six on 03.11.21
Little grebe – two on 03.11.21
Moorhen – five on 03.11.21
Teal – 30 on 31.01.21; seven on 03.11.21
Wigeon – 25 on 31.01.21; ten on 03.11.21
Mallard – 5 on 31.01.21; 14 on 03.11.21
Tufted duck – 18 on 31.01.21; 11 on 03.11.21

6.3.6.3.6 Winter Hen Harrier Roost Surveys

Information from the Irish Hen Harrier Winter Roost Survey indicated that there are two established roosts within distances of 5-8 km of the site proposed for the Ballykett Wind Farm. These are known to be used on an irregular basis. Surveys were carried out at these roosts in winters 2020/21 and 2021/22 following the standard method of O'Donoghue (2019). A single male bird was recorded flying into one of the roosts on two occasions (14th January 2021 & 11th November 2021). A further established roost occurs on an island in the Shannon estuary.

There was no evidence of any further winter roosts within the study area.

6.3.6.4 Evaluation of Status of Ornithological Receptors

The following species, which were recorded during the on-site surveys (Redline Boundary and 500 m buffer), are species of European conservation importance (as listed on Annex I of the Birds Directive as amended) and/or are species of national conservation importance (Red- or Amber-listed after Gilbert *et al*. 2021). Sparrowhawk and buzzard (both Green-listed) are included in the evaluation, as all bird of prey species are potentially sensitive to wind farm development. A summary of the status of each species in the area of the Site follows. For the purpose of discussion, the 'Site' refers to the Redline Boundary and 500 m buffer as used in the baseline bird surveys.

Table 6.11: Conservation status of species recorded in baseline surveys within the area of the proposed Ballykett Wind Farm.

Species	Annex I	Red list	Amber list
Cormorant			Y
Hen Harrier	Y		Y
Sparrowhawk			
Buzzard			
Kestrel		Y	
Merlin	Y		Y
Peregrine	Y		
Golden Plover	Y	Y	
Snipe		Y	
Herring Gull			Y
Lesser Black-backed Gull			Y
Goldcrest			Y
Skylark			Y
Swallow			Y
Willow Warbler			Y
Starling			Y
Grey Wagtail		Y	
Meadow Pipit		Y	
Linnet			Y

Cormorant – Amber List

Cormorant is an occasional visitor over the area of the Site (1 VP record & 1 transect record). The birds recorded (both singles) are expected to be from breeding and wintering populations along the Shannon estuary. There is no suitable habitat for this species within the Site or the surrounding areas.

Hen harrier – Amber List; Annex 1

There was a single hen harrier flightline over the 24 months of vantage point surveys – this was an immature male bird hunting over grassland to the east of the Site on 6th April 2021. While the cutover bog within the site and some open canopy plantation immediately to the west of the Site (all plantation within site in now closed canopy) provide suitable foraging habitat for hen harrier, breeding in this area of County Clare is not known and would not be expected due to the absence of continuous tracts of suitable foraging habitat.

The nearest breeding population of hen harrier would be the West Clare Uplands Important Bird Area (IBA), which is located approximately 9 km to the east and comprises a large area of bog, conifer plantation and agricultural grassland habitats. In the 2015 National Hen Harrier Survey, Ruddock et al. (2016) gave a population estimate of 3-9 pairs for North & West Clare, a reduction from 12-16 pairs since 2010. While the majority of foraging by hen harriers is within 5 km of the breeding site, hunting birds, and especially males, may travel further distances at times though probably not more than 10 km. While the Site area could be at the extreme distance that hen harriers from the IBA may travel to hunt, the baseline surveys carried out over the 24-month period indicate that at most hen harrier is an occasional visitor in the area.

There was no evidence of winter roosting within the Site or its hinterland, with the nearest documented roosts 5-8 km from the Ballykett Site.

From the available information it is concluded that foraging hen harriers associated with the West Clare Uplands IBA may visit the Ballykett Site area at times for foraging but that there are no breeding or winter roost locations within at least 5 km of the Site.

Sparrowhawk – Green List (former Amber-listed species)

Sparrowhawk, now a Green-listed species in Ireland, was observed in both summer and winter. Habitat suitable for breeding and foraging occurs within the Site and in surrounding areas. The species was also recorded in the hinterland surveys.

While there was no evidence of nesting within the Site or surrounding areas during the surveys, it is likely that there is a breeding territory in the vicinity (1-2 km range) of the Site.

Buzzard – Green List

Buzzard was observed in both summer and winter within and around the Site. The Site provides habitats suitable for foraging by buzzard, though nesting habitat (tall trees) are largely absent. The species was also recorded in the hinterland surveys.

While there was no evidence of nesting within the site or immediate surrounding areas, it is likely that there is a breeding territory in the vicinity (1-2 km range) of the Site.

Kestrel – Red List

Kestrel was the most frequently encountered bird of prey, both in summer and winter, with individuals regularly observed hunting within the area of the site. The species was also recorded in the hinterland surveys.

Baseline survey information indicates that the nearest known breeding site for Kestrel is at approximately 250 m to the east of the Site Redline Boundary. This was an occupied territory in summer 2021, with no further breeding attempts recorded in subsequent years.

Merlin – Amber List; Annex I

A female merlin was recorded within the Site in February 2021.

While it is likely that the vantage point surveys would have detected a breeding territory in the immediate Site area, merlin is an elusive species that is difficult to monitor. As the habitats within the Site and its hinterland are considered suitable for breeding merlin, there is some possibility that there is a breeding territory in the wider area of the site (up to 2 km).

Overall, however, the available baseline data indicate that merlin is a rare species within the Site and its environs.

Peregrine falcon – Green List; Annex I

A single Peregrine was observed in the area of the Site in the May 2021 transect survey, as well as a sighting in the hinterland survey in November 2021.

Information supplied by NPWS indicate that there are several breeding territories along the west Clare coast, as well as one to the southeast of the Site. All known breeding territories are greater than a 5 km distance from the Site.

While the Site would not support nesting by peregrine, peregrines have large territories and birds from any of the breeding territories could pass over the Ballykett Site area.

Golden plover – Red List; Annex I

This Red-listed and Annex I species was recorded on a single date (5th January 2021), when a flock of five birds was observed flying over land to the northeast of the Site (partly within the 500 m buffer zone).

The Winter Wildfowl Survey recorded golden plover at Moyasta Creek and Poulnasherry Bay. The habitats within the Site or within the immediate surrounding areas are not suitable for supporting feeding and/or roosting golden plover.

From the baseline information, it is considered that Golden Plover is a rare visitor to the area of the Site in winter.

Snipe – Red List

There were no records of snipe within the Site area in any of the baseline surveys. However, an incidental record (by B. Madden) of 42 snipe flushed from a wet area of cutover bog within the Redline Boundary on 26th October 2022 is likely to reflect a local immigration (Hutchinson 1989).

Snipe were recorded in a field just outside the 500 m buffer zone in October and November 2021, and the species was recorded at Moyasta Creek and Poulnasherry Bay during the Winter Wildfowl Survey.

Whilst snipe breed on cutover bog, the relatively small size of the bog at the Site and the fact that it is surrounded by conifer plantation is likely to make it unsuitable for breeding snipe. In winter, snipe is a widespread species of bogs and wet fields, and it would be expected in the general hinterland of the Site.

From the baseline information, it is considered that snipe is likely to be a visitor to the Site (cutover bog) and its hinterland in winter.

Lesser black-backed gull – Amber List

Lesser Black-backed Gull was recorded during summer vantage point surveys. The records were largely over adjoining fields with concentrations in fields where silage had been cut. The Winter Wildfowl Survey recorded lesser black-backed gull at Moyasta Creek and Poulnasherry Bay.

The Site for the proposed wind farm does not provide suitable habitat for lesser black-backed gull.

From the baseline information, it is considered that lesser black-backed gull is an occasional visitor to the area around the Site during summer and autumn. The birds in the Ballykett Wind Farm Site area are expected to be from breeding colonies in coastal areas of Co. Clare, such as Mutton and Mattle islands near Quilty.

Herring gull – Amber List

Herring gull were recorded in both the summer and winter surveys, with most of the records outside of the area of the Site. The Winter Wildfowl Survey recorded herring gull at Moyasta Creek and Poulnasherry Bay.

The Site does not provide suitable habitat for herring gull.

From the baseline information, it is considered that herring gull is an occasional visitor to the area around the Site during summer and winter. As with lesser black-backed gull, the birds recorded in the Site area are expected to be from coastal breeding colonies in Co. Clare.

Goldcrest – Amber List

Goldcrest is a widespread resident species within the conifer plantations within and around the Site. More prevalent in summer than in winter.

Skylark – Amber List

Skylarks breed on the cutover bog habitat within the Site. Largely absent in winter.

Swallow – Amber List

Recorded feeding over site regularly in summer. Expected to nest in local farm buildings but not within the Site.

Willow warbler – Amber List

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

Starling – Amber List

Recorded within the site in summer and may breed. Expected to be occasional in winter.

Grey wagtail – Red List

There were several records of grey wagtail during the various surveys and it is likely that the species breeds along the Moyasta River, probably downstream of the Site.

Meadow pipit – Red List

Breeds on the cutover bog within the Site and also present in small numbers in winter. Also occurs in pre-thicket conifer plantation where present.

Linnet – Amber List

Recorded on transect survey in May 2021 and may breed in marginal scrub areas along tracks within the Site.

6.3.7 Marsh Fritillary

While *Succissa pratensis* (foodplant of the butterfly) was recorded in the cutover bog, the distribution was localized and nowhere abundant. As the criteria for habitat in good condition for Marsh Fritillary, *i.e*. three or more well-developed Devil's-bit Scabious plants per square metre across more than twenty percent of the habitat, were not present within the survey area, further survey for this species was not merited.

6.3.8 Summary of Ecological Receptors and Conservation Value of Site

6.3.8.1 Habitats, vegetation and flora

The survey area at the Site for the proposed wind farm is dominated by coniferous plantation on peat. Coniferous plantation is a habitat of low ecological interest as it comprises non-native tree species and supports a very species-poor associated flora – rated as Local Importance (lower value). The improved grassland field in the southernmost part of the Site has negligible ecological interest and is also rated Local Importance (lower value).

The Site supports an area of unplanted cutover bog (formerly an example of a western raised bog) which is in a relatively undisturbed state as it has not been cut for a number of decades and retains a well-developed peatland flora. The bog on the Site is rated as Local Importance (higher value).

The section of the Moyasta River within and alongside the Site has been dredged in the recent past and is classified as having "*Moderate*" water quality under the current cycle of the Water Framework Directive as amended. The aquatic survey rated the streams in the vicinity of the Site as of low ecological value. Nevertheless, the section of the Moyasta River in the immediate vicinity of the Site provides a useful riparian corridor for wildlife and is rated as Local Importance (higher value).

There are no habitats on Site that are examples of those listed on Annex I of the EU Habitats Directive as amended.

No nationally rare or legally protected plant species listed in the 2022 Flora (Protection) Order were recorded from within the Site for the proposed wind farm development during this survey. There are no known previous records of legally protected plant species or Red-list species from within the Site or adjoining areas. The closest known site for such a species is to the north of Tullaher Lough, located approximately 7 km to the north-west of the Site, which has a record dating back to between 1987 and 1999 for the legally protected species bog orchid *Hammarbya paludosa* (Conaghan, Roden & Fuller 2006).

6.3.8.2 Terrestrial mammals, amphibians and reptiles

The Site supports a typical mammalian fauna of bog and conifer plantation habitats.

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

Otter, pine marten and all deer species are protected under the Wildlife Acts, as are other species likely on Site or in the immediate environs, namely pygmy shrew and badger. Otter is also listed on Annex II of the EU Habitats Directive as amended.

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

6.3.8.3 Bats

The bat assessment describes the study area in terms of roosting and foraging suitability for bats. A comprehensive and appropriate survey effort was employed, and no evidence of bat roosting in either structures or trees present within or immediately adjoining the proposed site could be found. Low productivity foraging habitat and suitable commuting habitat exists within the proposed wind farm site. No roosting was identified along the Grid Connection Route or Turbine Delivery Route.

Taking into account the results of surveys described in this report, the nature and context of the Site, the habitats present at the Site and their connectivity to the local environs, overall, the study site is considered to be of **Local Importance (Lower Value)** for bats.

All bats recorded are classified as 'Least Concern' on the Irish Red List (2019) and protected under the EU Habitats Directive as amended Annex IV and the Wildlife Acts 1976-2022 as amended. One species, lesser horseshoe, is listed as 'Annex II' under the EU Habitats Directive as amended.

6.3.8.4 Birds

The habitats on Site are of relatively low interest for birds. Meadow pipit (Red-listed) and skylark (Amber-listed) breed on the cutover bog, while snipe (Red-listed) was recorded in autumn and is expected to occur in winter.

The habitats within the Redline Boundary are suitable for foraging by hen harrier (while not recorded on site, could occur as one was observed in the adjoining fields), and merlin (one bird recorded on Site and could breed locally), both listed on Annex I of EU Birds Directive as amended. Kestrel (Red-listed) occurs regularly in the area (known breeding site approximately 250 m from Redline Boundary) and hunts within the Site. Sparrowhawk and buzzard have a regular presence in the area and use the area of the Site for hunting.

A range of Amber-listed species occur within the conifer plantations, including goldcrest, willow warbler and starling.

On the basis of providing breeding and foraging habitat for several bird species of conservation importance, the Site is rated as of Local Importance (higher value) for birds.

6.4 ASSESSMENT OF POTENTIAL EFFECTS

6.4.1 The 'Do-Nothing' Impact

Without the proposed wind farm development proceeding, it is expected that the present main land use on Site, namely afforestation, will continue, with future harvesting and replanting according to the forest cycle. The cutover bog on Site could be subject to future turbary.

Overall, the ecology of the Site would be expected to remain fairly similar as at present though some changes would be expected to occur with clear-felling and replanting.

6.4.2 Potential Impacts on European Conservation Sites

The NIS that accompanies this planning application has shown objectively that for five of the European sites identified within the zone of influence (**Figure 6.3**), there are no realistic Source-Pathway-Receptor linkages and hence there is no potential for effects on qualifying interests or Special Conservation Interests as a result of the proposed Development. These sites are:

- Tullaher Lough and Bog SAC (code 002165)
- Carrowmore Dunes SAC (code 002250)
- Carrowmore Point to Spanish Point and Islands SAC (code 001021)
- Kilkee Reefs SAC (code 002264)
- Mid-Clare Coast SPA (code 004182)

However, in the absence of mitigation, likely or possible significant effects could not be excluded during the construction, operational and/or decommissioning stages of the Project on the following sites:

- Lower River Shannon SAC (code 002165)
- River Shannon and River Fergus Estuaries SPA (code 004077)

Impacts of potential concern may arise as a result of contaminants originating within the project area, and especially during the construction phase, reaching the relevant designated site and causing harmful effects on the qualifying interests and/or the Special Conservation Interests of the designated site. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Mitigation is therefore required to minimise this risk.

Full details on the potential for adverse effects on these two European sites, and the required mitigation to prevent or minimise such effects, are given in the accompanying NIS.

6.4.3 Potential Impacts on National Conservation Sites

6.4.3.1 Natural Heritage Areas

As noted, a single Natural Heritage Area (NHA) occurs within the 15 km radius of the Site (see **Figure 6.4** and **Table 6.7**), namely Cragnashingaun Bogs NHA. This is approximately 14 km to the northeast of the Site and there are no ecological corridors or hydrological linkages with the Site.

It is concluded that the Development does not have the potential to impact on the interests of the Cragnashingun Bog NHA.

6.4.3.2 Proposed Natural Heritage Areas

A total of 12 proposed Natural Heritage Areas (pNHAs) occur within a 15 km radius of the Site (see **Figure 6.4** in Vol III and **Table 6.7**).

The Poulnasherry Bay pNHA, which receives drainage from the Site via the Moyasta River, is the site in closest proximity to the location for the Development. While the qualifying interests for this site are not stated, it is presumed that it is of ecological importance as an example of a shallow bay/estuarine system and in supporting important populations of wintering wetland birds.

In the absence of mitigation, impacts of potential concern may arise as a result of contaminants originating within the Site of the Development reaching the bay via the Moyasta River and causing potential harmful effects on the ecology of the bay. Of particular concern would be the effect of particles on infaunal species and particularly filter feeding invertebrates. Feeding and roosting bird species could be adversely affected by surface deposits, including hydrocarbons. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Mitigation is therefore required to minimise this risk. The issue of potential effects on the interests of Poulnasherry Bay pNHA, which is an integral part of the Shannon estuarine system, is assessed in the NIS.

A further five sites (Clonderalaw Bay, Scattery Island, Tarbert Bay, Ballylongford Bay, Beal Point) are located within or along the Shannon system, and could theoretically (in absence of mitigation) receive water with contaminants emanating from the Development Site. It is considered, however, that there is no realistic potential for the interests of these sites to be affected in any significant way as any contaminants entering the drainage network at the Site and subsequently the Shannon system would be completely attenuated by the dilution, dispersal and settlement that would occur within the Shannon estuarine system. Additionally, the CEMP presents a series of mitigation measures and a SWMP that when implemented will limit or prevent potential effects should contaminants enter local watercourses.

For the remaining listed pNHA sites, ecological or hydrological connectivity with the Site has not been identified.

6.4.4 Impacts on Habitats, Vegetation and Flora

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

- permanent loss of habitat
- temporary loss of habitat
- disturbance to habitats
- changes to existing habitats

In addition, some works will be required along part of the Turbine Delivery Route to facilitate large transport vehicles.

6.4.4.1 Permanent loss of habitat

The permanent loss of habitat to facilitate the construction of the project is estimated at 2.7 ha. This will result from the following:

- Turbines foundations and hardstand areas.
- Foundation for substation.
- Foundation for met mast.
- Wind farm road system including site access from local road.

The majority of the affected habitat, approximately 2.16 ha, is conifer plantation. As conifer plantation is a non-native habitat that is not classed as a key ecological receptor, the permanent loss of this habitat is rated as Not Significant.

The construction of turbine T4 will result in the permanent loss of 0.54 ha of cutover bog. Cutover bog is classed as a key ecological receptor and the area of open bog at this Site is rated as being of Local Importance (higher value). The loss represents 5.6% of the total area of open bog present and is rated as a Significant Adverse effect of Permanent duration. Mitigation for loss of cutover bog will be provided through a Biodiversity Enhancement and Management Plan (BEMP).

The site access from the main road will require the removal of a section of hedgerow of approximately 70 m in length. As noted, this hedge adjoins conifer plantation and is no longer managed as a field boundary. The loss of 70 m of hedge is rated as an Adverse effect of Slight Significance.

6.4.4.2 Temporary loss of habitat

There will be temporary loss of habitat to facilitate the construction of the Project. This largely occurs at the site of the borrow pit which is presently improved grassland. The spoil generated by construction works will be used to reinstate the borrow pit. This will then be capped with topsoil and reseeded for agricultural use. The impact by the temporary loss of improved grassland is Not Significant and on reinstatement the effect will be Neutral.

6.4.4.3 Disturbance to habitats

Areas adjoining the infrastructure will be disturbed by the construction works, including the need for construction of a drainage system, for the insertion of the electrical cabling including along the Grid Connection Route, and for temporary strengthening works along the L6132 component of the TDR.

Such disturbance alongside infrastructure within the conifer plantation is rated as Not Significant due to the low ecological importance of this habitat.

Disturbance to cutover bog will occur around the location of T4 and its hardstand and including a short stretch of Site access track. The extent of the zone of disturbance will vary, with both direct physical disturbance of bog and likely indirect drying effects on adjoining bog due to hydrological changes. Areas of bog that may become drier would be expected to support more vigorous growth of ling heather *Calluna vulgaris* and less development of bog mosses. This is rated as a Significant Adverse effect of Medium-term duration. Mitigation to minimise disturbance of cutover bog as a result of construction works will be implemented (see section 6.5.2.2).

Grid Connection Route (GCR)

The laying of the grid connection cable will cause localised disturbance to marginal vegetation alongside the roads due to trenching works and use of plant/machinery. The amount of disturbance would vary depending on the exact line of the trench but may affect grassy verges and roadside banks or ditches. However, hedging or trees are not expected to be removed to facilitate the works. Generally, there are no habitats of significant ecological interest alongside the GCR.

Overall, the disturbance caused to habitats as a result of the works associated with the grid connection is not considered a significant effect. After trenching and the works are completed, full recovery of the marginal vegetation is likely to take place within 1-2 years.

Turbine Delivery Route

Trees along a section of the Turbine Delivery Route, namely the local road (L6132) from the N68 to the site access, may need to be trimmed back to facilitate the large transport vehicles. This will be done outside of the bird breeding season and the effect is considered Not significant.

Some widening and strengthening of the road verges along this road will be necessary to support the abnormal load deliveries – as this will be within the public road verge only, which comprises grassy verges, and will not affect roadside ditches or hedging, the effect is considered Not significant.

At the three stream crossings along the L6132, steel beams are to be placed along the road resting against the existing carriage way and supported on the verge by sandbags. These steel plates will be placed on 10 metres each side of the water courses. The steel plates will only be in use for the duration of the turbine delivery (as outlined in **Appendix 16.2, Traffic Management Plan**) and will be removed directly afterwards leaving no significant effect on the surrounding area.

An area on the junction with the N68 will be upgraded to support the vehicles by the placement of a load bearing surface in part of the island – this is presently an area of grassland with some willow scrub and brambles (see **Plate 6.15**) and the effect by partial loss of habitat here is considered Not significant.

6.4.4.4 Changes to existing habitats

To facilitate the construction of the Project, there is a requirement to remove conifer trees alongside the infrastructure (turbine bases, hardstands, new roads etc.) to a distance of approximately 10 m. Such areas will not be replanted with conifers and it is expected that they will develop as a mosaic of cutover bog vegetation and scrub (willows, brambles etc). This more open habitat will be of some benefit to small mammals, birds and insects, and overall will be of more value to local biodiversity than the existing conifer plantation. The impact of this change in habitat is rated as a Positive effect of moderate significance.

Conifer plantation will be removed to facilitate the construction of a temporary spoil storage area (1.2 ha) near the site entrance and a temporary construction compound (0.129 ha). After use, these two areas will be levelled and allowed to regenerate naturally. It is likely that rushes and bramble will colonise at first and then scrub. The impact of this change in habitat is rated as a Positive effect of moderate significance.

Mitigation for bats requires that trees are removed from a minimum of 100 m around each turbine location and that the ground is maintained as a mowed sward or near bare (gravel) for the lifetime of the Development. Such habitat will be of minimum value to local wildlife. The impact by this change from conifer plantation is rated as Neutral, *i.e.* one habitat of low value replaced by another of low value.

The implementation of the Biodiversity Enhancement Management Plan will remove existing conifer plantation from an area of 3.4 ha so as to allow the regeneration of the underlying bog. The impact of this change in habitat is rated as a Positive effect of significance.

6.4.5 Potential Impacts on terrestrial mammals, amphibians and reptiles

The effect on terrestrial mammal species by the loss and disturbance of conifer plantation due to the proposed development is considered to be *Not Significant* on the basis that the species involved are all widespread species of the countryside which will still occur in the immediate area of the Site as well as in the wider environs. Species such as pine marten would still be expected to utilise the stands of forest plantation which will remain on Site (subject to commercial forest operations).

The local otter population associated with the Moyasta River, and the Shannon system could be affected adversely if contaminants generated during the construction phase, such as suspended solids, hydrocarbons and cementitious materials, were to enter the local watercourses and affect the prey items (fish etc.) of the otter. However, the feeding potential in the local streams is likely to be low as the Aquatic Ecology study (**Chapter 7**) notes that the local streams are not suitable for spawning salmonids or white-clawed crayfish. In the absence of mitigation, the effect on the otter population could be

Significant. Mitigation to maintain water quality during the construction and operational phases of the Development will minimise the risk to the otter population.

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

The common frog and common lizard populations would be affected by loss of cutover bog habitat during the construction works, though as the amount of habitat loss is relatively low viable breeding populations of these species are expected to remain elsewhere on Site. Mitigation will be implemented for the common frog to minimise direct impacts on spawn, tadpoles and adult frogs within the construction zone (see section 6.5.6). Mitigation will also be implemented for the common lizard. The significance of the effect on amphibian and reptile species within the Site is rated as Slight.

6.4.6 Potential impact on bats

6.4.6.1 Construction phase impacts

Wind energy developments present four potential risks to bats (NatureScot, 2021):

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

For each of these four risks, the detailed knowledge of bat distribution and activity within the study area gained during the current assessment is used to predict the potential effects of the Development on bats. Several bat species were noted within the proposed site, all of which are legally protected under the Irish Wildlife Acts 1976-2022 as amended and listed on the EU Habitats Directive.

While the Site mostly consists of commercial forestry, cutover bog and intensive agriculture with a general lack of roosting opportunities, there exists low productivity foraging habitat and suitable commuting habitat with good connectivity to surrounding habitats. Pasture based agriculture will continue in undeveloped areas of the site post-construction.

A total of 17.58 ha of forestry will be removed to facilitate construction of the wind farm and associated infrastructure including access roads, civil works, site compound, borrow pits and turbine hardstands (Veon Forestry, Ecology and Environment, 2023). The impact of this vegetation loss will be reduced foraging and commuting habitat for bats. Loss of such habitat function has the potential to disturb or displace bats that forage at the site or commute through it. The loss of linear features, i.e. hedgerows, to facilitate the construction of the site entrance will be approximately 70 m. While hedgerows and treelines are common features in the wider landscape, the loss of commuting habitats will potentially displace some bats in the immediate locality of works and marginally reduce habitat connectivity locally. It should be noted that in the context of wind farm development, it is preferrable to reduce habitat connectivity in the immediate locality of turbines to reduce the potential for collision and barotrauma to occur.

No bat roosts were confirmed within the site and surveys were characterised by moderate levels of activity. While it is considered that there is no potential for a significant bat roost to occur within the relevant distance of the proposed wind farm development (NatureScot, 2021), it is possible that individual bats or small numbers of bats may roost in trees or existing structures at least occasionally and mitigation measures will be applied to minimise the potential impacts on bats associated with construction related disturbance. No roosting features within trees capable of supporting significant numbers of bats or maternity colony were noted along the grid connection route. Neither trees with PRFs suitable for multiple bats (PRF-M) or trees suitable for small numbers of roosting bats (PRF-I) are located within areas proposed for tree trimming and thus the potential for impacts arising are limited. Similarly, considering the scale of the proposed works along the grid connection and turbine delivery route, impacts to both private and disused structures are limited. Trees proposed for removal within the windfarm site consist almost entirely of commercial forestry or stunted hardwood belts, with no specimen trees, that have a decreased probability of being used by roosting bats and thus do not require individual assessment (Marnell *et al.* 2022).

Construction phase lighting has the potential to attract certain bat species and displace others and floodlighting can be a significant source of disturbance to bat species. However, this impact will be temporary in nature and localized to areas around the site compound. Night-time lighting will be limited in extent (both static lighting, and vehicle headlights) as standard construction works will be carried out mostly during daylight hours.

Construction related run-off or degradation of aquatic habitats through hydrological links could potentially lead to a deterioration of the feeding resource for bats associated with watercourses within the site boundary and in the wider area. Assessment of potential water quality impacts is addressed elsewhere in the EIAR.

Considering the above, potential effects on bats are considered to be **'slight' permanent adverse** effects at a local level following EPA (2022).

6.4.6.2 Operational phase impacts

Habitat loss experienced during the construction phase (described above) will continue to persist through the operational phase. The operation of the wind farm at this site has the potential to result in disturbance to commuting and foraging bats. Bat activity at the site was variable with periods of moderate activity occurring for some high collision-risk species. Decreased connectivity resulting from removal of commuting features likely to be used by many bat species (e.g. hedgerows and treelines) will persist during the operational phase, but decreased connectivity to proposed turbine locations is desirable in terms of reducing risk of fatality or injury as a result of contact with rotating turbine blades. Collision risk is discussed further below.

6.4.6.2.1 Collision risk

There is little or no published evidence available on prevalence of bat fatalities at wind farms in an Irish context. Where fatalities have been monitored at wind farms in the USA, most losses have been related to periods of migration (www.nationalwind.org).

Both direct collision with turbine blades and barotrauma resulting from close contact with blades have been reported as an issue for bats at wind farms (e.g. Cryan *et al*. 2009). The susceptibility of bat species likely to be at risk of impacts from wind turbines is partly associated with the likelihood of different species flying at rotor blade height. In an Irish context, Leisler's bat is considered to have a somewhat greater mortality risk at wind farms than the other species recorded on (or adjacent to) the site as this species is a relatively large and high-flying species, and typically do not follow landscape features such as treelines or woodland edges when foraging.

6.4.6.3 Assessment of Collision Risk

A general assessment of vulnerability of bat populations to collision with wind turbines, based on best available scientific information, is provided below. This is adapted for use in an Irish context from the collision risk scheme provided in SNH (2019) and NatureScot (2021). NatureScot (2021) provides a generic assessment of bat collision risk for UK species, based on species behaviour and flight categorisation as well as evidence of casualty rates in the UK and Europe. This bat species collision risk assessment is considered to represent best available information for use in an Irish context.

This species collision risk categorisation is used in combination with relative abundance to indicate the potential vulnerability of bat populations. Relative abundance for Irish species was determined in accordance with a scheme for rarity of bat species provided in *Wray et al*. (2010) in combination with best available population data provided in recent Article 17 reports (NPWS, 2019). The limitations in terms of Irish bat population data are acknowledged in the latter report.

The collision risk estimation scheme for Irish bat species is presented in **Table 6.12** below.

Table 6.12: Scheme for estimation of Irish bat species' population vulnerability to wind energy development

Relative Abundance	Collision-Risk		
	Low	Medium	High
Common (100,000 plus)			Common Pipistrelle Soprano Pipistrelle
Rarer (10,000 – 100,000)	Daubenton's Bat Brown Long-eared Bat Lesser Horse-shoe Bat		Leisler's Bat
Rarest (under 10,000)	Natterer's Bat Whiskered Bat		Nathusius Pipistrelle

Population vulnerability: yellow = low, orange = medium, red = high.

In determining the project specific potential risk to bats, NatureScot (2021) recommends a two-stage process as follows:

- Stage 1: Indicatively assess potential site risk based on consideration of habitat present and development related features (i.e. number of turbines, size of turbines and proximity to other wind farms).
- Stage 2: Overall assessment of risk for high collision-risk species, considering bat activity results and the relative vulnerability of species.

Initially an assessment of the general site risk based on habitats present was carried out following the scheme presented in SNH (2019) and NatureScot (2021). A total of two PRF-M suitability tree roosts were recorded local to the proposed wind farm site, the closest of which is located approx. 2.6 km from the proposed redline boundary at the closest point. The site represents a low productivity foraging habitat which could be used by a small number of foraging bats. Although the site is relatively well connected to the surrounding landscape, it is assigned a habitat risk of 'Low' based on the quality of foraging habitat available and the general lack of roosting opportunities within the site.

Although the Development consists of ≤10 turbines (four-turbine project) it is considered 'Medium' as there is one proposed and three operational wind farms within 10 km of the proposed project. According to the project size categories in NatureScot (2021), turbines of height >100 m are included in the 'Large' project category. This height refers to the 'tip height' of the turbine (P. Taylor (NatureScot), pers. comm.). The maximum tip height of the turbines proposed for this development is 150 m, however given the number of turbines (significantly less than the threshold for a large site >40 no. turbines) it is considered that 'Medium' remains the appropriate project size category. Based on the above initial site risk assessment, the Project is considered to be 'Medium Risk' to bats and a site risk score of 2 is applicable.

The next stage of the process is applicable to 'high collision-risk' species only and utilises information on the activity level recorded on site in each monitoring period. This assessment is intended to identify projects which are of greatest concern in terms of bat collision risk. The following high collision-risk species have been recorded at the current site:

- Leisler's bat.
- Common pipistrelle.
- Soprano pipistrelle.
- Nathusius' pipistrelle.

Leisler's bats are considered to be a high-collision risk species due to their foraging ecology and flight characteristics. While Leisler's bat is rare in a European context, Ireland is a stronghold for the species. They are classified as 'Rarer' for the purposes of this assessment but the minimum population range for the species in Ireland is estimated at 63,000 to 113,000 (NPWS, 2019) and therefore the species may be 'Common'. Leisler's bats were recorded during activity surveys across the site. Overall activity levels for Leisler's bat in the context of the proposed wind farm are considered 'Low to Moderate' across all three survey seasons, see **Appendix 6.2**.

Common pipistrelle is a common and widespread species in Ireland which are considered to be a high-collision risk species due to their foraging ecology and flight characteristics. Common pipistrelles were the most commonly recorded species across the site. Overall activity levels for common pipistrelles in the context of the proposed wind farm are considered to vary between 'Moderate to High' in spring and summer and 'Low to Moderate' in autumn. High peaks in activity were noted in relation to common pipistrelle on individual nights for example, at Turbine 3 a peak of 557 registrations was recorded in the spring monitoring period and peak of 455 registrations on a single night during the summer monitoring period. Although peaks in activity are noted for this species on occasions, an average of 'Moderate to High' activity overall is considered to be appropriate.

Soprano pipistrelle are another common and widespread species in Ireland which are considered to be a high-collision risk species due to their foraging ecology and flight characteristics. Overall activity levels for soprano pipistrelles in the context of the proposed wind farm are considered to be 'Low' across all monitoring seasons, with the majority of registrations recorded at the proxy Turbine 3 monitoring location.

Nathusius' pipistrelle has a fast flight and is slightly less agile in flight than the other pipistrelle species and is positively associated with broadleaf woodland and areas where pasture is less extensive (Roche *et al*. 2014). This species is considered to be of high-collision risk due to their foraging ecology and flight characteristics. Nathusius' pipistrelle was only recorded once in Autumn 2023 during the entire survey period, yielding a 'Low' activity category for this season.

It is noted that proxy locations were used for the proposed Bat_01 and Bat_03 monitoring stations across all survey periods as the exact locations proposed were within commercial forestry and were not safely accessible at the time of surveys. A conservative approach was taken in relation to the selection of proxy locations. The Turbine 1 detector was placed approx. 25 m in from the edge of the commercial forestry, relatively proximal to the forest edge. Peaks in activity are noted for common pipistrelle and Leisler's bat at this proxy monitoring location, accounting for 13.38% and 47.47% of the total registrations recorded for these species' respectively. The Turbine 3 detector was placed at the forest edge, in optimal habitat locally. This monitoring station is likely to over-estimate activity which would be recorded at the base of the proposed turbine locations post-construction. For example, high peaks in activity were noted in relation to common pipistrelle at Turbine 3 across the survey period with a total of 1,786 common pipistrelle registrations recorded at this proxy location. Data from proxy locations was included in the overall assessment of collision risk.

Table 6.13: Overall collision risk assessment of relevant (high-risk) species.

	Species	Site Risk Level	Activity Category	Overall Assessment
Spring 2023	Common Pipistrelle	2	Moderate to High (4)	8
	Soprano Pipistrelle	2	Moderate (3)	6
	Leisler's Bat	2	Moderate (3)	6
Summer 2023	Common Pipistrelle	2	Moderate to High (4)	8
	Soprano Pipistrelle	2	Low to Moderate (2)	4
	Leisler's Bat	2	Low to Moderate (2)	4
Autumn 2023	Common Pipistrelle	2	Low to Moderate (2)	4
	Soprano Pipistrelle	2	Low to Moderate (2)	4
	Leisler's Bat	2	Low to Moderate (2)	4
	Nathusius' Pipistrelle	2	Low (1)	2

Overall collision risk assessment: Low (green), medium (amber), high (red) (following SNH, 2019).

While activity levels of the above species varied between survey locations (corresponding to proposed turbine locations) it is not possible to determine with any accuracy the different levels of collision risk presented by individual turbines (NatureScot, 2021).

As per NatureScot (2021) there is no requirement to complete an Overall Risk Assessment for low-risk species. The low-risk species that were recorded were brown long-eared bat, Natterer's bat, whiskered bat, Daubenton's bat and lesser horseshoe bat. Overall activity levels were generally 'Low' for the above species and by virtue of their low potential vulnerability to wind energy developments, no significant collision related risk is likely.

No additional loss of foraging and commuting habitat, relative to that discussed above in relation to the construction phase, will occur during the operational phase. No other significant impacts are likely to occur on bats during the operations phase of the Project.

Overall, the Project in its operational phase is likely to have a **'slight' permanent adverse effect** on bats at a local level (following EPA, 2022).

6.4.7 Impacts on birds.

For birds, the following predicted or potential impacts are considered:

- Loss of habitats.
- Potential disturbance to birds during construction.

- Potential displacement of birds during operation.
- Potential effects from noise during operation.
- Potential barrier effect by presence of turbines.
- Predicted collision risk to birds.
- Potential effects on birds in hinterland.

6.4.7.1 *Loss of habitats*

The permanent loss of habitat to facilitate the construction of the proposed Development is approximately 3.93 ha.

The majority of habitat loss is conifer plantation. While some bird species of conservation importance are associated with conifer plantation, such as goldcrest and willow warbler (both Amber-listed) but also merlin, hen harrier (latter mainly open canopy phase) and kestrel (often hunts along forest edge), none is dependent on this (non-native) habitat for breeding and/or wintering requirements. All of these species would be expected to continue to utilise the remaining area of plantation within the Site after the wind farm is constructed. Also, it is noted that conifer plantation is a widespread habitat in the local area and throughout County Clare. On the basis that a relatively small amount of conifer plantation is being lost, and that the bird species associated with this habitat will still retain a presence on Site, the effect on birds due to the loss of conifer habitat to facilitate the Project is considered Not Significant.

The construction of turbine T4 will result in the loss of 0.54 ha of cutover bog. The cutover bog at this Site supports breeding meadow pipit (Red-listed) and skylark (Amber-listed), as well as wintering snipe (Red-listed). While the loss will reduce the area of open bog on site by 5.6%, all these species will continue to occur within the Site. The effect on birds due to the loss of cutover bog to facilitate the proposed Development is considered an Adverse effect of Slight significance and Permanent duration. It is noted that the loss of cutover bog will be off-set through the provision of a Biodiversity Enhancement and Management Plan (see **Appendix 6.6**), which will restore 3.4 ha of planted bog – this area is expected to provide suitable habitat for peatland species such as meadow pipit and snipe.

While there appears to be no published reports in Ireland on post-construction monitoring of bird populations at wind farms, observations from a range of wind farms throughout the island of Ireland by the author of this report (Dr Brian Madden) indicate that passerine bird species, such as meadow pipit and skylark, are generally present in operational wind farm sites (where suitable habitat exists) and show no displacement effect due to the presence of the turbines. This is in line with published accounts which note that passerine species are generally not affected by wind farm development (see SNH Guidance 2017).

Birds of prey, including kestrel, are also regularly observed in wind farm sites and their presence may lead to risk of collision with turbines and possibly the need for mitigation (as discussed in section 6.5.7.2 "Mitigation for birds during operational phase" of EIAR).

While wind farm development results in the loss of some habitat for birds and in localised disturbance of habitats at sites, it is considered that, with mitigation where required, this is not likely to result in significant declines in any bird species at the proposed Development site due to:

(i) the relatively small scale of the habitat loss,

(ii) the additional habitat that will be supplied through the Biodiversity Enhancement and Management Plan,

(iii) the fact that the area around the wind farm infrastructure still provides similar habitats for bird species that were present on-site pre-construction.

6.4.7.2 Disturbance to birds during construction

The construction phase for the Project is anticipated to last approximately 20 - 28 weeks. In this period, on-site activities, including tree felling, civil works and turbine erection works, may have potential to cause disturbance effects on birds in areas adjoining the works.

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.

It is noted that passerine species, such as meadow pipit and skylark, are not perceived as being prone to disturbance by wind farm construction (SNH 2017) and indeed Pearce Higgins *et al*. (2012) found that densities of skylarks and stonechats increased on wind farms during construction.

During the baseline surveys carried out from 2020 to 2022, there was no evidence that any of the identified target species (as listed in **Table 6.13**), which could be perceived as sensitive to construction disturbance, have breeding populations within the Site.

As it is noted that potentially suitable breeding habitat occurs within or around the site for a number of species which have a presence in the area (as shown by the baseline surveys), namely buzzard, sparrowhawk, kestrel, merlin and snipe, focused pre-construction surveys will be undertaken for these species to establish if the breeding status has changed by the time of construction (see **section 6.8.5**).

Should pre-construction surveys indicate a requirement for protection from construction-related disturbance of any relevant species, appropriate measures (as described in **section 6.5.8.1**) will be taken to comply with all relevant legislation and best practice guidance available at the time.

The baseline surveys carried out from 2020 to 2022 did not indicate that any target species which were selected mainly for potential wintering presence, namely hen harrier and whooper swan, have populations within a distance of at least 2 km of the Site.

6.4.7.3 Displacement of birds during operation

Displacement of birds from otherwise suitable habitat as a result of the presence of wind turbines has been reported as an impact of wind turbines (Drewitt & Langston 2006, de Lucas *et al*. 2007, Pearce-Higgins *et al*. 2009). The displacement occurs as a result of behavioural responses that prevent or decrease the use of an area for activities such as nesting, foraging or roosting. However, the results of studies on potential displacement have varied widely. 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. It is noted that passerine species, including species such as meadow pipit, are not perceived as being prone to displacement as a result of the presence of wind turbines (SNH 2017).

Consideration of potential for displacement is given for the following target species which were recorded within the study area:

Sparrowhawk

The baseline surveys showed that sparrowhawk is regular at the Site, with breeding likely to occur in the local area.

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

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

Buzzard

The baseline surveys showed that buzzard is regular at the Site, with breeding likely to occur in the local area.

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 Ballykett, it is expected that the species could show some signs of displacement around the turbines at the 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. Significance of potential effect is rated as Slight and of short- to medium-term duration.

Merlin

While there was no evidence of merlin breeding in the study area, there was one on-site record, and it is likely that the species may pass through the Site on an occasional basis.

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

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

Kestrel

Kestrel was recorded regularly during the baseline surveys, with breeding known to occur in the local area (c.250 m from Redline Boundary in summer 2021). The baseline data show that the species uses the survey area for hunting purposes.

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

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

Hen harrier

While the nearest known breeding area for hen harrier is over 9 km from the Development site, birds possibly from that area may at times forage within the Site (as shown by one record to the east of Site in April 2021). From the baseline data it can be concluded that Hen Harrier is an occasional visitor at the 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. They note that results at Argyll and Northern Ireland sites suggest that foraging may be little affected but local displacement of nesting attempts may occur in the order of 200-300 m around turbines. 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, it is expected that birds would still pass through the area when the turbines are in operation and that the potential for disturbance to foraging birds is low – this effect is rated as Not Significant.

Snipe

The baseline surveys showed that snipe is a winter visitor to the Site and the surrounding wet grassland areas.

While there is evidence to show that breeding snipe may avoid suitable habitat around turbines, it is considered unlikely that the presence of the wind farm Development 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.

The significance of the potential displacement effect on wintering birds is rated as Imperceptible or Not significant.

6.4.7.4 Potential effect of noise on birds during operation

Many animal species rely on acoustic signals to communicate messages, which are critical to survival. However, noise from anthropogenic sources, such as traffic, industrial and commercial facilities, or wind farms, could impede the transmission of these signals. Birds in particular depend on acoustic signals and the masking effect of anthropogenic noise could have direct fitness consequences. Zwart *et al*. (2016) investigated whether wind turbine noise affects territory defence in the European robin. The study showed that robins increase low-frequency song elements in response to territorial intrusion under quiet conditions but that this response did not occur in the presence of wind turbine noise. Thus, anthropogenic noise may affect the ability to deter an intruder, leading to expenditure of extra time and energy and possibly reducing breeding success. Scholl and Nopp-Mayr (2021) undertook a major literature review of the impact of wind power plants on mammalian and avian wildlife species in shrub and woodlands. The study found that passerine density in areas near noise generating energy facilities, such as wind farms, is lower than density near noiseless energy facilities.

From these studies, it can be concluded that effects of noise from wind turbines may adversely affect behaviour of bird species, especially passerines, and ultimately breeding success, in a similar way as the effects of background noise from traffic, industry, urban areas etc.

At the Site, there is already a background level of noise, including local traffic and farming activities. While the literature suggests that the behaviour of passerine species using habitats in proximity to turbines may be affected by noise from turbines, which could result in declines in the densities of species, the significance of this effect is likely to be, at most, Slight.

6.4.7.5 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.

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

6.4.7.6 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 area are most at risk. It is generally considered that passerine species are less susceptible to collision with turbines than non-passerine species and especially waterfowl and raptor species (SNH 2017).

Collision Risk Modelling (CRM) is a method to estimate the number of birds likely to collide with turbines at the Site. This method uses vantage point data to calculate the risk of collision. In this case, the vantage point data collected over the two years 2019-2021 (two breeding seasons and two winter seasons) at the Site were used. Two stages are involved in the model:

> **Stage 1**: Vantage point observations of birds flying within the study area are used to calculate the number of birds likely to fly through areas swept by the proposed turbine blades.
>
> **Stage 2**: Calculation of the probability of a bird strike occurring.

Full details of the collision risk modelling method and results are given in the **Appendix 6.5**. Summary details of the key species recorded which may be sensitive to collision risk are given in **Table 6.14.**

Table 6.14: Summary of estimated number of collisions for key ornithological receptors over the lifetime of the project.

Species	Estimated Collisions over the Lifetime of Wind Farm	Estimated Collisions per Year	One Bird Collision every 'x' years
Hen harrier	0.005 birds	0.00017	>1,000 years
Sparrowhawk	0.153 birds	0.0051	196 years
Buzzard	1.545 birds	0.0515	19.4 years
Kestrel	1.68 birds	0.0559	17.9 years
Merlin	0.04 birds	0.0013	752 years
Lesser black-back gull	0.146 birds	0.0049	204 years
Herring gull	0.147 birds	0.0049	204 years

For all species, the annual number of collisions predicted to occur is considerably less than one bird per year, with the rate for hen harrier and merlin exceptionally low.

Only two of the species analysed, kestrel and buzzard, have a collision risk of more than one bird over the entire lifetime of the project. These two species, which showed regular activity in the vicinity of the Development, are considered further. For all the other species, the significance of collision risk is rated as Imperceptible and insignificant.

Kestrel

For kestrel, the collision risk modelling has calculated a rate of 1.68 collisions over the lifetime of the Development (i.e., 35 years) or 0.056 casualties per year. These rates are negligible in the context of the estimated national population of 13,500 birds (Lewis *et al.* 2019). However, it is noted that kestrel, as well as lesser kestrel (*Falco naumanni*) and American kestrel (*Falco sparverius*), is a genus that is prone to collision (see for instance Barrios & Redrigues 2004, Hotker *et al*. 2006, Hotker 2008, Lucas *et al*. 2008, Marques *et al.* 2014, Diffendorfer *et al*. 2021). This is expected to be due to the hovering behaviour of the species. While birds are hunting and focusing on ground prey, they may be unaware of the turbine position or may suddenly change their position due to a gust of wind. The hovering height level is often within the rotor sweep of the turbines.

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

Buzzard

For buzzard, the collision risk modelling has calculated a rate of 1.55 collisions over the lifetime of the Development or 0.052 casualties per year. While the size of the bird and its tendency to fly relatively low and within the potential collision risk zone makes buzzard prone to collision, the favourable conservation status of this species (Green-listed) limits the potential for ecologically significant effects to result. However, on a precautionary basis, the significance of collision risk is rated as a Long-term Slight Adverse effect.

6.1.1.1 Potential effects on birds in hinterland

The hinterland surveys to a distance of approximately 5 km from the location for the Development did not identify any areas of habitat of particular importance for supporting concentrations of bird species of conservation importance. While species such as sparrowhawk, kestrel, and peregrine were observed at various locations in the hinterland area, the presence of the proposed Development would not be expected to have any effects on these or other species.

Wetland sites within the wider hinterland area were also surveyed, as follows:

- Moyasta Creek 5.5 km westwards of proposed site for the wind farm
- Farrihy Lough 11 km northwest of proposed site for the wind farm
- Tullaher Lough 7 km northwest of proposed site for the wind farm
- Tullabrack Lough c.1 km north of proposed site for the wind farm
- Poulnasherry Bay 6 km westwards of proposed site for the wind farm

While the surveys confirmed the presence of various bird species of conservation importance at these sites (see **section 6.3.6.2.5**), the site for the Development does not have suitable habitats to support any of the bird species associated with the hinterland sites.

It is also noted that apart from golden plover (1 record) and gull species, none of the wetland bird species associated with the hinterland site, including whooper swan and Greenland white-fronted goose, were recorded flying over the site area, *i.e.* there is no evidence of flight corridors used by the bird species over the Site. For golden plover, herring gull and lesser black-backed gull, the operation of the Development does not pose a significant risk of collision.

Based on the above evidence, it is concluded that the construction and/or operation of the proposed Development is not likely to have significant effects on any of bird species associated with the identified hinterland sites of importance.

6.4.8 Decommissioning Phase Impacts

Decommissioning of the Project will result in the cessation of renewable energy generation at the end of the operational life of the Development with the removal of various infrastructural elements.

All Site access tracks and Turbine Hardstand areas forming part of a Site access track network which are required by wind farm operation and maintenance staff for ongoing agricultural and forestry operations will be left in situ for future use.

It is intended that all above ground components and underground cabling (ducting left in-situ) will be removed from the Site as part of the decommissioning of the Project. The approach proposed for decommissioning is one of minimal intervention.

The following elements are included in the decommissioning phase:

- Decommissioning works will be limited to removal of the proposed Development structures, *i.e.* removal of turbines, Electrical Substation, cabling and the meteorological monitoring mast.
- Site access tracks and associated drainage systems will remain in place to serve ongoing forestry and agriculture activity.
- Hardstanding areas will be allowed to revegetate naturally.
- Turbine plinths will be removed, and the hardcore surface area covering turbine foundations will be allowed to revegetate naturally.
- Soil disturbance will be avoided.
- Importing soil is not a preferred option. If this is to be considered, it will be as a last resort only. If it is nonetheless considered necessary to import soil, it will be peat soil. Mineral soil will not be brought into the Site. Any decision to import peat soil will need to carefully balance any benefits of doing so against the ecological and hydrological impacts of excavating it elsewhere.

A Decommissioning and Restoration Plan has been prepared as part of the planning application for the Development (see CEMP, **Appendix 2.1**). The key targets of the Plan are as follows:

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

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

- disturbance to the cutover bog at T4 location,
- disturbance to breeding birds and protected mammal species which may be on Site at the time
- potential pollution of local waterways and ultimately Poulnasherry Bay and the Shannon system
- creation of new habitats on Site

6.4.8.1 Disturbance of cutover bog

The unplanted cutover bog on Site is of significant local ecological importance and any disturbance to the bog during the works to dismantle turbine no. 4 would be an adverse impact of potential significance. The Decommissioning and Restoration Plan has a target of minimal impact on the natural environment and it is not anticipated that personnel will need to traverse out onto the bog surface for any reason. The Plan also highlights a target of providing training on sensitive receptors on Site to all involved personnel.

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

6.4.8.2 *Disturbance of breeding birds and other fauna* species

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

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

With the above approach followed, it is not likely that the decommissioning works will cause significance disturbance to fauna species associated with the Site.

6.4.8.3 *Maintenance of water quality*

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

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

On this basis, it is likely that the Decommissioning works will not result in adverse impacts on local watercourses and in turn the River Shannon system (SAC & SPA).

6.4.8.4 *Creation of new habitat*

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

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

6.4.9 Potential Impacts from Invasive Species

One Third Schedule listed invasive species was recorded within the project area (see **section 6.3.3.8**) - this was a stand of Japanese knotweed *Fallopia japonica* along the channel of the Brisla East Stream to the south side of the L6132 (route of turbine delivery). Another species, *Gunnera* spp., while not recorded in baseline surveys is known from within a 1 km distance of the Site.

The proposed development is not likely to have any effects on the location of the Japanese knotweed for the following reasons:

- the location of the plant is several metres upstream of the road edge.
- the proposed verge strengthening works required here merely involve the placement of a steel plate along the verge for 10 m each side of watercourse crossing to avoid excavation and disturbance of the existing ground. The steel plate will be removed from the verge when the deliveries are complete. There will be no instream or bankside works along the stream.

As more than two years are expected to have passed from the time of the baseline surveys and the commencement of works (subject to planning permission), pre-construction surveys will be carried out to check for the further spread of Japanese knotweed and any other invasive species within the study area.

6.4.10 Cumulative Impacts

There are 16 operational, consented, and proposed wind farms within 20 km of the proposed Development (details are given in **Table 2.1** and **Figure 2.1** of Chapter 2). The nearest operational wind farms are Moanmore Wind Farm (7 turbines), which is located approximately 1.31 km to the northwest of the Site, the Tullabrack Wind Farm (6 turbines), which is located approximately 1.52 km west of the Site, and the operational Moneypoint Wind Farm (5 turbines) located approximately 5.47 km to the south of the Site. The remaining 13 projects are located at distances varying from 11.57 km to 18.08 km from the Site.

Some of these projects are at least partly located on blanket bog and wet heath, such as Booltiagh, or cutover raised bog, such as Tullabrack. Other habitats within the various wind farm sites include wet grassland, improved or semi-improved grassland and conifer plantation. While the Development in absence of mitigation would contribute (by an estimated 0.54 ha) to a cumulative loss of cutover raised bog in the region, with the successful implementation of the Biodiversity Enhancement and Management Plan there will be a net gain of 2.86 ha of cutover raised bog. The proposed Development also would contribute to a cumulative loss of conifer plantation, but this is not considered a significant effect as conifer plantation is a commercial non-native habitat.

Other developments or proposed developments (larger than one-off houses) within 10 km of the proposed Development are listed in **Table 2.2** of **Chapter 2**. These include agricultural facilities, a solar energy development, refurbishment of the existing Moneypoint – Oldstreet 400kV overhead line, a wastewater treatment works, amenity facilities (9-hole pitch and putt course) and an apartment development. All of these projects have been rigorously assessed for environmental and ecological effects and where such effects are identified, mitigation has been incorporated into the planning. It is noted that projects such as solar farms and pitch and putt courses continue to support a range of habitats and native flora and fauna species. As the Project, with mitigation in place, will not be likely to result in any significant effect on terrestrial ecological interests at the Site or in the wider area, it will not contribute to any possible cumulative impact when considered with the various other projects within a 10 km radius.

The surveys undertaken for the Aquatic Ecology study (**Chapter 7**) have shown that the local watercourses currently have Moderate to Poor water quality and considers that current forestry and agricultural activities are having negative effects on water quality within the catchment. With respect to hydrology, the Development, with mitigation in place (as detailed **in Chapter 9 Hydrology and Hydrogeology**), is not considered likely to significantly contribute to such cumulative effects in terms of water quality.

6.5 MITIGATION MEASURES

6.5.1 Designated sites

This report has identified likely pathways between the Project and two European sites and one proposed Natural Heritage Area. The pathways are via the local drainage system, particularly the Moyasta River.

In the absence of mitigation, there is a risk that contaminants generated on Site during the construction phase could enter local watercourses and ultimately flow to the designated sites where there could be adverse effects on water quality, aquatic life and relevant qualifying interests within the sites. Mitigation is therefore required to minimise this risk.

The mitigation proposed to maintain water quality in the drainage channels and watercourses which drain the Site are detailed in **Chapter 9. Hydrology and Hydrogeology**. The implementation of mitigation through avoidance principles, pollution control measures, surface water drainage measures and other preventative measures have been incorporated into the project design in order to minimise potential significant adverse impacts on water quality at the Site. A 50 m buffer zone around watercourses will be implemented at the Site which will largely result in the avoidance of sensitive hydrological features. Direct discharges to surface waters of dewatered loads will not be permitted under any circumstances. This in turn will avoid or reduce the potential for adverse impacts on downstream designated sites.

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

The CEMP requires the contractor to appoint an Ecological Clerk of Works (ECoW), with experience in overseeing wind farm construction projects, for the duration of the construction phase. The ECoW will have responsibility for ensuring the CEMP is implemented and have oversight for compliance with all planning conditions relating to ecology.

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

6.5.2 Habitats

6.5.2.1 Mitigation for habitat loss

The Project will result in the permanent loss of an estimated 2.7 ha of habitat on Site. The majority of this comprises conifer plantation, which is not of conservation value and is not rated as a key ecological receptor. However, the loss of 0.54 ha of cutover bog as a result of the construction of T4 is a Significant effect; it will be offset through a Biodiversity Enhancement and Management Plan (see **Appendix 6.6** BEMP). The primary objective is to rehabilitate an area of cutover bog which had been planted with conifers although over much of the area the trees have grown poorly. The total area of the BEMP is 3.4 ha, which will provide a net gain in the area of unplanted cutover bog at this Site and enhance the biodiversity of the Site.

6.5.2.2 Mitigation to minimise disturbance of cutover bog.

Inevitably the construction works will cause disturbance to cutover bog habitat around the turbine and hardstand for the T4 turbine, as an area will be needed by the Contractor to facilitate the works. To minimise disturbance to the bog and to ensure good recovery, as well as to minimise areas of bare peat which would be prone to erosion, a programme of ongoing monitoring and rehabilitation will be followed during construction phase.

Restricted access to cutover bog

At the commencement of works at the T4 location, the required work footprint on the bog will be identified and the area will be marked by a rope fence (using range poles or similar) and with appropriate signage. No activities will be allowed outside of this agreed work area. The ECoW will inspect the area regularly whilst works are on-going at T4. Excavated peat and other material will be removed to the approved storage area with no storage of spoil or materials on unplanted bog or in areas immediately adjoining the bog. The fence will remain in place until the works are fully complete.

Re-vegetation of bare surfaces

The BEMP (**Appendix 6.6**) has an ecological objective to minimise the area of exposed peat surface and to encourage revegetation. This will be achieved by removing suitable areas of the vegetated cutover bog surface (cut out as sods or 'turves') within the work footprint at T4. This material will be stored appropriately on-site and reused to re-instate areas around the turbine and hardstand margins. It is noted that wet areas of the bog surface (such as along old drains) and/or undulating areas at old peat banks are unlikely to be suitable for the removal of peat turves.

The surface turves of vegetated bog will be dug out to a minimum depth of 30 cm using a dumper/digger with a bucket. Care will be taken to keep the turve as intact as possible and the vegetated side upwards (though this is not always possible). The turves will be loaded to a trailer and transported to a pre-identified storage area. The storage area will be located in an area of Site (not unplanted bog) where disturbance during the storage period will not occur. The turves will be off-loaded from the trailer and placed side by side and vegetation side upwards. They will be placed in single layers, *i.e.* not piled on top of each other. Should storage be for prolonged periods (months), the turves may need to be watered during dry spells. When ready for placement at the finished turbine/hardstand, they will be lifted with a dumper and bucket and taken to the destination. Here they will be off-loaded, placed side by side on the disturbed bog surface with vegetation side up. The turves will be bedded in with the bucket of a dumper so that they form a continuous layer without gaps between them. This approach will provide almost immediate cover of the bare surfaces. All of the above will be monitored by the ECoW.

6.5.3 Mitigation for Badgers

Whilst no signs of badger presence were found during the baseline survey in 2022, badger does occur in the wider area and distribution of local populations can change over time. Should more than 36 months have elapsed since the baseline surveys in 2022-23, a pre-construction confirmatory survey will be undertaken in accordance with NRA Guidance (2006). This will focus on the areas of the site where works will take place.

Should an active sett be located within a 50 m distance of the works area, mitigation would be necessary to ensure that the sett is closed prior to the commencement of any works on-site. This procedure would be carried out in strict accordance with relevant legislation.

6.5.4 Otter

Otter was recorded using the section of the Moyasta River which skirts the north-east boundary of the Site. While the baseline survey did not record any dwellings (holts) or regular usage of the banks of the river, a pre-construction survey will be carried out in the area where the new river crossing will be constructed (within at least a 150 distance either side) should more than 36 months have elapsed since the baseline 2022 survey (NRA

2008). Should an active holt be located (which is unlikely as the area is within conifer plantation) in the immediate area of the proposed works, measures may need to be taken to evacuate the animals from the holt to ensure that there is no disturbance to breeding animals ensuring all the necessary consents are in place.

The mitigation proposed to maintain water quality in the aquatic zones (as detailed in **Chapter 9: Hydrology and Hydrogeology**, and summarised in **Appendix 2.1: CEMP**) will ensure that the food supplies for otters within local watercourses are not affected by contaminants generated by the Development.

6.5.5 Common frog and common lizard

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

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

6.5.6 Bats

6.5.6.1 Construction phase mitigation

6.5.6.1.1 Tree and hedgerow clearance

Some sections of hedgerow (WL1) and mature treeline (WL2) habitat removal is required to accommodate the development of the new site access tracks and buffer areas for bats. Also, NatureScot (2021) recommends a minimum 50 m buffer from the blade tip to the nearest key habitat features (e.g. woodland, hedgerow etc.) to be implemented to avoid encouraging bat activity within the 'blade-swept' area. These areas will be maintained vegetation-free during the operational life of the development. A methodology for determining the clearance area at ground level is presented in NatureScot (2021). The clearance area surrounding each individual turbine was calculated using the formula presented below.

Calculate the distance between the edge of the feature and the centre of the tower (b) using the formula:

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

where:

bl = blade length,

hh = hub height,

fh = feature height (all in metres).

For the example shown,

b = 69.3 m.

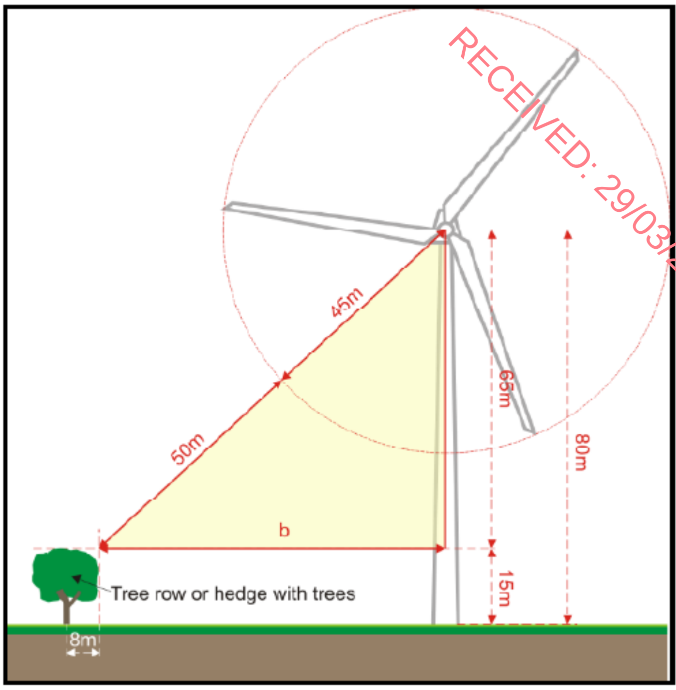

Illustration © Entec Ltd.

Figure 6.7 Methodology for determining the clearance area at ground level (NatureScot, 2021).

According to the Forestry Report (Veon Forestry, Ecology and Environment, 2023) the coniferous plantation within the proposed site is of poor quality with a maximum height of 10-12 m. However, for the purposes of calculation of buffer distance a more conservative height at harvest of 20 meters was chosen as the feature height (*fh*) of forestry surrounding each relevant turbine. Turbine 4 is located within a cutover bog without significant landscape features and no clearance buffer is required for this turbine. This estimated value was input into a formula alongside the associated turbine specifications to determine the minimum clearance buffers. Using this information, a minimum recommended clearance distance of 100 m from the center of the tower of was calculated.

A comprehensive survey effort was carried out in relation to potential roost features in structures following Collins (2023), see **Appendix 6.2.** Disused structures of low to high suitability for roosting bats were identified along the grid connection and turbine delivery route. No evidence of historic or contemporary roosting was identified at the time of the surveys. Additionally, private residential dwellings are located along the GCR and the relevant section of the TDR, which were not surveyed as part of this assessment.

Considering the scale and extent of the proposed facilitation works along the GCR and TDR, it is not likely that these structures will be significantly affected by the construction phase impacts and thus no mitigation measures are considered.

Construction operations will take place during the hours of daylight in as far as possible to minimise disturbances to bats and other wildlife. It is recognised that key works such as turbine delivery and turbine erection may require night-time working. Two 17 m high lightning monopole protection masts are proposed at the control building and a warning light will be fixed to two of the turbines. Otherwise, only motion sensitive lighting will be used.

6.5.6.1.2 Derogation licence

A derogation licence is required where disturbance to a bat roost is likely to occur (Marnell et al., 2022). Based on current information, a derogation licence issued under Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 is not required to facilitate the proposed works.

6.5.6.2 Operation phase mitigation

A 'High' level of overall collision risk has not been identified for any bat species in any of the bat activity seasons. Based on best available information, a 'Medium' overall collision risk level has been identified in relation to high-collision-risk bat species, across all three activity seasons, with the exception of a 'Low' risk for Nathusius' pipistrelle in the autumn period. The limitations of the assessment procedure and knowledge gaps in relation to bats and windfarms are acknowledged, particularly in an Irish context.

In addition to the creation of buffers between the proposed turbines and surrounding vegetation (discussed above) reduced rotation speeds will be implemented when turbines are idling. 'Feathering' of idling blades may reduce fatality rates by up to 50% and does not result in loss of output (NatureScot, 2021). No additional control measures to avoid/reduce collision related bat fatalities are considered warranted for this project.

NatureScot (2021) recommends post construction monitoring is carried out for three years post construction, but not necessarily consecutive years. Post-construction monitoring aims to assess changes in bat activity patterns (e.g. in response to landscape changes such as land management and forestry rotation) and the efficacy of mitigation to inform any changes which may be required to curtailment strategy. Post-construction fatality monitoring and activity surveys will be carried out in years 1, 2, 3, 5 and 10 post-construction. Post-construction monitoring will consist of:

- Passive bat monitoring at all turbine locations in order to monitor changes in activity levels relative to pre-construction baseline information (presented herein).
- Fatality monitoring following the methodology presented in Appendix 4 of NatureScot (2021) or subsequent updates.

Post-construction monitoring data will be analysed and presented in report format to the planning authority. Recommendations will be made in relation to curtailment strategy if required.

There will be 10 no. bat boxes erected at suitable locations, in consultation with a bat-licensed Ecologist. 'Woodcrete' bat boxes will be used as they are durable and long-lasting and do not require maintenance. A mixture of bat box types should be used to cater for seasonal and species requirements. The following products (or similar) are suitable:

- Schwegler 1FS Colony Bat Box 95
- Schwegler 2F Universal Bat Box
- Schwegler 2FN Bat Box 55

Bat boxes will be installed on suitably large trees or specially installed poles. Boxes will be installed at a minimum height of 4 meters above ground level, at suitable aspects (not northern) and in locations which are inaccessible to unaided climbing (to minimise the risk of validation) and not vulnerable to artificial light or noise pollution. Monitoring of proposed bat boxes will be carried out by a bat-licensed Ecologist, and relocation of any boxes with no evidence of use in the first year after construction.

All permanent lighting systems will be designed in accordance with ILP (2023)[5] in order to minimise nuisance through light spillage. All non-essential lighting will be switched off during the hours of darkness. No artificial lighting will illuminate any trees or structures with potential to be used by roosting bats to prevent disturbance to bats roosting within upon emergence and re-entry. To reduce the ecological disturbance from artificial lighting, the following guidance is recommended:

- Reduce non-essential external night lighting.
- Lower the angle of external night lighting.
- Use of LEDs, as these emit minimal ultra-violet light.

[5] https://theilp.org.uk/publication/guidance-note-8-bats-and-artificial-lighting/ [Last accessed on: 23/01/2024]

- White and blue wavelengths should be avoided; wavelength will be <2,700 kelvin.
- Lights should peak higher than 550 nm.

6.5.6.3 Grid connection route mitigation for bats

No trees of PRF-M suitability were recorded along the grid connection route. Additionally, no tree clearance or tree trimming works are proposed, only hedge trimming. Thus, no further inspection of these PRF-I trees is warranted (Collins 2023).

6.5.6.4 Turbine Delivery Route Mitigation for Bats

Enabling works along the proposed TDR will not result in the loss of existing roadside trees. No trees with moderate (PRF_M) suitability for roosting bats were located in areas where trimming is proposed to facilitate component delivery. As a result, there will be no direct impact on any such feature. There is some minor potential for trimming works to have an indirect impact on PRF-M trees, during hedge trimming works. Although there was no evidence of current or historic roosting by bats at the time of survey, these features will be resurveyed immediately in advance of proposed works at height or by means of emergence survey in, in order to determine if roosting occurs at that time. Surveys will be carried out according to Collins (2023). If required, a derogation license will be secured in advance of any tree-felling works, and appropriate mitigation measures will be put in place to avoid or reduce impacts on bats.

6.5.6.5 Decommissioning phase mitigation for bats

The potential for impacts during decommissioning are similar to those assessed for the Construction Phase. All decommissioning works will be governed by the same requirements to control run-off or potential pollution to watercourses (feeding resources for bats), as have been implemented during the construction phase. The compound will need to conform to the construction phase mitigation measures including those related to lighting design. Decommissioning phase works will include the re-establishment of woodland and linear features removed during the construction phase.

6.5.7 Birds

6.5.7.1 Mitigation for birds during construction phase

6.5.7.1.1 Mitigation for loss of habitat

This assessment has identified loss of cutover bog habitat (0.54 ha) as an adverse effect of slight significance for breeding birds (mainly meadow pipit & skylark). Mitigation is provided by the Biodiversity Enhancement and Management Plan, (**see Appendix 6.6**).

Briefly, this will rehabilitate an area of 3.4 ha of cutover bog which had been planted with commercial forestry.

The plan area adjoins the existing unplanted bog which remains within the Site. It is likely that passerine species such as meadow pipit would readily nest within the rehabilitated bog (as this Red-listed species breeds widely within open canopy forest on bog), and the plot would be expected to provide suitable habitat for hunting kestrel. As the rehabilitated bog becomes wetter, wintering snipe are likely to utilise the area.

6.5.7.1.2 Mitigation to minimise disturbance to sensitive breeding species.

While the baseline surveys carried out in the period 2020 to 2022 did not record any of the target species breeding within the Site, pre-construction confirmatory breeding surveys for selected species (see **Section 6.8.5**) are required on the basis of the presence of suitable breeding habitat which could support such species by the time of the commencement of construction works, *i.e.* as several years are likely to pass between the 2020-22 baseline surveys and the start of construction, the local status of some species may well have changed.

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

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

Sparrowhawk	200 m
Buzzard	200 m
Merlin	500 m
Kestrel	200 m
Snipe	400 m
Woodcock	200 m

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

The above mitigation, if needed, will apply from March to August (inclusive) and will ensure that the works will not have an adverse effect on the identified species of conservation importance.

6.5.7.1.3 Mitigation to minimise disturbance to nesting birds

A range of passerine bird species breed within the Site, including amber-listed species such as goldcrest and willow warbler. In compliance with Section 22 of the Wildlife Acts 1976 to 2021, all vegetation required to be cleared to facilitate the works will be done outside of the restricted period from 1st March to 30th August.

Should it be necessary to remove vegetation during the breeding season, for instance where bramble and ephemeral plant species have become established on ground cleared earlier, this will be surveyed by an ornithologist up to 10 days before any clearance. Should an active nest be located, the area will be restricted from works by a distance where it is considered that the works would not cause disturbance or abandonment of the nest. Such distances, which will vary according to species and local topography, will be determined by the ornithologist. The restriction will be maintained until it is established that any young birds present have fledged.

6.5.7.2 Mitigation for birds during operational phase

6.5.7.2.1 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, which is also required as mitigation for bats, will be carried out on an annual basis by mowing or strimming. This approach has proved highly effective at several wind farms in central-eastern Spain where the number of collisions with lesser kestrel decreased by 75% to 100% after the ground was superficially tilled to a distance of 80 m from the turbine base (Pescador *et al*. 2019).

6.5.7.3 Mitigation for birds during decommissioning phase

As the decommissioning works will involve works similar to those involved at construction stage (albeit at a lower intensity), these could result in similar effects on birds. Hence, the mitigation that will be undertaken for minimising disturbance to nesting birds during construction will also be applied during the decommissioning phase (taking into account changes that may have occurred locally during the operational life of the Project).

6.5.8 Invasive Species

While a stand of Japanese knotweed occurs within the Brisla East Stream along the Turbine Delivery Route, impacts on this Third Schedule invasive species as a result of the proposed development are not anticipated (see **section 6.4.9**).

Nevertheless, best practice measures will be taken throughout the construction phase to prevent the introduction or spread of invasive alien species. The commencement of works will be preceded by a confirmatory survey for invasive species, especially Japanese knotweed and Gunnera species.

During construction, the following best practice measures will be implemented:

- Good construction site hygiene will be employed to prevent introduction of invasive plant species by thoroughly washing vehicles prior to entering site
- Any soil or topsoil required on the site will be sourced only from a stock that has been screened for the presence of invasive species.
- Should the presence of an invasive species be detected, the treatment and control of same 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).

Implementation of the above measures will ensure that there will be no significant effect with regard to Third Schedule invasive species as a result of the proposed development.

6.6 RESIDUAL EFFECTS OF THE DEVELOPMENT

The strict mitigation measures which will be enforced to maintain water quality in local drains and watercourses during the construction, operational and decommissioning phases of the Project (as described in detail in **Chapter 7: Aquatic Ecology** & **Chapter 9: Hydrology and Hydrogeology**) will ensure that there will be no significant residual effects (rated as Imperceptible) on water quality or aquatic habitats or species.

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

While the project will result in the loss of an estimated 0.54 ha of cutover raised bog, an effect rated as Significant, the successful implementation of the Biodiversity Enhancement and Management Plan will result in a net increase in the area of unplanted cutover bog at the site from an existing 9.12 ha (includes for the loss of 0.54 ha at T4 location) to 12.28 ha – this will reduce the effect to Not Significant and in the long-term to a Likely Positive residual effect of Moderate significance.

With mitigation measures implemented in full to minimise disturbance to surrounding cutover bog at T4 location, it is considered that the significance of the disturbance effect can be reduced to a residual Moderate Significant medium-term adverse effect.

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

The mitigation measures described for the Project have been designed to minimise the impact of the development on the local bat populations, from the construction of the wind farm infrastructure including the Grid Connection Route and Turbine Delivery Route, through the operational phase and onto decommissioning. This assessment has found that the Project, in the absence of mitigation, will have a 'slight' permanent adverse effect on bats at a local level (EPA, 2022). The proposed mitigation measures are expected to avoid or significantly reduce the likelihood of any significant impacts occurring on bats because of the construction and operation of the proposed wind farm. Ongoing monitoring and implementation of the mitigation measures will ensure the preservation and future stability of the surrounding foraging and commuting habitats for bats.

With the implementation of the mitigation measures outlined in this assessment it is concluded that the development will have a 'not significant' permanent adverse residual effect on the bat population at a local level.

For birds, the predicted effects during the construction phase by loss of cutover bog habitat will be reduced to Not Significant with the implementation of the Biodiversity and Enhancement Management Plan and, in the long-term, potentially Positive as a larger area of cutover bog will be available for important species such as breeding meadow pipit and hunting kestrel.

The presence of the turbines is unlikely to cause a significant displacement effect for most bird species, though buzzard is identified as one which may avoid the areas around the turbines. While habituation to the presence of the turbines is likely with time, the residual effect is rated as a Slight Significant short- to medium-term effect.

6.7 BIODIVERSITY ENHANCEMENT

The Biodiversity and Enhancement Management Plan is presented in **Appendix 6.6**. The Plan will restore and enhance an area of cutover bog that has been degraded by afforestation. This will offset the loss of cutover bog on site as a result of construction of the Development. The total area of the BEMP is 3.4 ha, which compares to the estimated loss of cutover bog of 0.54 ha by construction of T4 turbine.

The objectives of the Plan are as follows:

Objectives – primary

- To extend the area of cutover bog, a habitat of high local importance, on the Site.

Objectives – secondary

- To increase biodiversity on the Site by the creation of habitat for species of conservation value, such as meadow pipit, skylark, the common frog and the common lizard.

The objectives for the Plan are achievable as similar work has been carried out successfully at other afforested sites throughout Ireland. The Plan is underwritten by a detailed monitoring programme, which will allow for any remediation works, such as failure of dams, to ensure that the objectives are being achieved.

6.8 PRE-CONSTRUCTION AND CONSTRUCTION PHASE MONITORING

6.8.1 Pre-construction bat surveys

Pre-construction surveys will be carried out by an ecologist immediately prior to the commencement of vegetation clearance to establish if the baseline conditions reported herein (established in 2023) remain valid. This will ensure that any changes in site context in relation to suitability for bats will be highlighted and that any additional mitigation measures which are then required are applied.

Prior to the commencement of site clearance, surveys will be carried out on trees identified in this assessment as having some (i.e. 'PRF-I' or 'PRF-M' in this instance) suitability for bat roosting. If roosts are found, or are likely to be present, an appropriate mitigation strategy will be devised following Marnell *et al.* (2022) and Collins (2023) or other relevant guidance, and an application to NPWS for a derogation license under section 55 of S.I. No. 477 of 2011 (Birds and Natural Habitats Regulations) will be made. Removal of trees with bat roost suitability will be carried out under the supervision of a bat licensed Ecologist and subject to receipt of derogation license (if required) and any additional conditions contained therein. Trees with ivy-cover or other features which may conceal roosting bats, once felled, should be left intact onsite for 24 hours prior to disposal to allow any bats present to depart.

6.8.2 Pre-construction badger survey

As noted in **section 6.5.3** of this report, whilst no signs of badger presence were found on the actual site during the baseline surveys in 2022 and 2023, if three years lapse from between the planning-stage surveys and the installation of the wind turbines, it will be necessary to carry out a pre-construction survey for badger as the local distribution may have changed in that period.

6.8.3 Pre-construction otter survey

While otter was not recorded breeding along the section of the Moyasta River which passes through and alongside the site for the proposed Development, if three years lapse from between the planning-stage surveys in 2022 and 2023 and the commencement of works on site, it will be necessary to carry out a pre-construction survey for otter along the Moyasta River as the local distribution of otter may have changed in that period.

It is noted that there are no watercourses to be crossed along the Grid Connection cable route leading to the Tullabrack substation, and that the three watercourses crossed along the L6132 section of the TDR are not suitable for supporting otter.

6.8.4 Pre-construction bird survey

Pre-construction confirmatory breeding surveys will take place within suitable habitat for the following species:

- Sparrowhawk

- Buzzard
- Merlin
- Kestrel
- Snipe
- Woodcock

The purpose of the surveys is to establish if breeding is occurring, which could be affected by disturbance during the construction phase. The surveys will take place within a distance of at least 500 m from the Development area.

Surveys will be carried out by an experienced ornithologist following standard methods. It is noted that the surveys will be in the period prior to any tree-felling on Site. Following on from the surveys, guidance will be provided to the contractor on where restrictive zones are required during the bird nesting season.

6.8.5 Pre-construction survey for invasive plant species

As noted in **section 6.5.8**, a survey for the presence of Third Schedule listed invasive species will be undertaken prior to the commencement of any works.

This will be carried out during the main growing season (April-September) and will focus particularly on Japanese knotweed and Gunnera spp., species known to be in the study area and widespread in County Clare.

6.8.6 On-going monitoring during construction

An Ecological Clerk of Works (ECoW) will be on site for the duration of the construction phase to ensure that all mitigation measures described herein are implemented. In particular, the ECoW will monitor the works within the cutover bog at turbine T4 location (the most sensitive ecological area within the Site).

6.9 POST-CONSTRUCTION MONITORING

6.9.1 Habitats

Post-construction monitoring will focus on the cutover bog which had been disturbed by construction of T4 turbine and on the bog enhancement area.

When all ground works are complete at the T4 location, a vegetation survey will take place by an ecologist. This will describe the state of the vegetation in the disturbed area and for a distance of up to 50 m beyond that where drying effects may occur as a result of the disturbance from construction works. A series of monitoring quadrats will be established to accurately describe the vegetation, including bare areas, at the time (Year 1) and in subsequent years. Details will be worked out by the ecologist, but it is likely that quadrats will be 2 m x 2 m in size and will be geo-referenced and photographed. As disturbance will be limited to one area of bog, it is expected that the number of quadrats would not exceed 10.

Vegetation recovery will be monitored over a period as follows: Years 1, 2, 3, 5, 10, 15, 20, 25. A similar programme of monitoring will take place within the enhancement area, with the objective of recording the re-vegetation process after the trees are cleared (details in **Appendix 6.6**). Reports will be prepared for each year of monitoring and issued to Clare County Council.

6.9.2 Bat monitoring

NatureScot (2021) recommends post construction monitoring is carried out in at least three years post construction, but not necessarily consecutive years. Post-construction monitoring aims to assess changes in bat activity patterns (e.g. in response to landscape changes such as land management and forestry rotation) and the efficacy of mitigation to inform any changes which may be required to curtailment strategy. Post-construction fatality monitoring and activity surveys will be carried out in years 1, 2, 3, 5 and 10 post-construction. Post-construction monitoring will consist of:

- Passive bat monitoring at all turbine locations in order to monitor changes in activity levels relative to pre-construction baseline information (presented herein).
- Fatality monitoring following the methodology presented in Appendix 4 of NatureScot (2021) or subsequent updates.

Post-construction monitoring data will be analysed and presented in report format to the planning authority. Recommendations will be made in relation to curtailment strategy if required.

6.9.3 Post-construction bird monitoring

Post-construction bird monitoring will take place to establish whether the construction and operation of the proposed Development has had effects on the bird species associated with the Site prior to construction (as shown by the baseline surveys in the 2020-2022 period). The monitoring programme will comprise the following:

Flight activity surveys

Flight activity surveys will be undertaken using the Vantage Point method (Scottish Natural Heritage 2017). The purpose of the surveys is to determine if the presence of the turbines is causing species such as kestrel and buzzard to avoid the Site. 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).

Transect surveys within Site

Transect 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. Two surveys will be undertaken in each of the summer and winter seasons and will be in the same monitoring years as the vantage point surveys.

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. A trained dog under the control of a handler will be used.

Note: A combined monitoring programme will be undertaken to detect both bat and bird carcasses, *i.e.* both bats and birds will be monitored during the same site visits/surveys.

6.10 SUMMARY OF SIGNIFICANT EFFECTS

With the implementation of mitigation through avoidance principles, pollution control measures, surface water drainage measures and other preventative measures which have been incorporated into the project design in order to minimise potential significant adverse impacts on water quality and biodiversity at the Site, the potential for adverse impacts on downstream designated sites is reduced to Imperceptible or Not Significant.

From the perspective of terrestrial habitats, the principal significant effect as a result of the proposed Development is the loss of 0.54 ha of cutover raised bog habitat from a total area of 9.66 ha within the Study Area. However, with the successful implementation of the BEMP (**Appendix 6.6**), there will be a net increase in the area of unplanted cutover bog at the Study Area (from existing 9.66 ha to 12.82 ha), which is rated as a Likely Positive Effect of Moderate significance and Long-term. As well as loss of cutover bog habitat at the turbine T4 location there will be disturbance to the surrounding area from construction works. However, with mitigation measures implemented in full, it is considered that the significance of the disturbance effect can be reduced to a Moderate Medium-term Adverse Effect.

With mitigation measures implemented in full, including preservation of water quality in local watercourses used by otter, it is considered that the significance of the predicted impact on terrestrial mammal species as a result of the proposed Development will be not significant.

Following surveys for bats within and surrounding the Site, it is considered that the Project will not have a significant long term negative effect on the local bat populations in the area.

For birds, the predicted effect with mitigation in place is reduced to a Slight Adverse Effect of Short- to Medium-term duration.

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7 AQUATIC ECOLOGY

7.1 INTRODUCTION

This chapter assesses the significant effects of the Project (**Figure 1.2**) on Aquatic Biodiversity. The Project refers to all elements of the application for the construction of Ballykett Wind Farm (**Chapter 2: Project Description**). In accordance with Article 3(1) of the EIA Directive (*i.e.,* the 2011 Directive as amended by the 2014 Directive (2014/52/EU), this chapter will identify, describe and assess the direct and indirect effects of a project on "(*b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC*". Where adverse effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Project:

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

Common acronyms used throughout this EIAR can be found in **Appendix 1.4**. This chapter of the EIAR is supported by Figures provided in Volume III and the following Appendix documents provided in **Volume IV**:

- Freshwater Pearl Mussel (FPM) Survey Report in **Appendix 7.1**

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. The CEMP will include all of the mitigation recommended within the EIAR. In the event that planning is granted for the Development, the CEMP will be updated prior to the commencement of construction to address the requirements of any planning conditions including any additional mitigation measures. The revised CEMP will be submitted to the planning authority for written approval as required.

7.1.1 Statement of Authority

This chapter has been written by Dr. Brendan O'Connor, Dr. Eddie McCormack and Aisling Hearty, M.Sc. (AQUAFACT International Services Ltd.). Dr. O'Connor has over 40 years' experience in freshwater, terrestrial, and marine environmental impact assessment and consultancy. Dr McCormack has over 16 years in environmental consultancy specialising in freshwater and marine ecology. Aisling Hearty has over 4 years of work in environmental consultancy and has experience in multiple different areas of marine biology including taxonomy, sampling work, data analysis and ecological report writing.

AQUAFACT is an environmental consultancy based in Galway City. It has been in operation for almost 40 years, specialising in monitoring and managing resources in marine, freshwater and terrestrial environments. In February 2022 AQUAFACT joined the APEM group. APEM was founded more than 30 years ago and is one of Europe's largest specialist environmental consultancy companies. It offers high quality scientific expertise covering the investigation, monitoring and management of water and terrestrial environments with services including aquatic & ecological consultancy, field surveys, ornithological surveys, fisheries science, laboratory services, and aerial surveys. Furthermore, APEM has helped the environment industry to identify responses to issues such as invasive non-native species, recognised the importance of the natural capital approach and river restoration. Additionally, APEM has employed technological solutions including aerial surveys and digital data collection. In Ireland the APEM Group comprises AQUAFACT, Woodrow, APEM Ireland, and Macro Works.

7.1.2 Assessment Structure

In line with the revised EIA Directive and EPA guidelines (2022) the structure of this Biodiversity chapter is as follows:

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

7.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

7.2.1 Assessment Methodology Aquatic Biodiversity

The general approach used for the evaluation of ecological receptors and assessment of significant likely effects for this current assessment is based on the '*Guidelines for Ecological Impact Assessment in the UK and Ireland*' (Chartered Institute of Ecology and Environmental Management, 2018). The evaluation of ecological receptors contained within this report uses the geographic scale and criteria defined in the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009).

7.2.1.1 *Desktop Study*

A desktop study review was carried out of existing data and records for fish, protected aquatic species and habitats (including Annex II species and aquatic Annex I habitats), and invasive species listed under the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011 (as amended)) on watercourses at or hydrologically connected (*i.e.,* downstream) to the development on the National Biodiversity Data Centre (NBDC) and National Parks and Wildlife Service (NPWS) websites.

7.2.1.2 *Field Survey*

Zone of Influence

The Zone of Influence (ZOI) differs for different habitats and species. Within terrestrial habitats, the ZOI may be confined to the study area, whereas for aquatic habitats, the ZOI will be more extensive, and the surveys undertaken were scoped accordingly for the Project. This entailed establishing the baseline conditions in aquatic habitats at a range of points upstream and downstream in the various watercourses draining the Site and is reflected in the range and extent of surveys undertaken. The ZOI for aquatic ecology therefore is considered to be the watercourses draining the Site and the watercourses crossed by the turbine delivery route. A conservative distance of <500m downstream was chosen for monitoring the watercourses during and immediately post construction. This will allow the assessment of any significant effects from these activities while being mindful of unrelated discharges and tributaries further downstream that may contribute pollution to or dilute any potential effects. An **Appropriate Assessment Screening Report and Natura Impact Statement** (BioSphere Environmental Services, 2022) have been prepared for the Project which assesses significant likely effects on European designated sites (the Natura 2000 network), a number of which are hydrologically connected via surface water flow.

Aquatic Habitats

Surveys of watercourses at, and within a potential Zone Of Influence of the Project undertaken on the 22nd of July 2022 and the 12th of October 2022 for the proposed wind farm Site, and on the 8th of November 2022 for the proposed Grid Connection. The surveys were limited to this timeframe as Autumn and Spring are the best times to survey for freshwater invertebrates. The surveys identified and mapped aquatic habitats, determined fisheries value and potential, and determined presence or suitability for Annex listed species or invasive alien species. The aquatic habitat assessment conducted at all sites was based on the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (Environment Agency, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland*' (Fossitt, 2000). The EPA Biotic Index Biological River Quality

Classification System (Q-value) (Toner *et al.,* 2005) (**Table 7.1**) has been used to monitor the ecological quality of streams and rivers in Ireland since 1971. It is routinely employed by the EPA. All sites were assessed in terms of:

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

A Biosecurity protocol was rigidly followed to avoid the potential for transfer of invasive alien species to or from the Site in accordance with guidance produced by Invasive Species Ireland and Inland Fisheries Ireland (IFI, 2010). A specific Biosecurity Method Statement was produced for the survey operation.

This Aquatic Ecology Chapter will be referring to watercourses by the local river names identified using the "Indicative Flow" layer (e.g. the Gowerhass) on EPA maps website to assess potential effects on each stretch, rather than the river catchment as a whole. For the Hydrology and Hydrogeology Chapter local river names have been included as well as the WFD river section ID [Moyasta_010 for example] which aligns with the overall WFD catchment or sub-catchment name.

Table 7.1: EPA Water Quality and Status Summary.

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

Freshwater Pearl Mussel Survey

The proposed Turbine Delivery Route (TDR) crosses the Tullagower River and Brisla East Stream which are part of the Doonbeg river catchment. These watercourse crossings are hydrologically connected to locations downstream where previous surveys, by consultants from EirEco in 2012 & 2016, and MKO in 2014[1], identified the presence of Freshwater Pearl Mussels (*Margaritifera margaritifera*). The latest study found no juvenile mussels indicating no recent recruitment in the population at the time.

Additional surveys were undertaken to investigate the presence of Freshwater Pearl Mussels (FPM) in the Doonbeg River and its tributaries on the 9th and 10th of October 2023 as the catchment is considered a sensitive area for the species.

The survey work was carried out under licence (No. C214/2023) granted by NPWS for qualified ecologists to survey the FPM in the specified locations. Three 300m river sections (sites 1-3) and three 50-150m spot check areas (sites 4-6) were selected on the Tullagower and Brisla East for proposed FPM Stage 1 surveys, where the works are due to take place, and downstream of the TDR crossings. Surveys took place following the standard methodology used by the NPWS (National Parks and Wildlife Service, 2004). Conditions during the surveys were clear (*c*. 15% cloud cover), sunny, 20°C with a light breeze. At each station, accessible sections of the proposed 300m section of riverbed were systematically searched for living mussels or mussel shells, where suitable habitat was available, giving particular attention to the immediate vicinity of suitable habitat (suitable habitat is described in detail in FPM report **Appendix 7.1** and a detailed recording Stage 1 data survey form was completed, including information on mussel numbers (including absence of mussels), describing the habitat in detail, and including any relevant observations on the state of the watercourse. The survey covered approximately 40m at site 1, 118m at site 2, and 130m at site 3; however, surveys were not possible at sites 4, 5 and 6 because they were inaccessible due to local conditions. Surveys were carried out using bathyscope techniques and were conducted by one surveyor and a bankside manager. All of the planned survey sections, and the areas surveyed are shown in **Figure 7.6**.

7.2.1.3 Ecological Evaluation and Impact Assessment Methodology

The evaluation of the key ecological receptors and the criteria used to assess the significance of effects are derived from the *Guidelines for Assessment of Ecological Impacts on National Road Schemes* (National Roads Authority, June 2009), *Guidelines on the Information to be contained in Environmental Impact Assessment*

[1] https://www.clarecoco.ie/services/planning/publications/heritageconservation/doonbeg-pearl-mussel-survey-report-2016-24581.pdf

Reports (Environmental Protection Agency, 2022) and the *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal* (CIEEM, 2018).

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

The criteria used for assessment of the value of the ecological resources sets out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The NRA (2009) guidelines provide a basis for determination of whether any particular site is of importance on a scale presented in **Table 7.2**.

Table 7.2: Valuation of Ecological Resources.

Scale of Importance	Determination of Value on a geographic basis

International Importance	• 'European Site' including Special Area of Conservation (SAC), Special Protection Area (SPA) or Site of Community Importance (SCI)
	• Proposed Special Area of Conservation
	• Proposed Special Protection Area
	• Site that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended)
	• Features essential to maintaining the coherence of the Natura 2000 Network
	• Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive
	• Resident or regularly occurring populations (assessed to be important at the national level) of the following:
	  ◦ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or
	  ◦ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.
	• Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971).
	• World Heritage Site (Convention for the Protection of World Cultural & Natural Heritage, 1972)

Scale of Importance	Determination of Value on a geographic basis
	• Biosphere Reserve (UNESCO Man & The Biosphere Programme) • Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979) • Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979) • Biogenetic Reserve under the Council of Europe • European Diploma Site under the Council of Europe • Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988)

National Importance	• Site designated or proposed as a Natural Heritage Area (NHA)
	• Statutory Nature Reserve
	• Refuge for Fauna and Flora protected under the Wildlife Acts
	• National Park
	• Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park
	• Resident or regularly occurring populations (assessed to be important at the national level) of the following:
	  ◦ Species protected under the Wildlife Acts; and/or
	  ◦ Species listed on the relevant Red Data list
	• Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive

County Importance	• Area of Special Amenity
	• Area subject to a Tree Preservation Order
	• Area of High Amenity, or equivalent, designated under the County Development Plan
	• Resident or regularly occurring populations (assessed to be important at the County level) of the following:
	  ◦ Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive;
	  ◦ Species of animal and plants listed in Annex II and/or IV of the Habitats Directive
	  ◦ Species protected under the Wildlife Acts; and/or
	  ◦ Species listed on the relevant Red Data list
	• Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance
	• County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared

Scale of Importance	Determination of Value on a geographic basis
	• Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county • Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level

Local Importance (higher value)	• Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared
	• Resident or regularly occurring populations (assessed to be important at the Local level) of the following:
	  • Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive
	  • Species of animal and plants listed in Annex II and/or IV of the Habitats Directive
	  • Species protected under the Wildlife Acts; and/or
	  • Species listed on the relevant Red Data list
	• Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality
	• Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value

Local Importance (lower value)	• Sites containing small areas of semi-natural habitat that are of some local importance for wildlife • Sites or features containing non-native species that are of some importance in maintaining habitat links

The Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines define a significant effect as, "a*n effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'…or for biodiversity in general*". The criteria used for assessment of significant effects are as follows while the Criteria for Assessing Effect Significance are presented in **Table 7.3**:

Positive or Adverse: Positive and adverse effects should be determined according to whether the change is in accordance with nature conservation objectives and policy.

Extent: Extent should be predicted in a quantified manner and relates to the area over which the significant effect occurs.

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

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

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

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

Likelihood:
- Certain/Near Certain: >95% chance of occurring as predicted.
- Likely: 50-95% chance as occurring as predicted.
- Unlikely: 5-50% chance as occurring as predicted.
- Extremely Unlikely: <5% chance as occurring as predicted.

Table 7.3: Criteria for Assessing Effect Significance (EPA, 2022).

Significance of Effects	Definition
Imperceptible	An effect capable of measurement but without significant consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.

Significance of Effects	Definition
Significant Effects	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 the sensitive aspect of the environment.
Profound Effect	An effect which obliterates sensitive characteristics.

7.3 BASELINE DESCRIPTION

7.3.1 Aquatic Environment

The Site area is located in the townland of Ballykett, approximately 3.5km northeast of the town of Kilrush, County Clare (**Figure 7.1**). There are three watercourses within/ draining the Site which could potentially be affected by the development, i.e., the Moyasta (EPA Code: 27M04), Gowerhass (EPA code: 27G13) and Ballykett (EPA Code: 27B52). Within the proposed development Site watercourses have previously been modified to receive input from man-made arterial drains, are culverted beneath roads, or they have been altered to provide cattle access for drinking water. The preferred Grid Connection Route (GCR) connects the Development to the existing Tullabrack 110KV Substation and does not cross any watercourses (**Figure 7.2**). The Turbine Delivery Route (TDR) includes three watercourse crossings which may potentially be affected by the transport of turbines on heavy load vehicles along this route. The Tullagower River and the Brisla East Stream are located to the East of the proposed Development Site and are part of the Doonbeg river catchment (**Figure 7.3**). The third crossing is on the GOWERHASS, upstream of the Site and connected to the Moyasta catchment. In order to assess any potential effect on the watercourses by the transport of turbines along the TDR, additional FPM surveys downstream of the watercourse crossings were carried out by APEM Ireland on October 9th and 10th 2023. The FPM Survey Report is attached as **Appendix 7.1**.

7.3.2 Aquatic Habitat Assessment

Table 7.4 presents a list of the watercourses and the four survey station locations. Four stations were assessed for the Site (B1-B4). EPA watercourse names, EPA codes and EPA segment codes are also presented. Station locations are presented in **Figure 7.1**.

The Proposed Windfarm Site

One watercourse flows through the Site – (Moyasta 27) which is a small stream under one metre (1m) in width during normal discharge. The four sample stations for the Site are illustrated in **Figure 7.1**. The sampling locations B1 and B2 are located upstream from the Site, B4 is located downstream of the Site. The sampling location B3 was on an intermittent stream which was dry during the summer and autumn sampling events, and the stream is only present after periods of heavy rainfall. When present it flows into Moyasta 27 downstream of the proposed Development Site. The riverbed at all stations was muddy and silted. Heavy iron staining was present at B2 which may be naturally occurring iron, or as a result of contamination upstream. There was an abundance of macrophytes (mainly *Potamogeton*) in the watercourses at B4 and B1, indicating some eutrophication is occurring at this station. Macroinvertebrate diversity was low, and pollution was moderate to serious at all stations. Due to the level of siltation and the macroinvertebrate diversity the streams are considered to be of low ecological value.

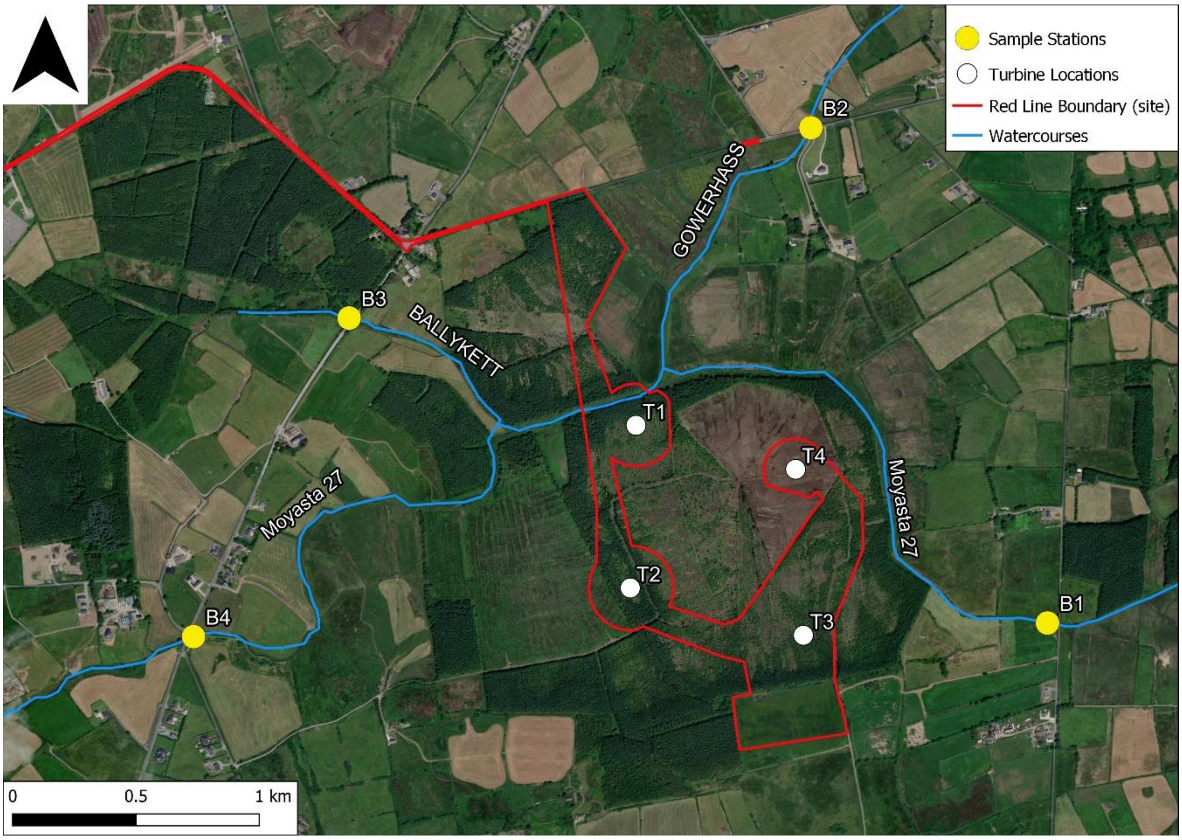

Figure 7.1: Location of the four water sampling locations, in proximity to the proposed turbine locations.

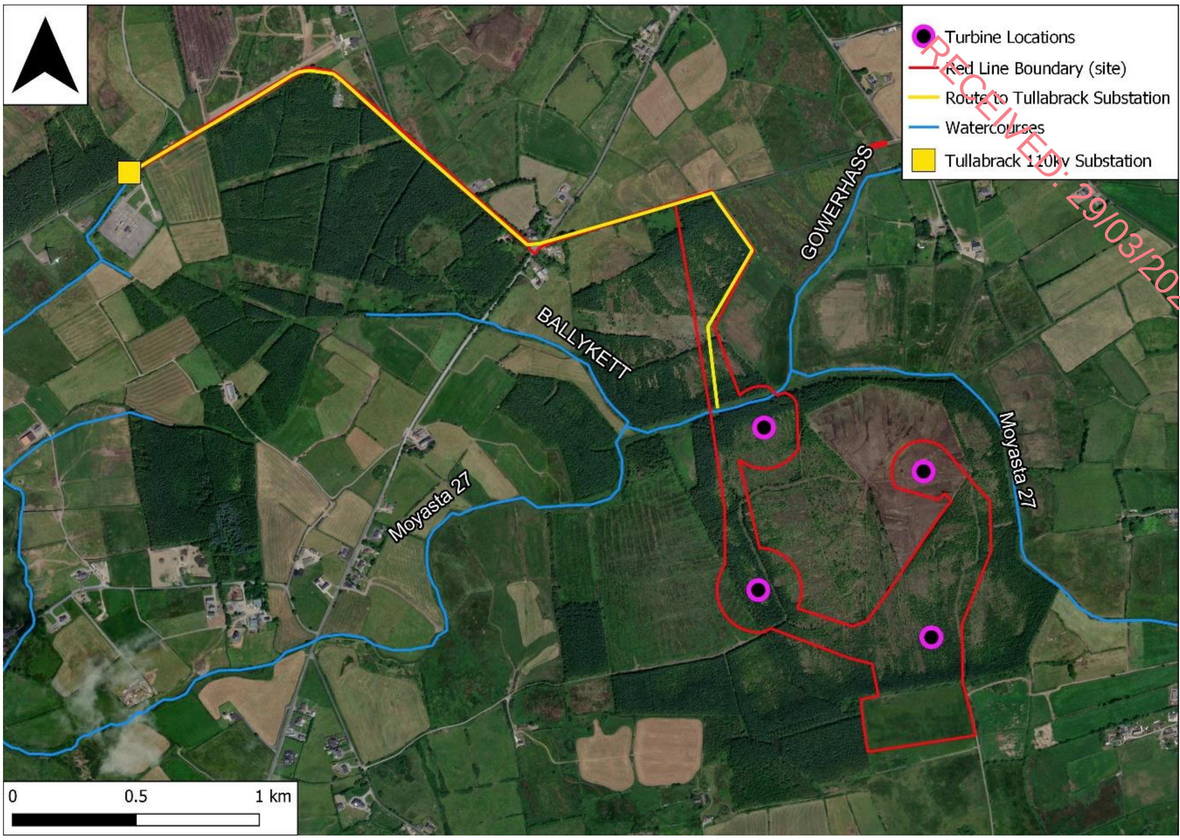

Figure 7.2: Grid Connection Route from the proposed Development Site to the existing Tullabrack 110Kv sub-station.

Table 7.4: List of watercourses that transverse the proposed Development site, including Survey Station locations and watercourse names.

Site Survey Stations	EPA Name	EPA Code	EPA Watercourse Segment Code	
B1	MOYASTA 27	27M04	27_970	

Site Survey Stations	EPA Name	EPA Code	EPA Watercourse Segment Code	
B2	GOWERHASS	27G13	27_962	

Site Survey Stations	EPA Name	EPA Code	EPA Watercourse Segment Code	
B3	BALLYKETT	27B52	27_1144	 

Site Survey Stations	EPA Name	EPA Code	EPA Watercourse Segment Code	
B4	MOYASTA 27	27M04	27_1158	

Proposed Grid Connection Route (GCR)

Three Grid Connection route options were investigated for the proposed Ballykett Windfarm. However, the optimal GCR selected (Option 1) involves the shortest distance, with no water crossings and therefore has the least potential environmental effects. It will connect the proposed Development to the existing Tullabrack 110kV Substation along a 1.7km route. This GCR is considered in detail in this EIAR, and a summary of surveys and findings for the alternative routes investigated can be seen in Chapter 3 Alternatives Considered and **Appendix 3.1**.

Turbine Delivery Route (TDR)

All turbine component delivery vehicles will use the site access junction on the L6132 local road. Turbine delivery traffic will travel to the proposed wind farm Site from Foynes Port using the national and regional road network. A TDR analysis for the transportation of turbine components along the L6132 from the N68 / L6132 junction to the site entrance has been caried out (see Chapter 16 and Appendix 16.1). As stated earlier, the TDR includes three water crossings, two of which are part of the Doonbeg River catchment which has a documented freshwater pearl mussel (*Margaritifera margaritifera*) population. The locations of the FPM surveys from 2012 and 2016 are shown in **Figure 7.3**. Further studies were carried out by APEM Ireland on October 9th & 10th 2023.

The watercourses crossed by the TDR are the (i) GOWERHASS (EPA code: 27G13) an order 1 watercourse, (ii) the TULLAGOWER river (EPA Code: 28T01) an order 1 watercourse, and (iii) BRISLA_EAST, an order 1 watercourse and a small tributary of the main Tullagower stream with limited to no flow (Figure 7.5: View of the Brisla-East watercourse crossing.**Figure 7.5**). Further pictures off the crossings can be seen un the FPM report in **Appendix 7.1**.

Analysis of the most recent Q-values from 2018 and 2021 of sections of the Tullagower in close proximity to the TDR strengthening works show a poor water quality score (Q3). The western crossing of the Tullagower stream by the TDR occurs downstream of a quarry/ recycling centre and commercial forestry identified by LAWPRO[2] as the potential source of sedimentation contributing to the poor water quality of this watercourse. **Figure 7.4** illustrates the current Water Framework Directive (WFD) status (https://gis.epa.ie/EPAMaps/) of the Doonbeg Catchment in the vicinity of the

[2] https://lawaters.ie/app/uploads/2022/03/Doonbeg-PAA-Desk-Study-F2.pdf

TDR (i.e. Tullagower stream) as well as the locations of the most recent EPA Q-value assessments.

None of the three watercourses surveyed in the vicinity of the TDR crossings were identified as suitable habitats for Annex II listed species or species of high conservation value. The fine sediments on the streambed are unsuitable for freshwater pearl mussel (*Margaritifera margaritifera*) or spawning salmonids. There was no sign of otter tracks or spraint, river lamprey (*Lampetra fluviatilis*) or white-clawed crayfish (*Austropotamobius pallipes*).

Freshwater Pearl Mussels require clean, fast-flowing water with water depths of 0.3–0.4m, optimum current velocities of 0.25–0.75ms^{-1} with boulder-stabilised refugia, which contain enough sand for burrowing. Adults can tolerate silty or muddy conditions for unknown lengths of time, but juveniles are never found in this type of habitat. Boulders are important as they usually prevent significant bed scour during major floods (Hastie *et al.,* 2000, Gittings *et al.*, 1998). Most suitable areas to search during stage 1 survey is in the immediate vicinity of boulders and under overhanging trees in suitable marginal areas because channel shading is extremely important. **Figure 7.6** below illustrates the areas surveyed for FPM by APEM Ireland in October 2023.

Where the channels were suitable for FPM survey no mussels were found. A survey of this type, based on a single site visit, always has the risk of missing the presence of the species elsewhere in the area to be affected. However, the absence of records paired with, for the most part, unsuitable habitat supports the conclusion there is genuine absence of FPM at the locations surveyed. Notwithstanding the likely absence of FPM in the tributaries, the Doonbeg River lies within an FPM sensitive area which means that consideration of this species is required, particularly with respect to mitigation during and following the construction phase of the proposed Development.

There are some previous records of FPM in the Doonbeg River, both upstream and downstream of its confluence with the Tullagower River. Therefore, although no FPM were recorded at the surveyed sites, and the watercourses at crossings along the TDR are unsuitable habitat for FPM, it is important to consider their presence in the wider Doonbeg system, particularly downstream of the confluence, when carrying out any works surrounding the watercourses.

No live mussels were encountered and there was no evidence recorded of mussels (*e.g.,* empty shells) during stage 1 surveys. The FPM survey report is presented in **Appendix 7.1**.

When surveying the sites for the Freshwater Pearl Mussel there was a significant difference noted in the flow within the Tullagower River between sites 1-3 and sites 4-6, as a result of this, further sites along the river system were visited for investigation. At site B there is an unmapped forestry drain which is flowing from site B east towards site E. The majority of the flow from the Tullagower River sites upstream of site B is flowing east here rather than along the mapped channel (EPA Maps). The mapped watercourse of Tullagower River which flowed directly north of site B towards the confluence with the Doonbeg River at site A is dry or marshy in parts as it flows though this boggy landscape. It appears that the most of the Tullagower river flows between Site B and Site E where it joins the Doonbeg River system. **Figure 7.7** illustrates the altered watercourse of the Tullagower river.

While FPM are known to exist in the Doonbeg catchment, none were recorded as part of this EIAR and the related aquatic and FPM surveys carried out.

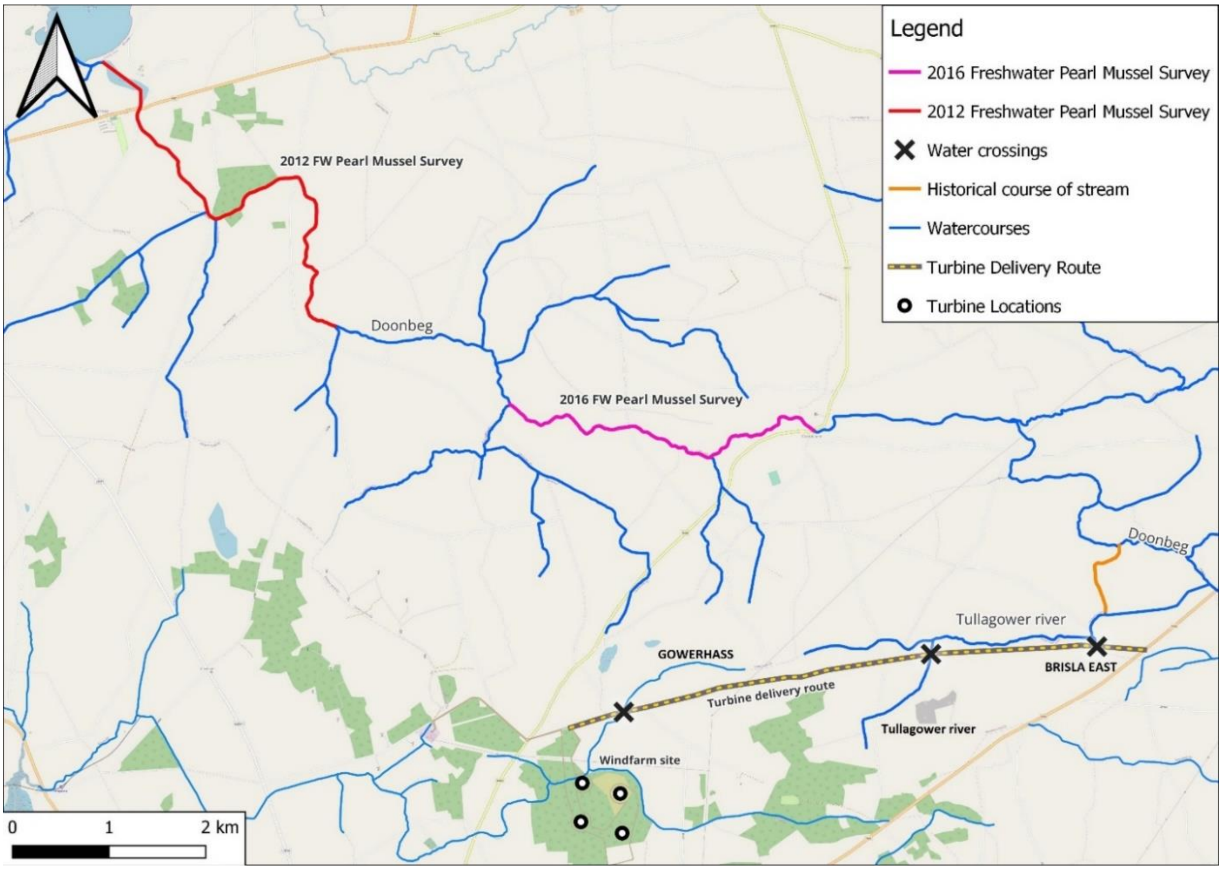

Figure 7.3: Turbine delivery route and previous Freshwater Pearl Mussel surveys.

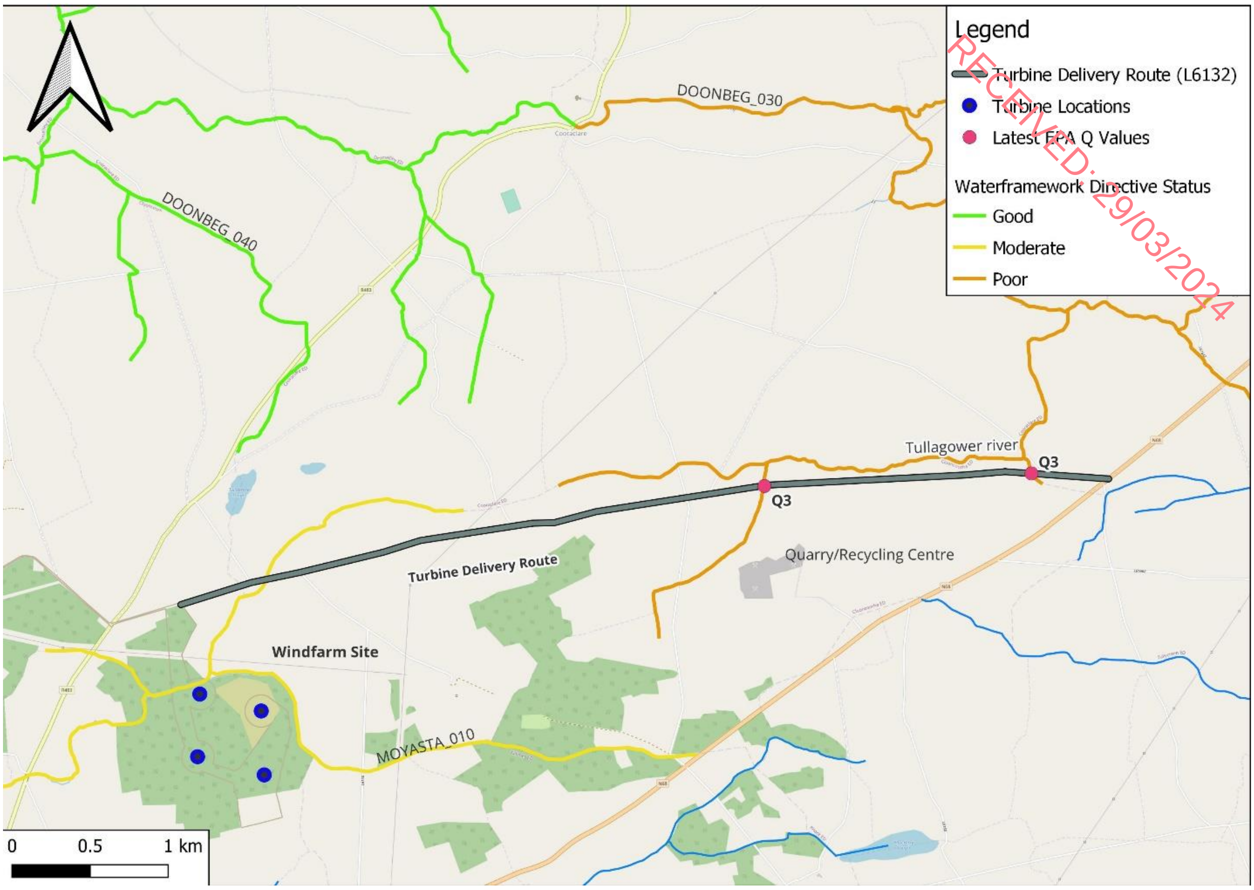

Figure 7.4: Doonbeg river catchment Water Framework Directive Status.

Figure 7.5: View of the Brisla-East watercourse crossing.

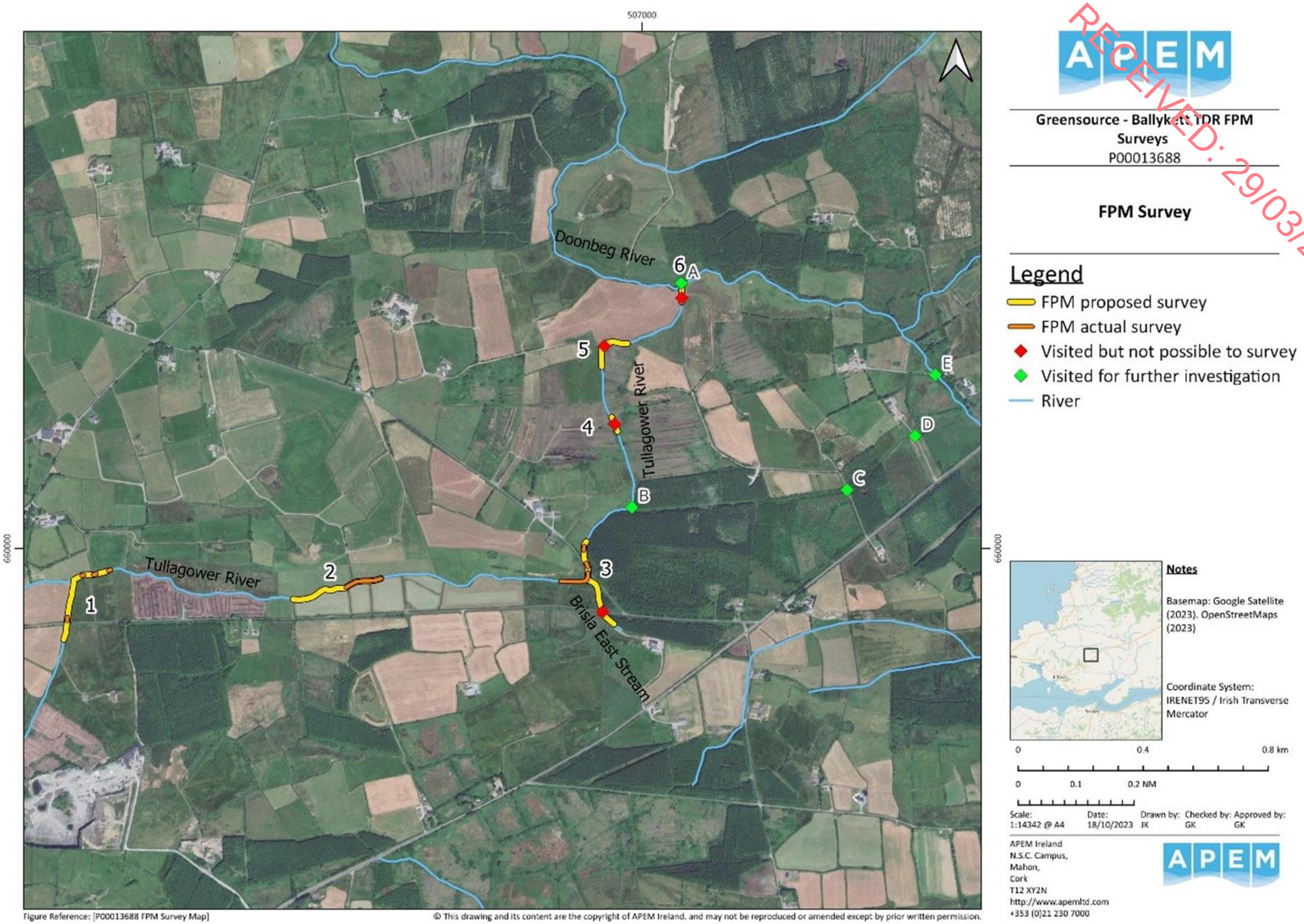

Figure 7.6: Freshwater Pearl Mussel survey sites, undertaken by APEM Ireland in October 2023.

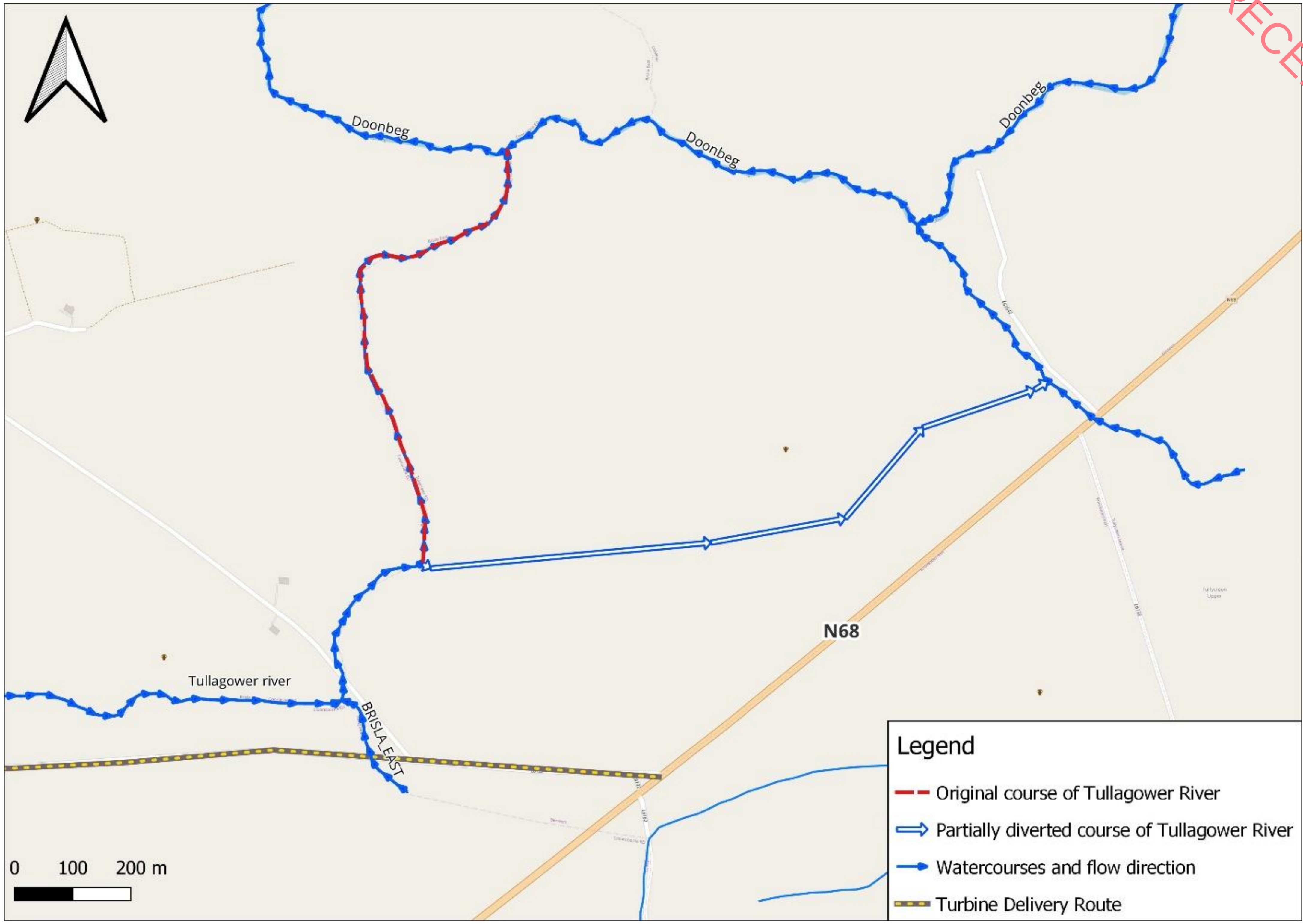

Figure 7.7: Site survey confirmed the Tullagower river was diverted historically, and the current position of the watercourse is shown with flow direction arrows.

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

Water quality was assessed using the Q-Value biotic index system. The Biological River Quality Classification System (Q-Scheme) has been in use in Ireland since 1971. For the purpose of this assessment, benthic invertebrates have been divided into five indicator groups according to the tolerance of pollution, particularly organic pollution.

In order to determine the biological quality of the river, the Q-scheme index is used whereby the analyst assigns a Biotic Index value (Q-Value) based on macroinvertebrate results. The Biotic Index is a quality measurement for freshwater bodies that range from Q1 – Q5 with Q1 being of poorest quality and Q5 being pristine/unpolluted (see **Table 7.5** below).

The most recent Q-values and WFD status available for the watercourses surveyed for FPM by APEM Ireland were taken from the EPA website and are listed in below in **7.5**.

Table 7.5: Water Quality Assessment of Site (Q Value and WFD Ecological Status).

Site No.	Current Q Value	WFD Ecological Status	Macrophytes	Comments	Latest EPA Q Value and WFD Status
B1	Q3	POOR	Abundant	Stream heavily vegetated, bank reprofiled, heavily silted, bordering pastoral land. Chironomidae was the dominant species group that was present.	N/A
B2	Q3	POOR		Receives input from arterial drains, culverted, heavy ferric staining, muddy substate. *Gammarus* and Lumbriculidae were the most dominant taxa present.	N/A
B3	Q2	BAD		Intermittent stream, not expected to have sensitive species. Simuliidae and *Potamopyrgus* were the dominant taxa present.	N/A
B4	Q3	POOR	Abundant	Heavily vegetated, deep muddy substrate,	Q1 BAD

Site No.	Current Q Value	WFD Ecological Status	Macrophytes	Comments	Latest EPA Q Value and WFD Status
				bordering pastoral land. Chironomidae, *Potamopyrgus* and Sphaeriidae were the dominant taxa present	(last surveyed 1991)

Table 7.6: Water Quality Assessment of Watercourses along the TDR (Q Value and WFD Ecological Status).

Site No.	WFD Ecological Status	Comments	Latest EPA Q Value and WFD Status
1	POOR	Largely overgrown channel which had signs of previous modification throughout. High banks and field drains were present throughout this stretch along with overhanging brambles and vegetation. Shading and substrate were unsuitable for FPM and none were found to be present.	Q3 POOR (last surveyed 2021)
2	POOR	Channel between 1-2m width with an average depth of ca. 70cm where surveyed. Signs of previous channel modification were present throughout with high steep banks and field drains present. High amount of instream vegetation including *Nasturtium officinale, Callitriche stagnalis, Sparganium* sp., and *Lolium* sp. No FPM found to be present and some stretches were unsuitable for survey because the channel was >1m depth and very soft. The river bed could not be seen even with the use of a torch.	N/A
3	POOR	Channel was up to 2m wide with an average depth of 30cm. Largely overgrown with brambles and ferns, conifers from the bordering forestry and inaccessible in many areas due to this vegetation. Evidence of previous channel modification and field drains at this site. Instream vegetation consisting of *Lolium* sp and *Stachys palustris.* Approx. 130m of the Tullagower River at this site was surveyed. No FPM found to be present Survey was not possible on the Brisla East Stream, due to heavy vegetation. Japanese knotweed (*Fallopia japonica*) was also noted upstream of the road crossing at this Site.	Q3 POOR (last surveyed 2018)
4	POOR	Located within an area of cutover bog. No water body present at this location, and thus no FPM surveys were conducted at this location. Bog drains, field drains and forestry drains are present in the surrounding areas	N/A

Site No.	WFD Ecological Status	Comments	Latest EPA Q Value and WFD Status
5	POOR	No FPM surveys were conducted due lack of access to the channel at this site. The channel here was narrow and shallow with high overgrown banks making it unsuitable to survey. Stagnant instream vegetation present.	N/A
6	POOR	No FPM surveys were conducted due to channel access at this site. The channel here was narrow and shallow with high overgrown banks making it unsuitable to survey. Stagnant instream vegetation present.	N/A

7.4 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

A more in-depth discussion of water quality is provided in **Chapter 9: Hydrology and Hydrogeology**. This section is focused on the effects on aquatic species and ecology. Groundwater pathways are not considered an issue at the Site on account of the underlying geology, and the area is mapped as low vulnerability by the EPA (EPA Maps).

7.4.1 The 'Do-Nothing' Impact

If the development does not proceed, lands at and in the vicinity of the Site will continue to be used for forestry and agricultural purposes. This 'do-nothing' scenario would result in no significant change to aquatic ecology and habitats within or downstream of the Site and TDR, subject to the continuation of current activities and practices. It should be noted however, that current forestry and agricultural activities (incl. drainage works) are having some effects on water quality within the catchment as evidenced by the results of the surveys undertaken.

7.4.2 Construction Phase Potential Effects

A full description of the project is given in **Chapter 2: Project Description**. A summary of potential sources of significant effects on aquatic ecology during the Construction Phase are:

- Clearance of vegetation, soil and rock for widening and construction of access roads, hardstand and turbine bases causing the release of suspended solids/nutrients, dissolved substances, concrete and hydrocarbons into the drainage network and site run-off, resulting in adverse effects on water quality within the watercourses onsite and downstream.
- Pollution from debris caused by vehicles during the turbine delivery crossing watercourses in proximity to the site access track.

- Adverse effects of tree felling on water quality as a result of sediment and nutrient release into water courses.
- Potential for accidental spillage of hydrocarbons and other pollutants including concrete laitance.
- The loss of natural watercourses due to watercourse crossings and the placement of bridges and culverts.
- Unlikely potential for peat slippage or failure leading to deposits in watercourses which can lead to eutrophication. This is discussed further in Appendix 8.1 "Ballykett Windfarm (BWF), Site Investigation by Peat Probing and Peat Stability Risk Assessment Report".
- Pollution of watercourses upstream of catchment for sensitive FPM, crossed by the TDR, from debris loosened from verges creating sedimentation in the water.

The principal potential construction phase effects of the Development relate to the release of sediments into the drainage network arising from construction related Site works including the access track network, turbine foundations and associated hardstands, drainage network, electrical sub-station building and borrow pits or spoil storage areas. These are considered to be short-term and localised to the zone of Influence (ZOI). There is a low risk of nutrient release from the clear-felling of conifers required for the Development; however, this is of a minor scale in comparison to the normal forestry activities taking place at the Site.

Water quality degradation in surface and groundwater from siltation or other forms of pollutants causing potential decrease in biodiversity of flora and fauna in the area, especially regarding the more sensitive species present, is the main result of the potential effects listed above. Release of suspended solids into watercourses can result in eutrophication and reduced oxygen levels due to minerals and nutrients such as phosphorus and nitrogen, which can adversely affect the local ecosystem. However, water quality degradation is considered to be short term during the Construction phase and not permanent.

The Site is located on the Moyasta river, approximately 5km upstream of Poulnasherry Bay. Poulnasherry Bay is a designated shellfish water body under the Quality of Shellfish Water Regulations (S.I 208 of 2008) and mitigations (**Chapter 9: Hydrology and Hydrogeology**) have been carefully put in place to prevent the incidence of pollution in the form of suspended solids and dissolved substances entering the watercourses, and subsequently transporting to Poulnasherry Bay. Poulnasherry Bay measures about

5km² and using a mean depth of 1m, this gives a total volume of 50,000m³, which is tidally refreshed twice a day. The Moyasta river is 24.75km in length and the Moyasta catchment is 26.12km². According to the EPAs River Flow Estimate tool the flow at the segment of the Moyasta river that enters Poulnasherry Bay is above the Q95 of 0.063m^3/sec for the majority of the time (the flow that is present 95% of the time, or across 95% of measurements). Q95 is often used as the precautionary flow when looking at capacity studies. The average flow at this section (Q50) is above 0.29m^3/sec. The size of the River Shannon catchment is *ca.* 18,000km² and land use is, to a large extent, agricultural/silviculture. Run off from such land use will bring in nutrients such as nitrogen (N), phosphorus (P), and humic acids into the river. Given the tidal exchanges as described above, there is sufficient dilution to prevent the potential effects of run-off (for which mitigation measures have been designed) from the proposed wind farm. With regard to flows in the Shannon Estuary, if all inflowing rivers are included along with the flows in the river, the total flow rate is 300m³ sec. In comparison, the flow of the Moyasta as presented above is >0.29m^3/sec at average. With Poulnasherry Bay having an estimated volume of 50,000m^3, which is tidally refreshed by the Shannon at a flow rate of 300m^3/sec, a flow rate of >0.29m^3/sec entering Bay would be massively diluted. Without mitigation in place there would only be a slight to moderate short-term significant effect.

With mitigation rigorously enforced, as outlined in **Chapter 2: Project Description**, **Appendix 2.1** (i.e., CEMP, SWMP) and **Chapter 9: Hydrology and Hydrogeology**, it can be concluded there would not be any significant effects on the designated shellfish water body as a result of the proposed wind farm project.

7.4.3 Operational Phase Potential Effects

The applicant is applying for a 35-year operational lifespan for the proposed Development. During the operational phase, it is not likely that there will be a significant effect on the surrounding aquatic environment due to the cessation of construction activities during this time. It is unlikely there is any risk for pollutants entering the watercourses during the operation phase from potential peat slippage, because as outlined in Appendix 8.1 ("Ballykett Windfarm (BWF), Site Investigation by Peat Probing and Peat Stability Risk Assessment Report" March 2023), there is no record of slope stability issues on Site and the Peat stability Factor of Safety (FoS) is acceptable across the Site. There is the potential for adverse effects during maintenance events at the turbine site or GCR, during which the risks would be similar to the construction phase such as water quality degradation and eutrophication from the release of suspended solids.

7.4.4 Decommissioning Phase Potential Effects

The Decommissioning phase poses similar risks of potential significant effects on the aquatic environment as listed above the construction phase, with the risk of pollution in the waterways causing a reduction in biodiversity of flora and fauna, especially the more sensitive species. Though in view of the presence of the road network and associated infrastructure, the resultant scale of effects is considered to be much lower. After 35 years the site will be revegetated and natural drainage management will be resumed, it is not expected that the Decommissioning phase will disturb this. In the absence of mitigation, the potential effect on the aquatic environment is considered much the same as the construction phase, due to the same potential sources to cause a significant short-term adverse effect at the local scale.

7.4.5 Effects on Natura 2000 Sites

Effects of the construction, operational and decommissioning phases on Natura 2000 sites within the ZOI are outlined in the accompanying NIS document. These are based on the connection of the Site to the Natura 2000 sites via watercourses.

7.5 MITIGATION MEASURES

7.5.1 Embedded Mitigation

The proposed Development incorporates embedded mitigation aimed at minimising the potential significant effects during the design phase. This includes the design principle of maintaining set-backs of 50m for turbines and associated infrastructure from watercourses (IWEA, 2012) and utilising existing forestry access tracks where feasible.

7.5.2 Construction Phase Mitigation

7.5.2.1 Mitigation by Avoidance

The greatest risk of significant adverse effects on the aquatic environment will occur during the construction phase of the development. The key to minimising this risk is the siting of all turbine locations and other key infrastructure at a minimum set-back of 50m from watercourses, following best practice guideline of the Irish Wind Energy Authority (IWEA, 2012). In designing the layout of the access tracks careful consideration has been given to minimise the number of watercourse crossings, and in choosing locations where crossing design can readily achieve the objective of maintaining the potential for unimpeded fish pass and ecological connectivity. The layout has also avoided any interference with existing hydrology on the Site and maintains surface water flow networks through the use of cross drains on access tracks.

7.5.2.2 Mitigation by Design

A comprehensive suite of drainage measures has been developed to protect all receiving waters from potential significant effects during the construction of the Development in the catchment, and along the proposed TDR. They are outlined in full in **Chapter 9: Hydrology and Hydrogeology** and are also referenced in the accompanying NIS document. These measures are aimed at preventing sediments or other pollutants from entering watercourses through the containment and treatment of all surface water run-off from areas of works. An Ecological Clerk of Works (ECoW) will be appointed to ensure compliance during the construction stage with all mitigation measures, planning conditions and legislative requirements related to ecology.

The mitigation measures have been incorporated into a Construction and Environmental Management Plan (CEMP) in Appendix 2.1 of the EIAR, for the development which includes construction method statements for key works. The CEMP includes a Surface Water Management Plan (SWMP). The CEMP and SWMP will require mandatory adherence by all parties involved in the construction of the Development (including any sub-contractors) in order to protect aquatic conservation interests within the Study Area. The development of the mitigation measures and all method statements for watercourse crossings follows all relevant guidance and current best practice as detailed in:

- CIRIA (2001). *Control of water pollution from construction sites - Guidance for consultants and contractors (C532)*. Construction Industry Research and Information Association, London.
- CIRIA (2019). *Culvert, screen and outfall manual (C786).* Construction Industry Research and Information Association, London.
- DHPLG (2019). *Draft Revised Wind Energy Development Guidelines*. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). *Best Practice Guide (BPGCS005) Oil storage guidelines*.
- IFI (2016). *Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters.* Inland Fisheries Ireland, Dublin.
- IWEA (2012). *Best Practice Guidelines for the Irish Wind Energy Industry*. Guidance prepared by Fehily Timoney & Company for the Irish Wind Energy Association.

- Kilfeather, P.K. (2007). *Maintenance and protection of the Inland Fisheries resource during road construction and improvement works*. Southern Regional Fisheries Board.
- Murphy, D.F. (2004). *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites.* Eastern Regional Fisheries Board.
- NRA (2008). *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*. National Roads Authority.
- SNH (2019). *Good Practice during Wind Farm Construction (4th edition).* Scottish Natural Heritage.

All turbine locations are located a minimum of 50m from the nearest watercourse, while the borrow pit location is over 500m from the nearest watercourse. No works will take place within a 65m buffer zone of watercourses except for the clear span and culverts on the seven watercourse crossings on the access track network.

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

Minimise → *Intercept* → *Treat* → *Disperse* → *Dilute*

Surface water management measures, including the installation of silt fencing and delineation of buffers will be put in place in advance of the development of the internal road network. All other measures including the following key elements which are described in detail within the Surface Water Management Plan (Appendix 2.1):

- Open constructed drains for development run-off collection and treatment.
- Collection drains for upslope "clean" water collection and dispersion.
- Filtration check dams to reduce velocities along sections of road which run perpendicular to contours.
- Settlement ponds, settlement lagoons and buffered outfalls to control and store development runoff to encourage settlement prior to discharge at greenfield runoff rates.

There will be no direct site run-off to watercourses during the construction phase with all outflows from drainage via settlement ponds from which treated surface water is released by diffuse overland flow at appropriate locations. To reduce the amount of silt laden water to be treated, clean water drains will be created upstream of the works area to divert water away from construction areas, thereby lessening the volume of water to be treated onsite. This will reduce the risk of suspended solids or dissolved substances entering the watercourses.

Dewatering flow rate or pumping rate will be controlled by an inline gate valve or similar infrastructure. This will facilitate reduction of loading on the receiving drainage and attenuation network, thus enhancing the attenuation and settlement of suspended solids. All pumped water will be discharged to constructed drainage and in line treatment train or to a vegetated surface through a silt bag outside of surface water buffer zones. Dewatering is a dynamic process and will require continuous monitoring and modification depending on conditions encountered.

There will be no instream works undertaken and no tracking of machinery across any watercourse. All machinery will stay within designated routes (working corridor) within the Site Boundary. To protect any known ecological features that occur close to the planned infrastructure, a delineated working corridor will be employed throughout the construction. Posts and tape will be used to establish these areas and thus prevent the entry of Contractors' plant outside the working corridor during construction works. Locations of ecological significance or where invasive species are identified will also be fenced off.

This will also include preparatory work in the vicinity of all watercourses and all riverbank works. Method statements for watercourse crossings will be prepared at the construction stage and submitted to Inland Fisheries Ireland for prior approval. All banksides in the vicinity of the new crossings will be fully reinstated with vegetation cover as quickly as possible using only native species appropriate to the existing environment.

The risk of landslides occurring on the Site as a result of the proposed Development has been assessed by RSK ("Ballykett Windfarm (BWF), Site Investigation by Peat Probing and Peat Stability Risk Assessment Report", March 2023). The Development will avoid areas classified as having high stability risk per this [RSK] report or the GSI Landslide Susceptibility model. Furthermore, any potential effects to hydrogeological conditions at high-risk areas will be avoided.

For abnormal load deliveries on the TDR, steel plates are to be placed along the road in ecologically sensitive areas (where the route traverses any watercourses), resting against the existing carriage way and supported on the verge by sandbags. This includes all three TDR river crossings (i.e., the GOWERHASS TULLAGOWER, and BRISLA EAST stream) outlined in **Figure 7.3**. These steel plates will be placed on 10 metres each side of the water courses. An Ecological Clerk of Works ("ECoW") will be employed from the commencement to completion of construction works and will be onsite to oversee the crossings of the watercourses during the turbine deliveries. The steel plates will only be in use for the duration of the turbine delivery as outlined in Appendix 16.2 (Traffic Management Plan) and will be removed afterwards leaving no significant effect on the surrounding area. This approach for crossing the Tullagower stream at this part of the Doonbeg catchment for turbine delivery will have no physical effect on the watercourses and the potential for effects on the Freshwater Pearl Mussels in the lower Doonbeg catchment is negligible.

7.5.2.3 Mitigation by Reduction

The specified measures detailed below are aimed at protection of instream aquatic biota within the vicinity of any proposed works at watercourses on the Site but equally with regards to the protection of the downstream population of Freshwater pearl mussel and salmonids. These measures are a summary of the principal requirements with full detail being presented in **Chapter 9: Hydrogeology and Hydrology**, which are transposed into the Construction Environmental Management Plan. The accompanying NIS deals with the hydrologically linked Natura 2000 sites.

During the construction phase the appointed contractor(s) will ensure that the following mitigation is adhered to in line with IFI (2016) *Guidelines on Protection of Fisheries during* Construction Works in and Adjacent to Waters:

- No works will take place within the 50m buffer zone of watercourses except for the watercourse crossing, road development and drainage measures as detailed on the **Appendix 2.1** CEMP.
- The Temporary Constriction Compound and any temporary soil storage areas will be located at a minimum distance of 50m from any watercourse. All drainage from these facilities will be directed through a settlement pond with appropriate capacity and measures to provide spill containment.
- All site drainage, as described in the Surface Water Management Plan and shown on associated drawings, will be directed through either sediment traps, settlement ponds and/or buffered drainage outfalls to ensure that total suspended solid levels in all waters discharging to any watercourse will not exceed 25mg/l (IFI, 2016). All construction site run-off will be channelled through a stilling process to allow

suspended solids to settle out and through a spill-containment facility prior to discharge.

- Daily monitoring of all sediment traps and settlement ponds will be undertaken by the Environmental Manager or Ecological Clerk of Works to ensure satisfactory operation and/or maintenance requirements. A full specification for the water quality monitoring is presented in the WQMP.
- The storage of oils, hydraulic fluids, etc., will be undertaken in accordance with current best practice for oil storage (Enterprise Ireland, BPGCS005).
- All machinery operating at the Site will be fully maintained and routinely checked to ensure no leakage of oils or lubricants occurs. All fuelling of machinery will be undertaken at a discrete "fuel station" designated for the purpose of safe fuel storage and fuel transfer to vehicles.
- Any extensions to existing drainage culverts on the Site Access Roads will be undertaken in dry conditions and in low flow.
- During the culvert installation and associated construction work, double silt fences shall be installed immediately downgradient and downstream of the construction area for the duration of the construction phase.
- The pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents, etc., will be completed in the dry to avoid pollution of the freshwater environment (see **Chapter 9** for further details). There will be no batching or storage of cement allowed in the vicinity of any watercourse crossing construction area.
- Procedures (as detailed in **Chapter 9: Hydrology and Hydrogeology**) will be put in place to ensure the full control of raw or uncured waste concrete to ensure that watercourses will not be affected.
- Should there be any incidents of pollution to watercourses, immediate steps as specified in the Emergency Response Plan in the CEMP will be undertaken to resolve the cause of the pollution and where feasible, mitigate against the effect of pollution.
- Re-seeding / re-vegetation of all areas of bare ground or the placement of geo-jute (or similar) matting will take place prior to the operational phase to prevent silt-laden run-off. Seed mixes will contain only suitable native species of plant that occur in the local area.
- Silt traps erected during the construction phase within roadside and artificial drainage will be replaced with stone check dams for the lifetime of the project. These stone check dams will only be placed within artificial drainage systems such as roadside drains and not in natural streams or drainage lines.

- A full review of construction stage temporary drainage will be undertaken by the Developer (in conjunction with the Project Hydrologist/ Site Engineer and the Project Ecologist) following the completion of construction, and drainage removed or appropriately blocked where this will not interfere with infrastructure.

7.5.3 Operational Phase Mitigation

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

- The Site compound / office will house all potential pollutants within a secure bunded COSSH store for the operational phase of the project.
- All onsite wastewaters will be removed by tanker to an off-site licensed WWTP facility to prevent nutrient loading entering aquatic environments.

7.5.4 Decommissioning Phase Mitigation

Decommissioning of the Development will be scheduled to take place after the proposed 35- year lifespan has expired. Decommissioning phase effects for the Development are likely to be broadly similar to construction phase effects, in terms of potential surface water quality effects from ground disturbance, refuelling and the storage of potentially hazardous materials onsite. The implementation of all mitigation measures detailed for the construction phase will be adopted in full during the Decommissioning phase to ensure all such significant effects are avoided.

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

Restoration of the Site following Decommissioning of infrastructure will require the prior establishment of the new baseline conditions at the Site which will have developed over the intervening 35-year life of the Project.

These studies will inform any modification or additional sensitivities that may need to be factored in restoration and site-specific measures.

7.6 RESIDUAL EFFECTS OF THE DEVELOPMENT

The clear span watercourse crossing will result in no loss of instream habitat. The design of the clear span crossings will ensure no impediment to movement of fish or other aquatic biota. See **Chapter 2: Project design** for further details.

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

Steel plates placed along the turbine delivery route will be removed after deliveries are complete, leaving no residual effect.

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

7.7 MONITORING

In order to verify the efficacy of pollution prevention and mitigation works during construction, water quality monitoring will be undertaken prior to, during and post completion of construction works. Monitoring will be undertaken in watercourses within the catchment as outlined in the CEMP, and in compliance with any potential conditions of planning consent. Monitoring will be overseen by a qualified and experienced Environmental Manager or Ecological Clerk of Works.

The specific monitoring requirements including frequency and parameters, are detailed in the **Chapter 9: Hydrogeology and Hydrology**.

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

7.7.1 Construction Phase Monitoring

- During the construction phase daily inspection of silt traps, settlement ponds, buffered outfalls and drainage channels will be undertaken. Routine measurement of total suspended solids, electrical conductivity, pH, and water temperature at selected water monitoring locations at the Site will be carried out. Monitoring of locations where excavations are being dewatered (likely high in solids) will be done in real time.
- Daily monitoring of excavations by the Geotechnical Engineer will occur during the construction phase. If high levels of seepage inflow occur, excavation work will immediately be stopped, and a geotechnical assessment undertaken.
- During the construction phase of the project, the development areas will be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system so that it does not become blocked, eroded or damaged during the construction process.
- An Ecological Clerk of Works ("ECoW") with an appropriate level of experience relevant to aquatic ecology will be present to supervise the water crossings during the strengthening works along the turbine delivery route. This approach for crossing the Tullagower stream at this part of the Doonbeg catchment for turbine delivery will not make any direct or indirect contact with the watercourses and potential for effects on the freshwater pearl mussels in the lower Doonbeg catchment are considered to be negligible.

7.7.2 Post-construction phase monitoring

- During the operational phase of the project the stilling ponds and buffered outfalls will be periodically inspected during maintenance visits to the Site.
- Water monitoring on nearby natural watercourses will be undertaken during and post construction to determine if any pollution has migrated off-site, and if so, measures will be implemented to rectify the impact, as agreed with relevant statutory agencies (e.g. Inland Fisheries Ireland (IFI)).

7.8 CUMULATIVE OR IN-COMBINATION EFFECTS

The Habitats Directive requires competent authorities to make an Appropriate Assessment of any plan or project which is likely to have a significant effect alone or in-combination with other plans and projects.

There are currently 17 operational and proposed wind farms within a 20km radius of the Site (see **Appendix 1.2**). The closest wind farms in operation are Moanmore Wind

Farm (7 turbines), located approximately 1.31km to the northwest of the Site and Tullabrack Wind Farm (6 turbines), located approximately 1.52km west of the Site. The closest proposed windfarm is Moanmore South, with 3 proposed wind turbines, located 3.27km from the Site. The remaining 14 wind farms are located at distances ranging from 5.47km to 18.08km from the Site.

There is the potential for cumulative adverse effects to the Moyasta river due to the proposed construction of a second, three turbine wind farms located downstream from the Ballykett site at Moanmore. The Moyasta River is ecologically connected to two Natura 2000 sites, The Lower River Shannon SAC (site code: IE002165) and the River Shannon and River Fergus Estuaries SPA (site code: IE004077). The Moyasta river is also classified as 'Moderate' status under the Water Framework Directive (WFD). The potential for indirect adverse effects to the downstream Natura 2000 sites, or a reduction in water quality in the Moyasta river is most likely limited to the construction phase of the project and can be managed by implementing the proposed mitigation measures.

The development has the potential to add to the cumulative nature of adverse effects within the watercourses in the area. The Water Framework Directive has categorised the surface waters in the area as 'Moderate' and the potential adverse cumulative effects would be short-term of the duration of construction on the Project. If pollution from contaminants were to occur during the Project, there is a potential to temporarily effect surface waterbodies in the catchment on a cumulative level. However, the mitigation measures outlined above, and detailed in Chapter 9 and Appendix 2.1 of this EIAR, can reduce any potential effect to acceptable or imperceptible levels. Therefore, the proposed Development is considered unlikely to significantly contribute to cumulative effects in terms of water quality.

A list of all other proposed or permitted developments larger than a once-off house within 10km of the proposed Ballykett Wind Farm Site are listed in Table 2.2 of **Chapter 2** in this EIAR. Each of these projects have been thoroughly assessed by the relevant statutory planning agency for environmental and ecological impacts and where such impacts are identified mitigation has been incorporated into the planning. This along with the mitigation in place for this project should result in slight to imperceptible effects in-combination.

7.9 SUMMARY OF SIGNIFICANT EFFECTS

The sources for potential adverse significant short-term environmental effects of the construction, operational and decommissioning phases have been identified as listed above in **Section 7.4.** These sources have the potential to lead to a decrease in local biodiversity of flora and fauna in the watercourses surveyed, especially with respect to any more sensitive species present. However, as the baseline surveys did not find any sensitive fauna present in the watercourses, this is unlikely. There is also a potential of loss of natural watercourses due to watercourse crossings and the placement of bridges, however, total loss of natural watercourses is considered to be very unlikely. The proposed wind farm Development is likely to cause significant, adverse, short-term effects on the aquatic environment at the local scale in the absence of mitigation. Additionally with mitigation measures in place along the turbine delivery route, significant effects on the watercourses to be crossed upstream of Doonbeg FPM sites is unlikely. Any cumulative or in-combination effects to Natura 2000 sites within the ZoI, have been ruled out with the proposed mitigation in place, in the accompanying NIS.

7.10 STATEMENT OF SIGNIFICANCE

There is deemed to be a potential for adverse significant short-term environmental effects from the project, as listed above. However, it is considered that with the proposed mitigation (outlined in **Section 7.5** and the accompanying Chapters 2 & 9 of the EIAR) successfully implemented, the proposed wind farm Development will result in an overall negligible to low significance residual effect upon the aquatic ecological features that lie within the Zone of Influence for the duration of the construction, operational and decommissioning phases.

7.11 REFERENCES

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8 SOILS AND GEOLOGY

8.1 INTRODUCTION

This chapter assesses the effects of the proposed Project on the soils and geology environment of the Site. This includes all elements within the Redline Boundary, the wind turbines, Electrical Substation, site access tracks, Turbine Hardstands and all site infrastructure, the proposed Grid Connection Route (GCR) and part of the Turbine Delivery Route (TDR) where road realignment works are necessary. Where adverse effects are predicted, the chapter identifies appropriate mitigation strategies therein. The assessment will consider the potential effects during the following phases of the Project:

- Construction Phase
- Operation Phase
- Decommissioning Phase (final phase)

The Project refers to all elements of the application for the construction and operation of the proposed Ballykett Wind Farm (**EIAR Chapter 2: Project Description**).

This chapter of the EIAR is supported by Figures provided in **Volume III:**

- **Figure 8.1a –** Site Location & Layout Wind Farm and Grid Connection Route
- **Figure 8.1b –** Site Location Turbine Delivery Route works
- **Figure 8.2a –** Land Use Wind Farm and Grid Connection Route
- **Figure 8.2b –** Land Use Turbine Delivery Route works
- **Figure 8.3a –** Geology Wind Farm and Grid Connection Route
- **Figure 8.3b –** Geology Turbine Delivery Route works
- **Figure 8.4a –** Soils Wind Farm and Grid Connection Route
- **Figure 8.4b –** Soils Turbine Delivery Route works
- **Figure 8.5a –** Subsoils Wind Farm and Grid Connection Route
- **Figure 8.5b –** Subsoils Turbine Delivery Route works
- **Figure 8.6a –** Landslide Risk & Events Wind Farm and Grid Connection Route
- **Figure 8.6b –** Landslide Risk and Events Turbine Delivery Route works

And by the following Appendix document provided in Volume IV of this EIAR:

- **Appendix 8.1 –** Site Investigation & Stability Risk Assessment
- **Appendix 8.1 –** App A - Peat Map
- **Appendix 8.1 –** App B(a) - Peat Database
- **Appendix 8.1 –** App B(b) - Risk Matrices
- **Appendix 8.1 –** App B(c) – Peat log
- **Appendix 8.1 –** App C(a) – Factor of Safety Map
- **Appendix 8.1 –** App C(b) – Risk Ranking Map

- **Appendix 8.2 –** Baseline Database – Grid Connection Route
- **Appendix 8.3 –** Baseline Database – Turbine Delivery Route works

A Construction Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. This document will be developed into a site-specific Ballykett Wind Farm CEMP post consent / pre-construction once a contractor has been appointed. The CEMP will cover the construction of the Project. It will include all of the mitigation recommended within the EIAR. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

8.1.1 Assessment Structure

In line with the EIA Directive (Directive 2014/52/EU) and current EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (2022), the structure of this Soils and Geology chapter is as follows:

- Details of the assessment methodology utilised for desk and field studies, in the context of legal and planning frameworks.
- Description of baseline conditions at the Site.
- Identification and assessment of effects to soils and geology associated with the Project, during the construction, operational and Decommissioning phases of the Project.
- Mitigation measures to avoid or reduce the effects identified.
- Identification and assessment of residual impact of the project considering mitigation measures.
- Identification and assessment of cumulative effects, if and where applicable.

8.1.2 Project Description

8.1.2.1 Wind Farm Site

Planning permission is being sought by the Developer for the construction of 4 no. wind turbines, permanent Met Mast, Electrical Substation and all ancillary works.

The Project (**Figure 8.1a**) will consist of the following main components:

- Erection of 4 no. 4-5MW wind turbines with an overall ground to blade tip height of 150m. The candidate wind turbine will have a rotor diameter of 136m and a hub height of 82m.
- Construction of site access tracks, Turbine Hardstand areas and Turbine Foundations.
- Construction of new site entrance with access onto the adjoining local road network (L6132).

- Construction of one no. Temporary Construction Compound with associated temporary site offices, parking areas and security fencing
- Installation of 1 no. permanent Met Mast of 82m overall height.
- Construction of new internal site access tracks and upgrade of existing site track, to include all associated drainage including new clear span bridge crossing of the Moyasta 27_010 watercourse.
- Development of a site drainage network.
- Construction of 1 no. Electrical Substation.
- 2. no permanent spoil storage areas.
- All Wind Farm Internal Cabling connecting the wind turbines to the Electrical Substation.
- Ancillary forestry felling to facilitate construction of the Development.
- All works associated to facilitate the permanent connection of the wind farm to the national electricity grid comprising a 38kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation and to the existing Tullabrack 110kV ESBN Substation.
- Vertical realignment of an existing crest curve on the L6132 local road in order to prevent grounding of abnormal load vehicles during delivery of turbine components.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.

The EIAR assesses the Project which includes the Development as outlined above; it includes improvements and temporary modifications to the existing public road infrastructure to facilitate delivery of abnormal loads and turbine delivery.

8.1.2.2 Turbine Delivery Route

It has been proposed that the turbine nacelle, towers, hubs and rotor blades will be landed at the port of Foynes. Co. Limerick. From there, they will be transported to the Site via the N69 to the outskirts of Limerick city. Turbine blades may be carried from Foynes Port to the delivery site via the Shannon Tunnel (N18) but the larger / wider tower sections and generator / nacelle components will need to remain on the N69 via Dock road in Limerick City and cross the Shannon bridge unto Condell Road (R527) and Ennis Road (R445), and join the N18 in the Ennis / Galway direction as far as Junction 12 of the N18 to join the N85 Ennis Distributor Road. After accessing the N85 distributor road the Turbine Delivery Route will access the N68 in the direction of Kilrush and then onto the L6132 east to the new site entrance 450 metres east of Tullabrack Cross.

Road widening between Tullybrack Cross and the wind farm site entrance will be carried out to accommodate increased volumes of HGV vehicles associated with the construction of the wind farm. The road widening and verge strengthening are temporary works. The vertical realignment works are permanent (**Figure 8.1b**).

All works along the TDR are assessed in **Chapter 16 Traffic and Transport** and shown on drawings attached as **Appendix 16.1**.

8.1.2.3 Grid Route

The proposed Grid Connection route for the Project is a 1.84km underground cable connection to Tullabrack 110kV substation **(Figure 8.1b**). The Grid Connection route assessment report carried out by BFA Consulting can be found in **Appendix 2.2**. The Grid Connection route considered can be summarised as follows:

- A single underground cable in permanent cable ducts from the proposed, permanent, on-site substation to the existing Tullabrack 110kV ESBN Substation.

8.1.2.4 Cable Joint Bays

Joint bays are pre-cast concrete chambers where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay will typically be 6m long x 2.5m wide x 2.3m deep, pre-cast, reinforced, concrete structures installed below finished ground level. It is envisioned that joint bays will be located in the non-wheel and weight bearing strip of roadways, however given the narrow profile of some local roads this may not always be possible.

8.1.2.5 Watercourse Crossings

There are no watercourse crossings along the grid connection route to the Tullabrack 110kV substation.

8.1.3 Statement of Authority

RSK (Ireland) Ltd. (RSK), part of RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological and other environmental disciplines. The company and group provide consultancy to clients in both the public & private sectors. More information can be found at www.rskgroup.com. RSK was commissioned by Jennings O'Donovan on behalf of their Client, Greensource, to carry out this Environmental Impact Assessment Report. The principal members of the EIA team involved in this assessment include the following persons:

- Sven Klinkenbergh – B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection) –Principal Environmental Consultant, Project Manager and EIA Lead

Author with c. 10 years industry experience in the preparation of hydrological and hydrogeological reports.

- Project Scientist: Jayne Stephens - B.S.c (Environmental Science), PhD (Environmental and Infection Microbiology). Jayne is an Environmental consultant with c. 5 years' experience working in microbiology, water, and environmental disciplines. She graduated with a BSc in Environmental Science from National University of Ireland Galway in 2014, majoring in mammal ecology. Following this, Jayne was the successful Irish applicant to the Tropical Biological Association in Cambridge to complete a field course in tropical biodiversity and conservation in Tanzania. She holds a PhD in environmental microbiology, graduating in 2023. Jayne has worked on a large number of bathing water and surface water monitoring investigations, on project Acclimatize, an EU funded project which aimed to bridge the knowledge gap in relation to at-risk urban and rural bathing waters in Ireland and Wales. During this project, Jayne was team lead for site investigations and has a number of years' experience on microbial contamination and public involvement projects for better water quality.
- Lissa Colleen McClung - B.Sc. Environmental Studies (hons.), M.Sc. Environmental Science (hons.). Current Role: Graduate Project Scientist. Colleen has recently joined RSK Ireland as a Graduate Project Scientist under the Hydrology & Hydrogeology and Land, Soils & Geology Team. After attaining an MSc in Environmental Science, with 1.1 First Class Honours, from Trinity College Dublin in 2021. Since coming on board, Colleen has worked on a variety of projects for urban residential development schemes and renewable energy. As a Project Scientist, Colleen has undertaken technical report writing in many forms, such as: Flood Risk Assessments (Stage 1 and Stage 2) (ROI), Drainage Assessments (NI), Water Framework Directive Assessments, Environmental Impact Assessment Reports (ROI) and Environmental Statements (NI). She has also carried out extensive field work around the country. Key capabilities include preparation of Environmental Impact Assessment Reports and running software such as QGIS, Python and Matlab coding languages.
- Mairéad Duffy- B.Sc. Environmental Management, M.Sc. Climate Change. Current Role: Graduate Project Scientist. Mairead has experience in technical report writing of Flood Risk Assessments (Stage 1 and Stage 2) (ROI), Drainage Assessments (NI), and field work surveying of hydrological (surface water sampling) and geological elements of the environment with associated proposed green energy projects around the country.
- Deirdre Walsh – B.Sc. (Geology), M.Sc. (Geoscience), PhD (Geomodelling). Current Role: Environmental Consultant. Deirdre has a background in exploration geology (c. 2 years) and geoscience research (c. 8 years). Since joining RSK Ireland, Deirdre has

worked on a variety of projects from renewable energy to urban developments, preparing Environmental Impact Assessment Report chapters and Stability Risk Assessments.

8.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

8.2.1 Assessment Methodology

The following assessments were undertaken in order to evaluate the potential effects of the Project on the soils, geology and ground stability aspects of the environment at the Site, the Grid Connection route and the Turbine Delivery Route:

- Characterise the topographical, geological and geomorphological regime of the Site, the preferred Grid Connection and the preferred Turbine Delivery Route from the data acquired through desk study and onsite surveys.
- Consider ground stability issues as a result of the Project, its design and methodology of construction.
- Assess the combined data acquired and evaluate any likely effects on the soils, geology and ground stability aspects of the environment.
- If effects are identified, consider measures that would prevent, mitigate or reduce the identified effects.
- Present and report these findings in a clear and logical format that complies with EIAR reporting requirements.

8.2.2 Assessment Principles

Direct impacts or effects on geological attributes or soils themselves are localised in the context of soils and geology (e.g., excavated soils from holes, stored and used as back fill). However, in many instances, these geological impacts give rise to the potential sources of contamination by water run off (i.e., indirect or secondary impacts) to ecological and hydrological receptors. For example: Contamination of soils / peat by cementitious material is considered a localised impact, however if cementitious contamination is intercepted by surface water features or groundwater bodies the impact is potentially regional depending in the environmental circumstances. Therefore, throughout this report references will be made to **Chapter 9: Hydrology and Hydrogeology**, for further detail and clarification on potential effects and mitigation measures of the Project.

8.2.3 Relevant Legislation and Guidance

This assessment complies with the European Directive 2014/52/EU which requires Environmental Impact Assessment for certain types of major development before development consent is granted. This assessment was undertaken in accordance with the following Irish legislation (transposition of the aforementioned directive):

- SI No.600 of 2001 as amended: Planning and Development Regulations 2001-23.

In addition to this planning legislation, environmental legislation relevant to geological, geotechnical, hydrological and hydrogeological aspects of the environment were referred to, such as:

- Planning and Development Act 2000 (as amended) (e.g. Sections 212 (1) f; Part IV, 6; Fifth Schedule Condition 21).
- Planning and Development Regulations 2001 (as amended),
- The Heritage Act 1995 (as amended),
- The Wildlife Acts, 2000-2022.

The Clare County Development Plan (2023-2029) County Development Plan- i.e., Clare Wind Energy Strategy, were also consulted as part of the EIA process.

This assessment has been prepared using, inter alia, the following guidance documents, which take account of the aforementioned legislation and policy:

- BSI (1999) Code of Practice for Site Investigations - BS 5930
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance
- DHPLG (2017) Interim Guidelines for Planning Authorities on Statutory Plans, Renewable Energy and Climate Change and Wind Energy Development Guidelines 2006
- Department of Housing, Planning and Local Government (2020) Draft Revised Wind Energy Guidelines
- European Commission (EC) (2021) EU Soil Strategy for 2030
- EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports
- Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Impact Statements – A Guide
- IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements
- Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry
- National Roads Authority (NRA) (2008) Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes
- NPWS (2015) National Peatlands Strategy

- NPWS (2017) Best practice in raised bog restoration in Ireland
- NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1
- NRA (2014) Guidelines for the Management of Waste from National Road Construction Projects
- Scottish Forestry Commission (2006) "Guidelines for the Risk Management of Peat Slips on the Construction of Low Volume / Low Cost Roads Over Peat"
- Scottish Government (2017) Peat Landslide Hazard and Risk Assessment: Best Practice Guide for Proposed Electricity Generation Developments
- Scottish National Heritage (SNH) (2013) A Handbook on Environmental Impact Assessment.

8.2.4 Study Area

The study area is any land, soils and geology underlying the Site and the area directly adjacent to the site. The study area for the assessment of geology extends to a wider area in order to assess the large-scale structure and additionally considerations for stability assessments.

Constraints in the wider area outside of the Site such as SACs, SPAs, NHAs, surface water bodies, springs wells etc were mapped with hydrology and hydrogeology considered at the catchment and aquifer scale.

8.2.5 Desk Study

Desktop assessments were undertaken on the soils and geology aspects of the proposed Project before and after field investigations. This involved the following components:

- Acquisition and compilation of all available and relevant maps of the Project.
- Study and assessment of the proposed locations of turbines and Site access roads tracks and Onsite Substation relative to available data on Site topography and slope gradients.
- Study and assessment of the proposed locations of turbines, Turbine Delivery Route, site access tracks, onsite substation and Grid Connection route connecting the Proposed project to the national grid and associated infrastructure (e.g., typical drainage infrastructure) relative to available data on soils, subsoil and bedrock geology.
- Study of geospatial data obtained from various sources including; Environmental Protection Agency (EPA), Geological Survey Ireland (GSI), Teagasc, Ordinance Survey Ireland (OSi), National Parks and Wildlife (NPWS) overlain with the development plan drawings using a Geographic Information System (GIS). Data was assessed at a regional, local and site-specific scale.

- Additional data was obtained and assessed where relevant, for example, rain data obtained from Met Eireann, and river discharge rates and synoptic data sets obtained from the EPA.

8.2.6 Field Work

8.2.6.1 Preliminary Geotechnical Investigations, Site Walk Over and Observations

EIA team personnel carried out field investigations at the site of the Project during the months of June, August, September and October 2022 and November 2023. These works consisted of the following:

- Bedrock and mineral subsoil outcrop logging and characterisation.
- Confirm if peat is present at or near any proposed Project locations.
- Peat depth probing where peat is present (depth to bedrock and/or competent subsoil).
- Slope measurements at all proposed turbine locations to determine slope gradient.
- Recording of GPS co-ordinates for all investigation and monitoring points in the study.
- Digital photography of significant features.

Site walk overs were carried out to assess general ground conditions including topographical characteristics, potential for peat and to observe the existing site including visual assessment of the receiving environment in terms of effects arising from the existing infrastructure and practices at the Site.

8.2.7 Evaluation of Potential Effects

In line with relevant guidelines (EPA, 2022), and consideration of the criteria listed in Annex III of the Directive 2014/52/EU of the European Parliament and the council of April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, effects should be described by reference to the individual environmental factors and their sensitivities;

a) the **magnitude** and **spatial extent** of the effect (for example geographical area and size of the population likely to be affected);
b) the **nature** of the effect;
c) the **transboundary nature** of the effect;
d) the **intensity** and **complexity** of the effect;
e) the **probability** of the effect;
f) the **expected onset, duration, frequency** and **reversibility** of the effect;
g) the **cumulation** of the effect with the impact of other existing and/or approved projects;
h) the **possibility of effectively reducing the impact**.

8.2.7.1 *Sensitivity*

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed Development (EPA, 2022). The EPA provides guidance on the assessment methodology, including defining general descriptive terms in relation to magnitude of effects however, in terms of qualifying significance of the receiving environment the EPA guidance also states that:

"The value of the superficial/ solid geology should be identified to allow an assessment of the impact of the proposed Development to be considered adequately" (EPA, 2015)

Potential effects arising from a Development in terms of soils and geology will be limited to a localised scale, and therefore in describing the sensitivity of soils and geology it is appropriate to rate such effects while considering the sensitivity value of the receiving environment or site attributes. To facilitate the qualification of geological attributes, guidance specific to land and soils as set out by National Roads Authority (NRA), and guidance specific to landscape as set out by Scottish National Heritage (SNH) has been used in conjunction with EPA guidance.

The following table (**Table 8.1**) presents rated categories and criteria for rating Site attributes (NRA, 2008).

Table 8.1: Criteria for rating site attributes – soils and geology specific

Importance	Criteria
Extremely High	Attribute has a high quality or value on an international scale.
Very High	Attribute has a high quality, significance or value on a regional or national scale.
High	Attribute has a high quality, significance or value on a local scale.
Medium	Attribute has a medium quality, significance or value on a local scale.
Low	Attribute has a low quality, significance or value on a local scale.

The sensitivity of the receiving geological environment is defined by the baseline quality of geological environment, as well as its potential the environment has to absorb potential change and for substitution Considering the above categories of rating importance and associated criteria, the following table (**Table 8.2**) presents rated sensitivity categories (SNH, 2018).

Table 8.2: Criteria for rating site sensitivity – landscape character specific

Importance	Criteria
High Sensitivity	Key characteristics and features which contribute significantly to the distinctiveness and character of the landscape character type. Designated landscapes e.g., National Parks, Natural Heritage Areas (NHAs) and Special Areas of Conservation (SACs) and landscapes identified as having low capacity to accommodate proposed form of change, that is, sites with attributes of **Very High Importance**.

Importance	Criteria
Medium Sensitivity	Other characteristics or features of the landscape that contribute to the character of the landscape locally. Locally valued landscapes which are not designated. Landscapes identified as having some tolerance of the proposed change subject to design and mitigation etc., that is, sites with attributes of **Medium to High Importance**.
Low Sensitivity	Landscape characteristics and features that do not make a significant contribution to landscape character or distinctiveness locally, or which are untypical or uncharacteristic of the landscape type. Landscapes identified as being generally tolerant of the proposed change subject to design and mitigation etc, that is, sites with attributes of **Low Importance**.

8.2.7.2 Magnitude

The magnitude of potential effects arising as a product of the Development are defined in accordance with the criteria provided by the EPA, as presented in the following table (**Table 8.3**, EPA, 2022). These descriptive phrases are considered general terms for describing potential effects of the Development, and provide for considering baseline tends, for example, a *Moderate* effect is one which *is consistent with the existing or emerging trends*.

Table 8.3: Describing the magnitude of effects

Magnitude of Effect	Description
Imperceptible	An effect capable of measurement but without noticeable consequences.
Slight	An effect that alters 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 the existing or emerging trends.
Significant	An effect, which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Profound	An effect which obliterates all previous sensitive characteristics.

In terms of soils and geology, magnitude is qualified in line with relevant guidance, as presented in the following table (**Table 8.4**, NRA, 2008). These descriptive phrases are considered development specific terms for describing potential effects of the Development, and do not provide for considering baseline trends and therefore are utilised to qualify effects in terms of weighting effects relative to site attribute importance and scale where applicable.

Table 8.4: Qualifying the magnitude of effect on soil and geological attributes

Magnitude of Impact	Description	Example
Large Adverse	Results in a loss of attribute.	Removal of the majority (>50%) of geological heritage feature.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute.	Removal of part (15-50%) of geological heritage feature.

Magnitude of Impact	Description	Example
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute.	Removal of small part (<15%) of geological heritage feature.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity.	No measurable changes in attributes.
Minor Beneficial	Results in minor improvement of attribute quality.	Minor enhancement of geological heritage feature.
Moderate Beneficial	Results in moderate improvement of attribute quality.	Moderate enhancement of geological heritage feature.
Major Beneficial	Results in major improvement of attribute quality.	Major enhancement of geological heritage feature.

8.2.7.3 Significance Criteria

Considering the above definitions and rating structures associated with sensitivity, attribute importance, and magnitude of potential effects, rating of significant environmental effects is done in accordance with relevant guidance, as presented in the table below which is, in effect, a risk matrix.

This matrix (**Table 8.5**) qualifies the magnitude of potential effects, based on the weighting of these effects in light of their importance and/or sensitivity of the receiving environment. In terms of Soils and Geology, the general terms for describing potential effects (**Table 8.3: Describing the Magnitude of Effects**) are not linked directly with the Development specific terms for qualifying potential effects (**Table 8.4: Qualifying the Magnitude of Impact on Soil and Geological Attributes)** therefore, both descriptive (**Table 8.3**) and qualifying (**Table 8.4**) terms are used in describing potential effects of the Development. This is largely driven by the likely localised characteristic of potential effects arising as a product of the Development in terms of soil and geology, and the separation of land areas based on baseline conditions (**Section 8.4**).

Table 8.5: Weighted rating of significant environmental effects

Sensitivity (Importance of Attribute)	Magnitude of Effect			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant

Sensitivity (Importance of Attribute)	Magnitude of Effect			
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

8.2.8 Scoping Responses and Consultation

Information has been provided by a number of consultee organisations during the assessment, and this is summarised in **Table 8.6**. The response to each point raised by consultees is also presented within the table, demonstrating where the design of the Development has addressed responses to specific issues indicated by respective consultees.

Table 8.6: Scoping responses and consultation

Consultee	Type and Date	Summary of Consultee Response With Relevance to This Chapter	Addressed
National Parks and Wildlife Services (NPWS)	G Pre00240/2022 Proposed Pre Planning Development: Ballykett Green Energy: Request for Scoping Opinion on information to be included in the preparation of an Environmental Impact Assessment (EIA) for Ballykett Wind Farm, Ballykett, Co. Clare 27.10.2022	*(a) The Department is concerned that it appears from the supplied details and the EIA Scoping report that it is not intended to assess the proposed grid connection in the EIA. As the grid connection is required for the wind farm project both the turbine and grid connection proposals need to be assessed together in terms of both EIA/EIS and NIS/AA process to avoid project splitting the grid connection effects aspects of the project from the wind farm effects aspects of the project within the assessment process.* *(b) In general, the EIAR should include sufficient project details so that the full nature and extent of the likely significant effects are clear and assessed fully in relation to, among other things, road design and construction methodology; site drainage details, including settlement ponds; temporary and permanent storage or disposal areas for peat and other materials or wastes arising; extraction sites/borrow pits; and any modifications to roads, bridges or culverts along the entire length of haul routes. Volumes of surplus material arising and of fill required should be calculated.* *(c) The EIAR should give specific consideration to the mobilisation of silt and changes to the stability of soil. The proposed windfarm has the potential for significant changes in patterns of surface water flow and may desiccate underlying soils allowing pathways to open up resulting in subsurface water losses.* *(d) If a Peat Stability Risk Assessment is required it must be considered in light of these occurrences with consideration of climate change predictions (e.g. rainfall level) in the hazard rating and should thoroughly assess risk with regard to change in weather patterns due to climate change such as more frequent and intense storms and rainfall events, increased likelihood and magnitude of river flooding, prolonged periods of dry conditions which may increase the likelihood of unstable peat.* *(e) Potential negative effects on peatland habitats could arise through direct excavation of peatland habitat, drainage effects on adjacent/nearby peatland habitat, habitat fragmentation, exposure of underlying peat, increased risk of erosion, opening up of areas of the habitats to new or increased exploitation or disturbance through the provision of new and upgraded roads, peat slippage, landscaping, side casting, drain installation, excavate storage, sediment disposal etc*	(a) Grid Connection route Options 1-3 are assessed throughout entire report. (b) **Section 8.4.3** and **Section 8.5.2.** Refer also to **EIAR Chapter 9 Hydrology and Hydrogeology** in addition to Surface Water Management Plan **Appendix 2.1.** (c) **Section 8.4.2.2**; Also explained in more detail in **EIAR Chapter 9 Hydrology and** Hydrogeology see also, Surface Water Management Plan **Appendix 2.1.** (d) See Peat Stability Risk Assessment **Appendix 8.1** as well as Ballykett Flood Risk Assessment **Appendix 9.1** and associated Technical Appendices. (e) Potential negative effects outline in **Section 8.4.3,** subsequent mitigation measures outlined in **Section 8.5.2.** Refer also to **EIAR Chapter 6 Biodiversity** (f) **Section 8.5.2.2.4**; Also explained in more detail in **EIAR Chapter 9 Hydrology and Hydrogeology** (g) **EIAR Chapter 9 Hydrology and Hydrogeology** (h) **Sections 8.4.3.3.8 8.5.2.2 and 8.5.2.3.** Refer also to Peat and Spoil Management Plan **Appendix 2.1**

Consultee	Type and Date	Summary of Consultee Response With Relevance to This Chapter	Addressed
		(f) Excavated or exposed peat / soil should not pose any threat to surface waters and water quality. *(g) A detailed site drainage map would be required and should show all existing watercourses, drainage ditches, flushes, lakes or ponds; new drainage ditches; all outfall points to watercourses or lakes; and all settlement ponds. The EIAR would have to demonstrate that the proposed development will not pose any threat to surface waters and associated species. Any impact on water table levels or groundwater flows may impact on wetland sites some distance away. The EIAR should assess cumulative impacts with other plans or projects, if applicable. Where negative impacts are identified suitable mitigation measures should be detailed as appropriate.* *(h) The associated impacts of quarrying or extraction should be included among the considerations at the earliest stages of project planning and design and should be assessed fully in the EIAR. Reinstatement or restoration plans would be required for any quarries or borrow pits on-site and should be included in the EIAR. As with any other part of the development, all borrow pits (existing or proposed) to be used in construction would have to be included within the application area for the proposed development.* *(i) Any tree felling of forested sites should be included as an intrinsic element of the overall development, the impacts and implications of which should be assessed fully in the EIAR. The extent of tree felling should be mapped, and the future use and management of all cleared areas should be specified. The impacts of tree felling on wildlife, habitats and surface waters (e.g. water quality) should be assessed fully, including the risk of Phosphate mobilisation from peat soils as a result of tree clearance and ground disturbance.*	(i) **Sections 8.4.3.1 and 8.5.2.1.** Nutrient loading to receptors covered in **EIAR Chapter 9 Hydrology and Hydrogeology.** The extent of tree felling will be mapped, and the future use and management of all cleared areas will be specified.
Inland Fisheries Ireland (Ireland)	11/10/2022	*IFI have no objection in principle to the proposal as indicated but reserve the right to make further submissions as detail emerges.* *We are concerned about soils, their structure and types around all the turbines, turbine pads, associated access roads and site development. In particular we have general concerns about the stability of the soils and the impact that works on both the turbines and access roads may have either directly or by vibration on the stability of the soils. IFI are particularly concerned where it is proposed to construct wind turbines on peat soils of which there appears to be some in this general area.* *Should works be approved a finalised CEMP must be agreed with Inland Fisheries Ireland before works commence.*	**Section 8.3.7** and **8.3.8** address the risk of landslide and peat stability. Refer to **Appendix 8.1** for the full peat stability risk assessment.

8.3 BASELINE DESCRIPTION

8.3.1 Introduction

An investigation of the existing land, soils and geology characteristics of the Site, TDR and GDR was conducted by undertaking a desk study, consultation with relevant authorities and site-based fieldwork surveys. All data collected has been interpreted to establish the baseline conditions within the Proposed Project and the significance of potential adverse effects have been assessed. These elements are discussed in detail in the following sections.

8.3.2 Site Description

The wind farm Site is situated approximately 3.5km northeast of the town of Kilrush and 3km south-west of Coorraclare village, south-west county Clare. Located within the townlands of Ballykett and Tullabrack East, the Project is situated within an area comprised of agricultural livestock grazing farmland, cutaway bog and conifer forestry plantation.

There are a number of established wind farms in the area, for example, Moanmore Wind Farm, located c.1.3km to the west and Tullabrack Wind Farm, located c.1.5km to the northwest of the Site (refer to **Table 2.1, EIAR Chapter 2 Project description).**

8.3.3 Land Use

Consultation with Corine (2018) Land Use maps (EPA) indicate the landcover at the Site is comprised of '*Transitional woodland scrub'* with a small area of *'Pastures'* (**Figure 8.2a**). The Grid Connection Route traverses land that is classified primarily as '*Pastures'* and borders land use classified as '*Coniferous Forest'* (**Figure 8.2a**).

Along the portion of the Turbine Delivery Route with proposed works most of the land is used for '*pastures*' with some small areas of '*mixed forest*', and '*land principally occupied by agriculture, with significant areas of natural vegetation*' (**Figure 8.2b**).

The wind farm Site is significantly impacted by agricultural practices including extensive land improvement works involving drainage and excavation and manipulation of natural soil profiles or horizons for drainage purposes. For further information on extent of drainage see **EIAR Chapter 9: Hydrology and Hydrogeology.**

8.3.4 Bedrock Geology

There are two mapped (GSI, Bedrock 100k, **Figure 8.3a**) geological formations underlying the wind farm Site, both of which are sandstone and siltstone.

- The Central Clare Group (CCG) – Interbedded sandstone, siltstone & mudstone of variable thicknesses, with snays bed laminated; The group comprises five cyclothems (I to V), of mudstone, siltstone, and sandstone. The basal mudstone is 7-18m thick and laminated. In general, the mudstones are overlain by laminated to massive grey siltstones. This formation underlies the location of T1.
- The Gull Island Formation (CNGULL) - Grey siltstone & sandstone; The formation is dominated by grey siltstones with up to 20% sandstones at the base of the succession, decreasing towards the top. The sandstones are usually graded and exhibit flute casts at their base and ripple marks at the top. This formation underlies the location of T2, T3, T4.

Rock strength is strongly correlated to grain size but is affected by other characteristics such as layering and weathering. Sandstone is considered a relatively fine-grained rock, siltstone is comprised of finer constituents than sandstone.

Consultation with GSI Geotechnical database indicates there is no available data for the underlying formations or in the general area of these Namurian mudstone, sand and siltstones.

The mapped geological formations underlying the c. 1.84km Grid Connection Route (GSI, Bedrock 100k) are presented in **Figure 8.3a** and are the same as those at the wind farm Site which include the sandstone and siltstones of the Central Clare Group and the Gull Island Formation.

The mapped geological formations (GSI, Bedrock 100k, **Figure 8.3b**) underlying the portion of the TDR where works will take place between the Junction of the N68 and L6132 are the same as those at the windfarm. These include the sandstone and siltstones of the Central Clare Group and the Gull Island Formation.

There are no karst features located within or near the vicinity of any elements as part of the proposed Project.

8.3.5 Seismic Activity

The island of Ireland does experience, monitor and record seismic activity, although the magnitude of such occurrences are generally low and do not generally pose a risk to infrastructure or human health. Seismic activity is monitored on an ongoing basis by the Irish National Seismic Network (INSN). Since 1980, a low number of earthquakes of <M5.0

(Richter magnitude scale (M)) have been detected in the Atlantic close to Ireland. Some relatively recent earthquakes detected on or near the mainland of Ireland include:

- An M2.4 earthquake which occurred on 07/04/19, the epicentre for which was located within Donegal Bay, and at a depth of 4km;
- An M2.0 earthquake which occurred on 29/04/19, the epicentre for which was located approximately midway between Donegal Town and Lough Derg, and at 16km depth; and
- An M0.9 earthquake that occurred 20/08/21, the epicentre of which was located near the townlands of Lambstown at a depth of 8km.

Although earthquakes are considered a triggering mechanism for landslides, given the low magnitude experienced in Ireland earthquakes are not considered an important triggering factor in terms of stability risks.

8.3.6 Soils and Subsoils

8.3.6.1 Soils

Consultation with available soil maps (SIS, EPA, Teagasc, **Figure 8.4a**) indicate that the soil type across the site is 'Cutover Peat' (Cut), with a small portion to the south at the Borrow Pit location mapped as 'Acid Shallow Poorly Drained Mineral' (AminSP) and 'Acid Deep Poorly Drained Mineral (AminPD)'.

Consultation with available soil maps (GSI, EPA, Teagasc, **Figure 8.4a**) indicate a number of soil types along the proposed grid connection route. The main soil type is 'Cutover Peat' (Cut) with smaller areas of 'Acid Shallow Well Drained Mineral' (AminSW), 'Acid Shallow Poorly Drained Mineral' (AminSP) and 'Acid Deep Poorly Drained Mineral (AminPD)'.

Consultation with available soil maps (GSI, EPA, Teagasc, **Figure 8.4b**) indicate a number of soil types along the portion of the Turbine Delivery Route between the junction of the N68 and L6132 and the site entrance including 'Cutover/cutaway peat' (Cut), 'Acid Shallow Well Drained Mineral' (AminSW), 'Acid Shallow peaty poorly drained mineral' (AminSRPT), 'Acid Poorly Drained Mineral' (AminPD), 'Acid Poorly Drained Mineral' (AminPD), 'Acid Poorly Drained Mineral Soils with Peaty Topsoil' (AminPDPT), 'Acid Shallow Poorly Drained Mineral' (AminSP).

8.3.6.2 Subsoils

Consultation with available subsoil maps (EPA, **Figure 8.5a**) indicate that the subsoil type across the Site is 'cutover peat' (Cut). At the Borrow Pit and spoil storage area the subsoil is 'Bedrock at Surface' (Rck) and 'Shales and sandstones till (Namurian)' (TPS).

Based on the GSI Groundwater Vulnerability map (GSI 2023; **Figure 9.7a**), the depth to bedrock or subsoil thickness can be inferred for each of the infrastructure units. Across the site the groundwater vulnerability is mapped as 'Moderate' giving an approximate depth of 5- 10m. To the south of T3 towards the borrow pit the vulnerability is mapped a 'High', 'Extreme' and 'Rock at surface' giving a depth to bed rock of 3-5m, 1-3m and <1m respectively.

Consultation with available subsoil maps (EPA, **Figure 8.5a**) indicate that the subsoils along the proposed Grid Connection Route ranges from 'cutover peat' (Cut), 'Sandstone and shale till' (TNSSs), 'Shales and sandstones sands and gravels' (GNSSs), and 'Acidic Esker sands and gravels' (AcEsk).

Based on the GSI Groundwater Vulnerability map (GSI 2023; **Figure 9.7a**), the depth to bedrock or subsoil thickness along the grid connection route is 'Moderate' and 'High' giving depth 5-10m and 3-5m respectively.

Consultation with available subsoil maps (EPA; **Figure 8.5b**) indicate that there is a variety of subsoil underlying the portion of the proposed Turbine Delivery Route between the junction of the N68 and L6132 and the site entrance. These include 'Sandstone and shale till' (TNSSs), 'Shales and sandstones sands and gravels' (GNSSs), 'Cutover peat' (Cut) and 'Rock at or near surface' (Rck).

According to the GSI Groundwater Body Description database, the subsoil thickness within the area of the Kilrush groundwater body range from 1m to over 20m, and generally decrease eastwards. Subsoils are thickest around Poulnasherry Bay and in the area to the southwest of the Bay. Bedrock outcrop is mainly confined to coastal areas and the uplands in the east.

Observations presented in **EIAR Chapter 9 - Appendix 9.2** and data obtained during Site surveys (**Appendix 8.1- App B(b)),** coincide with the findings of the desk study as previously stated.

8.3.6.3 Peat Depths

The results of the peat depth probing surveys within the Redline Boundary of the main Site are detailed in the SI Report of **Appendix 8.1, App A** and **App B(a)**.

Peat depths at survey points (314 No.) range from 0.0m to 5.0m (**Table 8.7**). Peat depths were generally shallow to moderately deep. Isolated pockets of deeper peat are observed at some locations north of the track between T2 and T3, at T3 and west of T4.

Table 8.7: Peat depth probe points by depth category

Peat Depth Category	No. of Survey Points	Percentage of probe points
A – Rock (0.00-0.01m)	7	2%
B – Very Shallow (0.01-0.5m)	33	11%
C – Shallow (0.5-2.0m)	134	43%
D – Moderately Deep (2.0-3.5m)	108	34%
E – Deep (3.5-5.0m)	32	10%
F – Very Deep (>5.0m)	0	0%
TOTAL	314	

With reference and upon review of the Peat Stability Assessment result data and maps as presented in **Appendix 8.1,** indicate that the factor of safety is generally acceptable and very low to low stability risk across the Site with the exception of minor isolated areas or pockets of deeper peat. The Project footprint is in close proximity (T3, T4) or intersects (T2 to T3 site access track, site access track near entrance) deeper areas of peat, however other site parameters including very minor slope inclines result in the stability or Factor of Safety of peat at the site being qualified as acceptable and there is very low risk of a significant stability issue or landslide occurring.

One of the four proposed turbine hardstands, T1 is within the 150m surface water buffer and adjacent to the 50m surface water buffers (**Appendix 8.1 – App C(b) Ranked Risk Map**), however the peat depths in the area of T1 and the general area in the proximity of the proposed river crossing are shallow.

8.3.7 Landslide Susceptibility

The Geological Survey of Ireland (GSI) has developed a Landslide Susceptibility map of Ireland (**Figure 8.6a**). In consultation with this map, the site is mapped as 'Low Risk'. A small portion to the south, at the proposed borrow pit and spoil storage area, is mapped as having 'Moderately Low' to 'Moderately High' Risk.

There are no recorded landslide events in close proximity to the Site (GSI, Accessed 2023). The closest mapped Landslide Event recorded is c. 21km to the southeast which occurred in 1997. There were no indications of stability issues or mass movement observed on the

Site during site surveys. There is a report of a peat slide in this area (c. 27 years ago) with associated pollution into the Moyasta River, the exact location of which is unknown.

The Grid Connection Route is considered to be of 'Low Risk' to landslide susceptibility (**Figure 8.6a**).

The Turbine Delivery Route is considered to be of 'Low Risk' with some small areas of 'Moderate Risk' to landslide susceptibility (**Figure 8.6b**).

8.3.8 Peat Slide Risk Assessment

Subsoils underlying the Site are characterized generally as cutover peat. Peat depth across the Site is generally shallow to moderately deep with isolated pockets of deep peat (**Appendix 8.1 App A Peat Map**). There was no 'very deep peat' (>5m) observed at the Site during sampling. Considering this, there remains a residual risk at the Site. With reference to **Appendix 8.1,** the risk of significant peat landslide events occurring at the Site is low given the nature, namely the shallow, flat topography at the Site. However, the Site also possesses a degree of elevated risk in terms of localised soil and subsoil stability. Nonetheless, a significant movement of subsoils at the Site, if intercepted by the downgradient surface water network at the Site could have similar consequences to that of a significant peat landslide.

The Factor of Safety (Adjusted) (Scenario B i.e., 3m surcharge) using conservative values, at peat probe locations is generally Acceptable (**Appendix 8.1 App C(a) Factor of Safety Map**).

The Risk Ranking (Distance) Scenario B i.e., 3m surcharge) at peat probe locations, which takes into account distance to sensitive receptors is generally Very Low. With low to moderate risk at peat probe points within the 150m and 50m surface water buffer respectively (**Appendix 8.1 App C(b) Risk Ranking Map**).

The following table (**Table 8.8**) summarises the peat stability risk assessment data interpretation at turbine or infrastructure unit location and portions of site access track (see **Appendix 8.1 – Site Investigation & Stability Risk Assessment Report, Section 4** for more detail).

Table 8.8: Peat stability risk assessment at main infrastructure units and portions of track

Turbine No. / Unit	Peat depth (m)	FoS_{ADJ} (Factor of Safety adjusted according considering site specific conditions)	RR_D (Ranked Risk considering Distance to Sensitive Receptors)	Geo-Hazard / Comment (To consider at detailed design / preconstruction planning)
T1	1.4 – 2.9	Acceptable	Low	Close proximity to surface water feature. Includes access track within SW buffer.
T2	0.5 – 3.2	Acceptable	Very Low	
T3	0.5 – 4.7	Acceptable	Very Low	Variable peat, with some isolated pockets of deep peat.
T4	3.0 – 3.4	Acceptable	Very Low / Low	Close proximity to surface water feature
Met Mast	1.2 – 2.4	Acceptable	Very Low	
Temporary Construction Compound	3.1 – 3.9	Acceptable	Very Low	Deep peat
On-Site Substation	1.0 - 3.8	Acceptable	Very Low	Variable peat, with deep pockets of peat
Borrow Pit	0.1 – 0.2	Generally Acceptable	Very Low / Low	One moderate stability point however the surrounding points suggest the risk is low.
Entrance to T1	0.6 – 3.8	Acceptable	Moderate	Close proximity to surface water feature. Works within 50m SW Buffer. However, the area is flat, indicating with mitigation the risk is low.
T1 to T2	0.1 - 3	Acceptable	Very Low / Moderate	Close proximity to surface water feature
T2 to T3	0.4 – 4.5	Acceptable	Very Low / Low	Variable peat, with some isolated pockets of deep peat.
T3 to T4	0.4 – 1.8	Acceptable	Very Low	Close proximity to surface water feature
Track to Borrow Pit	1.5 – 2.9	Acceptable	Very Low / Low	

8.3.9 Geological Resource Importance

The Geological Survey of Ireland (GSI) has areas mapped as Geological Resource Importance, such as Active Quarries and Pit as well as Mineral Localities. Consultation with the GSI database does not indicate Mineral Localities or Quarries within the Site. The closest 'non-metallic' and 'metallic' localities are approximately 5km to the south.

8.3.10 Features of Geological Heritage

The Geological Survey of Ireland (GSI) also maintains a database for known Geological Heritage Sites in Ireland. Consultation with available maps indicates that there is no recorded 'Geoheritage' areas within the Site boundary, or within 14km of the proposed Project which includes the Grid Connection Route.

8.3.11 Designated Sites

The Site is not within any designated or protected areas. Any potential effects to soils or geology are not considered to have direct effects to downgradient designated sites, however entrainment of soils in runoff is a significant potential impact of the Project covered under **EIAR Chapter 9: Hydrology and Hydrogeology.** Therefore, effects to soil have the potential to have secondary or indirect and effects via hydrology in particular to down gradient receptors.

8.4 ASSESSMENT OF POTENTIAL EFFECTS

The *Soil Thematic Strategy* and the *Roadmap to a Resource Efficient Europe* highlights the importance of sustainable use of soil and the need to tackle land take. In line with this proposal, it states:

Public and private projects should therefore consider and limit their impact on land, particularly land take, and soil, including on organic matter, erosion, compaction and sealing. This should be facilitated through appropriate land use plans and policies at national, regional and local levels" (EC, 2012).

8.4.1 Significance Rating

Given the condition of the site in terms of land use practices, peat and soil quality, bedrock quality etc., Land, Soils and Geology as environmental attributes at the Site are considered to be of Medium Importance i.e. attribute has a medium quality, significance or value on a local scale (**Section 8.2.5).**

With reference to **Section 8.2.7** of this report and as summarised in **Table 8.9**, the geological attributes within the Project are considered to be of **Low to Medium Importance** and **Low to Medium Sensitivity**, and therefore classification of any potential effects of the Project will be limited to Magnitudes associated with **Medium Importance**, where by the Site attributes (Land, Soils and Geology) are considered to be of "*medium quality, significance or value on a local scale*".

Table 8.9: Weighted Rating of Significant Environmental Effects – Within the Footprint of the Site

Sensitivity (Importance of Attribute)	Magnitude of Effect			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

8.4.2 Do Nothing Impact

The "Do Nothing Impact" is the effect on the Site should the Project not be constructed. Site investigations of the baseline geological and geotechnical conditions of the Site indicate the following:

- The site has already experienced effects to baseline conditions due to the land use practices (**Figure 8.2a,** and **EIAR Chapter 9 Appendix 9.2**) including agricultural (pastures, extensive drainage) and commercial afforestation activities (**Section 8.3.5**).
- There is no indication that current land use practices have had adverse effects in terms of ground stability.
- The cumulative impact of afforestation on the proposed Site appear to be excavation of soil to construct drainage ditches and localised drainage of the soil, and varying degrees of soil erosion due to constructed roads and tracks, constructed drainage, vehicular movements, livestock movements etc.

Should the Project not proceed, the existing land-use practices will continue with associated modification of the existing environment.

8.4.3 Construction Phase Potential Effects

8.4.3.1 Typical Sequence of Events in Wind Farm Construction on the Receiving Environment

The following sections outline and summarises the general stages and elements of construction related to the Project. Detailed assessment of effects follows in the subsequent headings.

8.4.3.1.1 Activities – Pre-mitigation

1. Site investigation.
2. Site preparation:
   - Install surface water monitoring equipment,
   - Install silt screens, interceptor drains, and SuDS.
   - Prepare construction areas for compounds and facilities.
   - Clear vegetation and topsoil.
   - Excavate and grade the area for the construction of access tracks, hardstand areas, foundations, and other significant infrastructure units.
3. Access track and turbine hardstand areas:
   - Install silt screens, interceptor drains, and SuDS.
   - Clear vegetation and excavate topsoil, subsoil, and bedrock.
   - Temporarily stockpile arisings.
   - Install drainage structures and erosion control measures, such as culverts and SuDS
   - Construct the road base and hardstand using suitable materials, such as crushed rock or concrete.
   - Construct hardstand areas for the installation and maintenance of wind turbines.
   - Use designated temporary stockpile areas and segregation of materials for different types of material, including materials arising at the Site, and being imported to the Site.
4. Drainage & Sustainable Drainage Systems (SuDS):
   - Install drainage and Sustainable Drainage Systems (SuDS)
   - SuDS maintenance, including during construction phase.
5. Watercourse crossings and culverts:
   - Design and plan the culvert to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
   - Install silt screens and sediment traps upstream of the construction area to intercept, manage, and divert runoff, reduce entrainment of solids and capture sediment, and prevent it from entering the watercourse.
   - Excavate the area for the culvert installation.
   - Construct the culvert.
   - Backfill the area around the culvert.
   - Install headwalls or other associated infrastructure.
   - Restore the natural watercourse flow.
6. Clear Span Bridges:

- Design and plan the clear span bridge to meet the required hydraulic capacity and align with the watercourse's natural flow pattern.
- Prepare the area for the bridge construction.
- Construct the bridge abutments and piers using suitable materials.
- Install the bridge beams or arches using suitable materials.
- Backfill the areas around the abutments and piers with suitable materials.
- Restore the area.

7. Foundations:
   - Excavate and Backfill: To construct the wind turbine foundation, the area will be excavated to the required depth and diameter. Turbine foundation locations will be excavated to dimensions: 3.4 to 4.0mbgl, 22m to 25.8m diameter The area around and above the Turbine Foundation will be backfilled with compacted stone or crushed rock.
   - Form and Pour Foundation: Shuttering and membranes are used to form the foundation pour structure, and foundation reinforcement steel rebar is installed and formed. Concrete is then poured into the foundation structure.
8. Other Significant Infrastructure Units:
   - Construct Infrastructure Units: Other significant infrastructure units, such as substation buildings, electrical cabling, and meteorological masts, will be constructed using suitable materials such as concrete or steel. Temporary infrastructure units such as temporary stockpile areas are also included here.
   - Install Drainage Structures and Erosion Control Measures: As with access track and hardstand areas, drainage structures and erosion control measures such as culverts and erosion control blankets will be installed for other significant infrastructure units.
9. Site Restoration:
   - Backfilling: Excavation areas, such as those where wind turbine foundations were installed, will be backfilled with suitable materials.
   - Soil and Vegetation: Topsoil that was removed during the Site preparation phase will be redistributed.
   - Waste Management: Waste arising from construction activities, including general construction waste and/or excess soils will be removed from site to a licenced waste management facility. The nearest licenced waste facility is Creegh to the north of the Site.

8.4.3.2 Compaction, Erosion and Degradation

Compaction of soils will occur during construction and to a limited extent during operation and Decommissioning. In general, compacted soils will be excavated during construction, and access to soils away from hardstanding areas will be prevented. Ongoing compaction of soils will occur in areas of floated road construction, which will continue during operation and Decommissioning. Compaction effects are considered to be **direct, likely**, **slight** to **moderate, permanent and adverse**.

Erosion and degradation of exposed soils will also occur, primarily during construction, which will potentially lead to loading of runoff with solids and other contaminants. Entrainment of solids in storm or construction water runoff are assessed under **Chapter 9: Hydrology & Hydrogeology**. Erosion effects are considered to be **direct, likely, moderate to significant, permanent and adverse**.

8.4.3.3 Soil Sealing

Soil sealing is the covering of a soil with an impermeable material which in turn changes the geotechnical and hydrogeological attributes, for example, increased runoff. The use of impermeable material is an inevitable direct effect to some extent of most types of construction particularly in greenfield sites.

Soil sealing effects are considered to be **direct, unavoidable**, **slight to moderate**, **long term/ permanent** and **adverse**.

8.4.3.4 Land Take

Land take will be required during the construction and operation of the wind farm. The total land take required for the Project will be approximately 5.26ha. Of this c. 2.72ha will be permanent and is required for construction of site access tracks, Turbine Foundations, Electrical Substation, Met Mast. The temporary land take on Site will be c. 1.85ha which will be reinstated following the construction phase. The grid connection route land take is 0.11ha and will be reinstated following the laying of the ducts and the temporary land take along the TDR is equal to 0.58ha.

The effect of land take during construction is considered to be **direct, adverse, slight, localised, and permanent but reversible.** The probability of this effect occurring is **unavoidable** during the construction phase but conforms to baseline conditions e.g., existing public roads. With appropriate mitigation measures, planning and management this effect and disturbance can be minimised. Long-term land take associated with the Wind Farm Development is covered in **Section 8.4.4 Operational Phase Potential Effects**.

8.4.3.4.1 Land Take Turbine Delivery Route

Land take is required for the Turbine Delivery Route (TDR), although a majority of the route will traverse already existing roadways (i.e. existing access tracks, public and local road networks). However, there is a portion of the TDR that will require temporary works of widening and strengthening of the verge on the junction between the N68 and the L6132. These temporary works of verge strengthening will involve:

- Digging out road verges to c. 0.4mbGL
- Replacing excavated area with compact stone to support traffic
- Dressing compact stone aggregate with topsoil upon completion of construction deliveries.

Excavation activities associated with land take required for the above temporary works will lead to disturbance of otherwise generally undisturbed, or bordering greenfield land, that is, the natural soil profile will potentially be disturbed. The area excavated can be potentially reinstated post decommissioning. The temporary land take along the Turbine Delivery Route amounts to 0.58ha. The overall potential effect here is considered to be **slight** in terms of land, soils and geology, however it is very important to consider proximity and impact to the existing receiving drainage network, as assessed under **EIAR Chapter 9 Hydrology and Hydrogeology**.

8.4.3.4.2 Land Take Grid Connection Route

Minimal land take is required for the Grid Connection route considering the cable ducting will be buried in existing public roadways and verges and will be reinstated following laying of ducts. The Grid Connection will involve temporary land take 0.1ha, reinstatement will occur following the laying of the ducts. Any such effect is described similarly to general land take described above, however considering the small scale of disturbance, shallow cable trench (c. 1.22mbGL), the overall effect is considered to be **small-scaled, direct, localised, permanent but reversible** and **adverse**. The probability of this effect occurring is **unavoidable** during the construction phase but conforms to baseline conditions**.**

8.4.3.5 Clear Fell of Afforested Areas

Felling of forestry at the Site will be necessary for areas of the Project in afforested sections within the Redline Boundary. This is an unavoidable consequence of the Project. The likely felled area of approximately 17.58ha will represent approximately 56.5% of the proposed Site area. This can lead to a slight increase in parameters such as nitrate, dissolved organic carbon and potassium in receiving waters flowing from the Site, which is considered a negative impact of the proposed Project (this is discussed in greater detail in **Chapter 9: Hydrology and Hydrogeology).** If the proposed Development does not take place, it is likely that the forestry at the Site will eventually either be clear felled or felled in larger volumes than the amount proposed as a function of this Project.

The overall potential effects here are considered to be **direct**, of **moderate** significance, **permanent but reversible**, and **adverse**. The probability of this effect occurring is **unavoidable** during the construction phase but conforms to baseline conditions e.g. forestry tracks or operations. With appropriate mitigation measures, planning and management this effect can be reversed, and disturbance minimised.

8.4.3.6 Subsoil and Bedrock Removal

Subsoil and bedrock removal will occur during construction excavations and is an **unavoidable** consequence of the Project for turbine bases or other foundations, as well as the removal of bedrock material from the site borrow pit. Removal of the soil and bedrock is considered to be a **permanent** effect if breaking into competent bedrock.

The excavation and removal of soils and bedrock has the potential to result in the release of contaminants, particularly suspended solids to the receiving environment during the construction phase of the project, and to a lesser extent during the operational phase relative to baseline conditions. No further subsoil or bedrock removal will be required during operation.

The amounts of subsoil and bedrock to be removed will depend on specific construction and excavation plans which are specified in **EIAR Chapter 2: Project Description.** The total volume of excavated material for site infrastructure is 54,259m^3 (see Appendix 2.1 CEMP – Peat Spoil Management Plan) which will be stored locally near the site entrance and temporarily next to the borrow pit where it will be used to reinstate the borrow pit. There will be 32,280m^3 of material excavated from the borrow pit for use on Site. The borrow pit will have capacity of 38,280m^3 for spoil storage (see Section 8.4.3.7). The excavation volumes are dependent on the results of plate-bearing tests during the construction phase. The overall potential effects for the removal and replacement of subsoil and bedrock for Turbine Foundation construction, and at the borrow pit location is considered to be of **slight** to **moderate** significance, **slight** weighted significance (effects <15% of the area of the proposed Site which is classified as having medium importance), **direct, adverse,** effect on the proposed Project.

Although the effects on the local geology are **slight to moderate**, there are a number of indirect or secondary effects including the potential for entrainment of suspended solids in runoff and increasing groundwater vulnerability by decreasing the depth to water table. These effects are discussed further under **Chapter 9: Hydrology and Hydrogeology**.
Subsoils and weathered bedrock, when segregated and managed, can be reinstated similar to baseline conditions, and therefore effects are **temporary**, however breaking of competent bedrock cannot be reinstated to baseline conditions and are therefore **permanent**.

Worst case scenarios to result from subsoil and bedrock removal include the triggering of a significant localised peat-landslide or mass movement event, a potentially **profound** effect if in close proximity to receptors, and **permanent adverse** effect, refer to **Appendix 8.1 – Site Investigation & Stability Risk Assessment Report**.

Mitigative and reductive measures with regard to materials budget handling and potential indirect impact on water quality from mineral subsoil and bedrock excavation activities are outlined in the mitigation section of this report.

8.4.3.6.1 Excavations

Excavations will be required for most aspects of the Project including for turbines, turbine hardstand areas, site access tracks, works along Turbine Delivery Route, Temporary Construction Compound, cable trenches and Grid Connection route. Estimates of excavation volumes are presented in **Table 2.6** of **EIAR Chapter 2 Project Description.** It should be noted that the proposed Project includes floating access tracks on peat for the majority of the proposed access track with the exception of the site entrance area.

Increased excavation and peat / soil / subsoil / bedrock removal activity will be concentrated to particular locations of the Project, including; the site entrance, load bearing portions of Turbine Hardstands, Turbine Foundations, borrow pit, and works associated with the improvement or construction of watercourse crossings and culverts.

The approach and methodology in which excavation of in-situ earth materials is undertaken is very important for ground stability in any environment. Excavation has the potential to cause slippage or mass failure under certain geotechnical and hydrological conditions, for example excavating in deep saturated peat on, above or below steep inclines in peatland areas during periods of extensive rainfall[1].

The proposed location of turbines /met mast and substation avoid areas with steep to severe inclines, which is the nature of the Site. Nonetheless, the degree of slope steepness and the safe angle of repose will be considered when excavating material i.e., cut and fill, sidewalls of open excavations, movement and management of material etc., refer to **Appendix 8.1 -App B** and **Appendix 2.1: Ballykett Peat and Spoil Management Plan.** The overall potential effects under the footprint of the Project in greenfield or natural / peatland areas here are considered to be of **direct, unavoidable, adverse, slight to moderate significance, localised** impact of the Project, and is considered **permanent but reversible** during the decommissioning and restoration phase of the Project. In areas associated with existing infrastructure (turbine delivery route / grid connection) the effect will be **neutral to slight** including for adequate reinstatement.

8.4.3.6.2 Site Access Tracks

Site access tracks will be needed to accommodate the construction works and to provide access to the turbine locations for the whole life cycle of the wind farm. The tracks (c. 2,060m) will be constructed using unbound crushed aggregates and incorporate drainage to maintain the performance of the pavement during wet weather.

The roads will be constructed as floating roads except at the site entrance which will be excavated. Founded roads are excavated down to and constructed up from a competent geological stratum, whereas floated roads are built directly on top of the peat and soft soils using a geotextile mat. The roads shall be constructed to average heights of 0.5m or 1.0m above existing ground level.

The deposition of fill material on a geotextile membrane on top of in situ peat material will likely lead to a degree of subsidence with time. The degree of subsidence observed will vary depending on an array of geological properties including saturation and water levels in peat. Floating tracks are constructed by depositing the fill material on a geotextile membrane which distributes the surcharge over a wider area. Worst case scenarios when dealing with floating loads include the potential for excessive subsidence and in extreme cases failure of ground conditions and 'sinking' of infrastructure in deep saturated peat. The

[1] Feehan, J. and O'Donovan, G. (1996) "The bod of Ireland: an introduction to the natural, cultural and industrial heritage of Irish peatland" *University College Dublin – The Environmental Institute*.

subject site and site access tracks does not possess areas of deep and highly saturated peat but does possess areas of relatively deep peat and the potential for or progress of subsidence over time will require monitoring and management.

Preliminary ground investigations in the form of peat probing has been carried out along the proposed Site Access Tracks to inform the depth of excavation and upfill required for the access tracks. The estimated volumes of excavated and imported materials are given in **EIAR Chapter 2: Project Description**.

Permeable geotextile is usually placed at the base of access tracks, along with other infrastructure, as part of their typical design. However, this will have a **slight to moderate**, **adverse, direct**, **permanent but reversible** effect due to the relatively small footprint of infrastructure and its location.

8.4.3.6.3 Turbines and Hardstand Areas

The material encountered at each turbine and infrastructure location is mostly shallow to moderately deep peat overlying bedrock. Minor areas of glacial till may also be encountered locally. It is unlikely that excavations for the majority of infrastructure will be taken down to bedrock; the depth of the excavation required for the Turbine Foundations (generally to approximately 3.4mbGL and up to 4.0mbGL), however, some excavation of rock may also be required. The exact depth of excavation will be determined at detailed design stage.

Excavations will require granular fill material to upfill the excavation to the levels required for construction. It is proposed that the granular fill material will be obtained from the local Borrow Pit i.e., maintaining local geo and hydro chemistry. Ground investigations in the form of peat probing have been carried out at the proposed turbine hardstand locations to inform the depth of excavation and upfill required.

Any imported material, if necessary, will be fully tested in accordance with industry standards. Only verified clean, inert material will used.

The Temporary Construction Compound located to the north of the Site, near the site entrance will measure approximately 43m x 30m and will require similar foundations to those of turbine hardstands. The likely effects associated with excavations at hardstand areas are considered to be **direct**, **slight to moderate, adverse** (in terms of overall project scale), **permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project**.** The probability of this effect occurring is **unavoidable**.

8.4.3.6.4 Bedrock Excavations

Bedrock excavations could potentially be required at the proposed locations of Turbine Foundations, Turbine Hardstands, site access track excavations, Electrical Substation excavations and for the proposed borrow pit.

While intrusive groundworks, providing a detailed assessment of the bedrock character, has not been undertaken at this stage, it is recommended to determine the precise composition and depth to bedrock at turbine localities. The detailed ground investigations will inform the quality and strength of the bedrock and if the material will be suitable for re-use after crushing and screening, to use as granular fill for site access track construction. Indicative depths to subsoil were however gathered during site visits and are presented in **Table 8.10** below.

Table 8.10: Indicative depth of subsoil at proposed turbine locations

Turbine No. / Unit	Peat Probe Depth (mbGL)	Average Peat Depth (mbGL)
T1	1.4 – 2.9	2.1
T2	0.5 – 3.2	1.7
T3	0.5 – 4.7	2.2
T4	3.0 – 3.4	3.2

8.4.3.6.5 Wind Farm Site Cable Trenches

Cable trenches throughout the Wind Farm Site will be excavated to an anticipated depth of approximately 1.0m, depending on the detailed design. Excavation of peat, bedrock and inferred locally glacial till will be required. Granular fill, from the Borrow Pit, will be used to surround the cables, however the majority of the excavated soils will be used for backfill with only minor amounts being removed and used elsewhere for berm landscaping.

The effects associated with shallow excavations for Site Cable trenches are considered to be **direct, adverse** and **small to moderate** (in terms of overall project scale), **slight** significance, **permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. The probability of this effect occurring is **unavoidable** during the construction phase but conforms to baseline conditions e.g., public roads and services.

8.4.3.6.6 Borrow Pit

The proposed borrow pit is located to the south of the Site and it is understood its area will measure 12,000m^2 and be excavated to a depth of approximately 2.69m. As noted by the GSI (2023) this area has been mapped as 'Rock at or near Surface'.

The likely effects associated with the removal and replacement of subsoil and bedrock at excavations for the on-site Borrow Pit are considered to be **unavoidable**, **direct, adverse** and **moderate to large** (in terms of overall project scale), **slight to moderate significance, temporary** and **reversible** in terms of geology e.g., replacing competent bedrock, but impacts to ground levels will be **reversible** through reinstatement with fill. This effect is considered to be limited to the footprint of the Project and with appropriate mitigation measures, planning and management the effect and disturbance can be minimised.

8.4.3.6.7 Turbine Delivery Route

The Turbine Delivery Route will use existing roadway and will require; shallow excavations associated with; regrading, widening and strengthening of the verge on the junction between the N68 and the L6132 to accommodate the delivery of turbine components.

The likely effects associated with excavations on the Turbine Delivery Route are considered to be **direct, unavoidable, slight, adverse**, **localised, long term** to **permanent (life of project)** and **reversible** through reinstatement of temporary works following delivery of turbines**.**

8.4.3.6.8 Grid Connection Cable

Grid Connection trenches will be excavated along the Grid Connection route to Tullabrack 110kV Substation The trenches will be predominantly within roads and verges, to an anticipated depth of approximately 1.22m, and to a width of 0.6m. Depending on the detailed design and excavation of road aggregates, peat, bedrock and inferred locally glacial till will be required. The trenches will be backfilled using granular material. The excavated material will be disposed of offsite as a by-product or if that is not possible in an inert landfill at a licenced facility (at Creegh to the north of the Site or at another appropriately licensed facility) or recycled for use elsewhere. The effects associated with excavations for cable trenches are considered to be **unavoidable**, **direct, slight, localised, permanent** and **adverse**.

8.4.3.7 Storage and Stockpiles

8.4.3.7.1 Overview

It is expected that the majority of spoil generated on Site will be peat and subsoils with some rock excavated at Turbine Foundations.

It is expected that the majority of rock will be reused for the construction of site access tracks and/or Turbine Hardstands.

Material to be temporarily stored for a relatively long period during the construction phase will be stored in a designated temporary spoil storage area beside the borrow pit (6,000m^2) and will be limited to 2m height. Short term temporary stockpiles elsewhere on the site will be limited to 1m. This material will be used for later reinstatement of the borrow pit.

Material being permanently stored on site will be deposited in the storage area beside the site entrance (12,000m^2) and will be limited to 2m height. The borrow pit will be excavated in two phases with Phase 1 being reinstated and then Phase 2 beginning. That way the size of the temporary spoil storage area is minimised. The borrow pit will allow for the storage of 38,280m^3.

8.4.3.7.2 Spoil Management

Of significance, during the construction phase of the Project, is the management of excavated materials handling, storage and re-use. There is potential for **direct adverse** effects on localised ground stability, particularly in the vicinity of ongoing excavation works (**Plate 8.1)**. **Direct** and **indirect adverse** effects on surface water quality can also occur **(EIAR Chapter 9: Hydrology & Hydrogeology**). However, such effects are considered **temporary** and **reversible**.

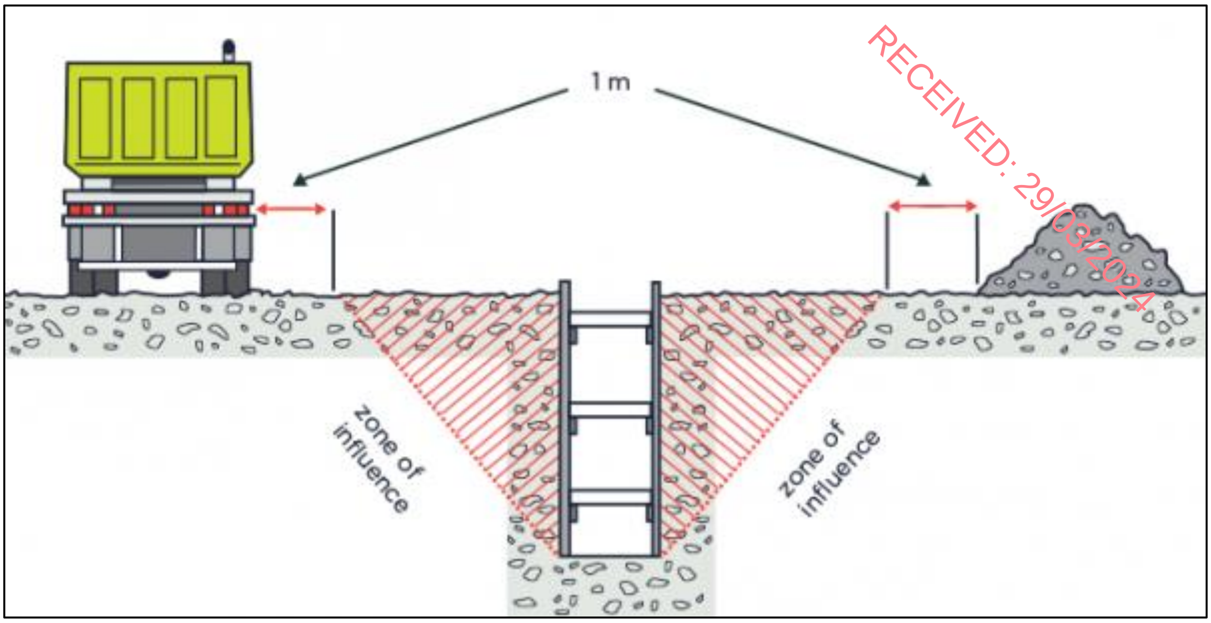

Plate 8.1: Examples impact of loading or surcharge on ground in proximity to open excavations.[2]

It is envisaged that excavated material (i.e. soils and subsoils) for Turbine Foundations will be used as backfill and for reinstatement purposes, that is reused on Site as appropriate and any surplus material will be transported to one of the three spoil storage areas (i.e., borrow pit, and 2 no. spoil storage areas, **Figure 8.1a**). Excavated material will arise from all infrastructure elements of the wind farm (foundations, tracks, hardstands etc.). As such, the handling, management and re-use of excavated materials are of importance during the construction phase of the project. Peat should be stockpiled no higher than 2m and follow the recommendations set out in the (NRA, 2014, Section 8.2).

With relation to excavated material removed during the Grid Connection network installation, any earthen (sod) banks to be excavated will be carefully removed and stored separately, maintained and used during reinstatement. Any surplus excavated material from roadways will be disposed of to the licenced facility at Creegh or at another licensed facility. There is potential for a **moderate adverse** effect on soil due to erosion of inappropriately handled excavated materials. However, any effects from the handling of excavated materials will be managed through good Site practice.

2 New Zealand Government (2016) Good Practice Guidelines – Excavation Safety

Organic matter loss can occur when wet peat is excavated and allowed to dry in the open air. Peat material is a major source of carbon and the loss of organic matter leads to an emission source of carbon dioxide (CO_2) and nitrogen dioxide (NO_2). Furthermore, excavated forestry material can also contribute to Nutrient Enrichment from historical site practices, refer to **Section 9.4.3.2 of EIAR Chapter 9: Hydrology and Hydrogeology.**

The effects associated with spoil management are considered to be **direct, adverse** and **moderate to large** (in terms of overall project scale), **slight to moderate significance, permanent** (life of project) and **reversible** through reinstatement during the decommissioning phase of the Project. The probability of this effect occurring is **unavoidable** during the construction phase but conforms to baseline conditions e.g. public roads and services.

8.4.3.7.3 Peat Stability and Slope Failure

While the possibility of a peat slide is considered to be low (**Appendix 8.1**), poorly managed construction activities can increase the risk of stability issues arising including at a localised scale. Soil stability issues brought about by excavation or vehicular movement activities on Site have the potential to lead to open excavation side wall collapse, or spilling of soil material etc., which in turn will potentially:

- Compromise ground stability in the vicinity of the works, thus increasing the effective footprint of the proposed Project.
- Impact on the receiving surface water or drainage network. This is of particular concern in relation to portions of the Project within surface water buffer zones or intercepting the existing drainage network.

As a worst case, stockpiling of peat can give rise to increased pore pressures and the possibility of a bog burst or peat slide. Careful management of the spoil and ongoing landslide risk assessments will minimise the possibility of a landslide occurring and potential runoff from site.

Worst case scenarios include significant movements of soils which are intercepted by surface water receptors, this is assessed further under **Chapter 9 Hydrology & Hydrogeology**.

Any peat slide or slope failure which occurs will likely be localised due to the flat topography of the Site, and acceptable Factor of Safety rating for stability at the Site (**Appendix 8.1**). Potential indirect soil stability issues including downgradient of the Project footprint brought about by construction activities are considered to be **slight (to profound)** (geology), **adverse**, potentially **permanent** effect but reversible. Risk of severe ground stability effects will be greatly minimised by applying mitigation measures, as described in following sections, and under **Chapter 9: Hydrology and Hydrogeology**.

8.4.3.8 Vehicular Movement

8.4.3.8.1 Overview

Vehicle movement will occur primarily during the construction phase of the wind farm. Construction vehicles will include cranes, excavators, dumper trucks, concrete trucks, private cars (construction personnel). During the operational phase, vehicles will be limited to occasional maintenance vehicles only.

8.4.3.8.2 Peat Stability and Slope Failure

Vehicular movements on site have the potential to trigger soil or slope stability. The effects associated with a stability issue are considered to be **direct, adverse, localised, small to moderate** (in terms of overall project scale) and **slight to profound** significance.

8.4.3.8.3 Turbine Delivery Route and Site Tracks

The delivery and connection routes will utilise existing roadways and infrastructure along the majority of the routes and therefore, the effects associated with vehicle movements along the TDR is considered to be **not significant** to **slight, permanent** and **adverse**.

Vehicle movement along the site access tracks will result in a slight compaction of the underlying soils and subsidence of floating tracks. The effects associated with vehicle movements along the site access tracks is considered to be **slight, permanent** and **adverse.**

8.4.3.9 Soil Contamination

8.4.3.9.1 Overview

Construction activities associated with the proposed Project have the potential to introduce a number of contaminants in a number of ways. Potential causing activities and associated contaminants include:

- Operation of plant vehicles and other petrol / diesel driven equipment - hydrocarbons e.g., diesel, oil, grease.
- Wastewater sanitation – sewage
- Construction materials – e.g., concrete or cement
- General waste – e.g., plastic

Use of waste materials during construction, operation and Decommissioning will be minimised by good site practices and waste management plans. The following sections present the possible effects primarily associated with the use of construction plant.

8.4.3.9.2 Hydrocarbons

Wherever there are vehicles and plant in use, there is the potential for a direct hydro-carbon release which have the capacity to contaminate soils and subsoils. Furthermore, a spill has the potential to indirectly pollute water, if the soil and subsoil act as a pathway from any source of pollution.

Hydrocarbon is a pollutant risk due to its toxicity to all flora and fauna organisms. Hydrocarbons adsorb (stick) onto the majority of natural solid objects it encounters, such as vegetation, animals, and earth materials such as peat. From a land and soils perspective, the naturally occurring chemical in crude oil and gasoline products, Polycyclic Aromatic Hydrocarbons or (PAHs), can burn most living organic tissue, such as vegetation, due to their volatile chemistry. It is also a nutrient supply for adapted micro-organisms, which can deplete dissolved oxygen at a rapid rate and thus kill off water based vertebrate and invertebrate life.

The hazard posed by hydrocarbon contamination to soil is significant in terms of adversely impacting on the health of the soils associated with the proposed Site and the flora and fauna it supports, however the risk is considered limited considering the movement of same is limited. The more significant risk of hydrocarbons contamination of soils is the eventual and likely migration to surface water systems, a potentially significant adverse effect - this is covered in **Chapter 9: Hydrology and Hydrogeology**.

Any accidental contaminant spillage of fuel or oil, depending on the volume, would potentially present a **direct, moderate** to **significant, localised, long term to permanent**, **adverse** effect on the soil and geological environment on the Site. However, this potential effect is considered to be localised (if contained, **Chapter 9: Hydrology & Hydrogeology**), naturally reversible (natural attenuation over a relatively medium to long term period of time), or immediately reversible (through remediation and restoration activities over a relatively short to medium term period of time). With appropriate environmental engineering controls and measures, this potential risk can be significantly reduced.

8.4.3.9.3 Wastewater and Sanitation

The Project includes for temporary sanitation facilities for site workers during the construction phase. The Project therefore has the potential to result in the accidental leakage of wastewater or chemicals associated with wastewater sanitation onto soils, and into the drainage network during the construction and operational phases of the project.

Wastewater and wastewater sanitation chemicals are pollutant risks due to their potential impact on the ecological productivity or chemical status of surface water systems, and toxicity to water-based flora and fauna.

The worst-case scenario/s associated with wastewater sanitation is the potential for sanitation chemical, particularly related to porta-loos, accidentally spilling or leaking and being intercepted by surface water drainage features and in turn surface water networks associated with the proposed Project.

Potential incidents of release contaminants at the Site will likely be **short lived** or **temporary**, however the potential effects to downstream receptors can be **long lasting, or permanent**. With appropriate environmental engineering controls and mitigation measures these potential effects can be significantly reduced. The effects associated with wastewater and sewage is considered to be **direct, moderate to significant**, **localised, temporary** and **adverse**.

8.4.3.9.4 Construction or Cementitious Materials

The Project will require concrete for the formation of Turbine Foundations, including in locations which are in proximity to receptors e.g., drains and surface waterbodies. This gives rise to result in the accidental spillage or deposition of construction waste into soils and in turn impact on surface water runoff, or accidental spillages directly intercepted by drainage or surface water networks associated with the Project.

Depending on the chemistry of the material in question, the introduction of such materials can lead to a local change in hydrochemistry and impact on sensitive attributes e.g., ecology. For example, the introduction of cementitious material (concrete / cement / lean mix etc.) can lead to changes in soil and water pH, and increased concentrations of sulphates and other constituents of concrete can further impact water quality. Fresh or wet concrete is a much more significant hazard when compared to set or precast concrete which is considered inert in comparison, however it should also be noted that any construction materials or waste deposited, even if inert, is considered contamination.

Surface water runoff, or groundwater coming into contact with concrete will be impacted to a degree, however water percolating through lean mix concrete will be impacted significantly. Therefore, the production / acquisition, transport of material and management of plant machinery must also be considered.

The worst-case effects associated with a release of wet or lean mix cementitious materials is considered to be potentially **adverse, direct, slight to significant, likely, long-term to permanent,** particularly in terms of potential indirect or secondary effects on the receiving surface water system**.**

8.4.3.9.5 General Waste

The construction phase has the potential to generate excess general wastes from construction personnel such as organic food waste, plastics (bottles and/or packaging), metals (aluminium cans and/or tins) and cardboard waste (Tetra Pak cartons, newspaper, wastepaper). This is an unavoidable effect of the Project, but every effort will be made to ensure that every piece of general waste will be disposed of properly and removed from Site. The effects associated with waste materials is considered to be **direct, slight, likely, long term to permanent** and **adverse**.

8.4.4 Operational Phase Potential Effects

Land take will be required during the construction and operation of the wind farm. This will be required for construction of site access tracks, Turbine Foundations, Electrical Substation and Met Mast.

8.4.4.1 Land Take Windfarm

Land take is a Slight (permanent land take = c. 2.73ha, red line boundary = c. 31.33ha, land take equates to 8.6% relative to the scale of the Site) direct effect of the Project, that is land being used as forestry currently will be replaced by the Project. The extent of land take will correlate with the footprint of the Project with the exception of some existing track ways. There is also additional land take required for cut and fill, drainage and cable trench infrastructure, and the increased excavation footprint required for safe excavation practices (e.g. batter back, discussed in the following sections).

Excavation, deposition, and ground sealing activities associated with land take required for the Project will lead to disturbance of otherwise generally undisturbed, greenfield land, that is facilitating current land use practices, namely forestry and agriculture and will directly affect the footprint of the Project.

The overall potential effects here are considered to be of **direct, slight** to **moderate** significance, **adverse,** long term to **permanent** (life of projects), but reversable through the decommissioning and restoration phase of the Project. With appropriate mitigation measures, planning and management this impact can be reversed, and disturbance minimised. The probability of this effect occurring is **unavoidable** during the operational phase but conforms to baseline conditions e.g., agriculture/forestry tracks or operations. Land take associated with the Turbine Delivery Route and Grid Connection route will be limited to the construction phase of the Project.

8.4.4.2 Soil Compaction and Subsidence

The Project will include floating site access tracks on peat, which over time have the potential to compact underlying peat soils leading to subsidence. Excessive subsidence can potentially lead to localised track stability issues, and development of new preferential flow paths for runoff and potentially erosion leading to further localised track stability issues. The overall potential effects here are considered to be of **slight** to **moderate** significance, **adverse,** long term to **permanent** (life of projects), but with appropriate monitoring, mitigation and maintenance these potential effects can be minimised.

8.4.5 Decommissioning of the Wind Farm

In general, the potential effects associated with Decommissioning will be similar to those associated with construction but of reduced magnitude because extensive excavation, and wet concrete handling will not be required. The potential environmental effect of soil storage and stockpiling and contamination by fuel leaks will remain during Decommissioning.

No new effects are anticipated during the Decommissioning phase of the project in comparison to the construction phase (removal of turbines and similar infrastructure on the geological, geomorphological and geotechnical environment), as stated above, therefore no new mitigation measures are required. However, the Decommissioning of major infrastructure including turbines poses similar hazards and risks to the environment compared to that of the construction phase.

Restoration of the Site following Decommissioning of the proposed infrastructure is in its own right a phase of the Project. Restoration activities have the potential to be disruptive and hazardous to the environment, to the point that a 'benefit analysis' will likely be required to evaluate any such activity before it is permitted[3].

Examples of likely difficulties impeding restoration highlighted by means of 'benefit analysis' in terms of soil and geology include the following:

[3] Schumann, M., and Joosten, H. (2008) Global Peatland Restoration Manual. Institute of Botany and Landscape Ecology. Greifswald University, Germany.

- Removal of Turbine Foundations – Significant disturbance due to the difficulties associated with excavating, breaking concrete, cutting steel, loading and transferring foundation materials offsite, and subsequent disturbance associated with the excavation of suitable material to be used as fill to replace the Turbine Foundation.
- Vibration caused, particularly in relation to the breaking of concrete, may impact on peat and slope stability locally. Turbine Foundations will likely be left in situ and covered in peat/topsoil and allowed to revegetate.
- Removal of Hardstand / site access tracks – Significant disturbance due to operations associated with excavation and removal of hardstand materials. Removal of such materials will likely impact on peat directly adjacent to the Turbine Hardstand area in question and change the hydrological characteristics of the area in question (**Chapter 9: Hydrology and Hydrogeology**).
- The material required to reinstate any areas where infrastructure is removed will need to be sourced from elsewhere on the Site. Considering the elapsed time (reasonable to presume >35 years) the acquisition of natural material itself will likely do more harm (to established blanket bog) than that of the benefit of removing and restoring infrastructure associated with the Project.

Given that the condition of the environment will likely change over the course of the operational phase of the Project, particularly in terms of the condition and degree of reinstated peatlands that were once afforested areas and associated ecology, and ornithology, it is recommended that the potential for restoration following the Project phase of the Development is evaluated closer to the time (c. 25-30 years). It should be noted that restoration activities do not currently conform to baseline conditions (i.e., forestry).

Excavation and removal of some designated portions of wind turbines is planned as part of the Project and will be undertaken during the Decommissioning phase. Excavation of all material including concrete Turbine Foundations is not proposed due to the high impact nature of such works e.g., breaking of reinforced concrete. Extensive vehicular movement on peat is not anticipated to any significant extent considering adequate Turbine Hardstand will have been established, however as previously stated, the risk of fuel or other contaminant spillages, or management of waste are valid hazards during the Decommissioning phase. The mitigation measures described in this EIAR chapter will be adopted and implemented by means of a Decommissioning Plan. In order to reduce the potential impact of excavating and removing the entirety of the crane hardstand areas, it is proposed that the majority of the stone structure of the individual crane hard- stands will be left in place, with topsoil and or peat being spread on top of the hardstand to form a vegetated surface layer. The top layer of the crane hardstand areas will have the rock/stone dug out and be left to revegetate naturally. Any reinstatement of topsoil and the restoration of vegetation will be kept consistent and compatible with surrounding vegetation.

All components removed from Site will be sent to a licensed waste management firm and or recycling facility and disposed of in accordance with European Union (Waste Electrical and Electronic Equipment) Regulations 2014 and EU (Environmental Impact Assessment) Waste Regulations 2013 or other applicable legislation which may be in force at the time of decommissioning.

On the basis that a Decommissioning Plan has been established, **Appendix 2.1**, and will be implemented during the Decommissioning works associated with the Project, potential issues arising giving cause to residual effects are likely to be infrequent, **imperceptible to slight**, **localised and reversible**.

8.4.6 Cumulative Effects

Considering the discipline under investigation, soils and geology, and the fact that potential effects of the Project are generally localised, the cumulative effects of the Project are not considered to vary dramatically or behave synergistically when considering the Site as a unit, or indeed when considering in conjunction with other developments in the vicinity or downgradient of the Site. However, on a national scale the importance of soils and peatlands in particular in terms of ecological value and carbon value must be considered. The cumulative effects associated with hydrological and hydrogeological characteristics of the Site are also identified in **Chapter 9: Hydrology and Hydrogeology.**

Aim and objectives for soil quality and soil health have been outlined in the *EU Soil Strategy* (EC, 2021). To name a few:

- All EU soil ecosystems are healthy and more resilient and can therefore continue to provide their crucial services.
- No net land take and reduction in soil pollution.
- Protecting and reducing degradation of soils, as well as sustainable management practices.

These will be implemented by means of several key actions. Although this is not yet transposed, the development in question would aid some of the actions by 'limiting drainage of wetlands and organic soils and to restore managed and drained peatlands to mitigate and adapt to climate change'. Mitigation measures installed on site would also 'restore degraded soils' and 'reduce erosion'.

8.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

This section outlines the main mitigation measures which will be applied to the wind farm in order to reduce the effects outlined previously.

8.5.1 Design Phase

8.5.1.1 Mitigation by Avoidance

The opportunity to mitigate any effect is greatest at the design phase. In this respect, a detailed Site selection process was carried out by the Design Team. A process of "mitigation and prevention by avoidance" was undertaken by the EIA team during the design of the turbine and associated infrastructure layout. Arising from the results of this study, a constraints map was produced that identifies areas where geotechnical constraints (deep peat and shallow bedrock and drains) could make parts of the Site less suitable for development. Furthermore, within the chosen Site, areas of deep peat and shallow bedrock were identified, and the infrastructure design sought to avoid those areas as much as possible. The layout plan was reviewed and the best layout design available for protecting the Site's existing geotechnical (and hydrological) regime was identified, but while also incorporating and overlaying landownership, engineering and avoiding other environmental constraints.

It is proposed that the majority of the site access track on the Site will be floating tracks on peat, with the exception of the site entrance area. Floating tracks will be used where suitable and geotechnically feasible. This reduces the extent to which excavation activities, and removal of peat, soils etc. will occur, in turn reducing secondary or indirect risks associated with the handling and management of plant movements and spoil management. There remain some risks that cannot be mitigated through design and will be managed during construction by using best management practice, including; subsidence. Mitigation through design is especially applicable in the risk to human health during a project and this shall be exercised to minimise the adverse risks present.

Key Considerations and design of Floating tracks, as outlined by Scottish guidelines (SNH) are listed below:

- Detailed hydrology survey of the area and the peat type (according to the "Von Post" system, there are 10 possible classification for this material depending on the decomposition level).

- Identifying the value for in situ peat strength.
- Estimate the expected traffic loading.
- Design the road.
- Monitoring the construction and possible checks, as turbines serviced (Operational phase).
- Recording action and outcomes for future projects.

8.5.2 Construction Phase

Any and all direct effects on soils, peat and bedrock arising from the Project are considered localised, therefore, effects assessed and classified in the following section/s are considered at the localised scale, with the exception of potential indirect effects on downgradient receptors, for example associated with surface water.

8.5.2.1 Erosion and Degradation

Erosion and degradation of exposed soils will occur at a minimal, primarily during construction. considering the variability of metrological conditions and the potential for significant events to occur at any stage of the year, the construction phase will be limited to favourable meteorological conditions to avoid erosion and runoff from the site. In order to mitigate for particular earth works tasks and suitable meteorological conditions, construction activities will not occur during periods of sustained significant rainfall events, or directly after such events (allowing time for work areas to drain excessive surface water loading and discharge rates reduce).

To avoid potentially loading of runoff with solids and other contaminants into the surface water network. Entrainment of solids in storm or construction water runoff are assessed under **Chapter 9: Hydrology & Hydrogeology**.

8.5.2.2 Soil Sealing

Soil sealing will be mitigated by the use of a geotextile membrane on top of in situ peat material and will likely lead to a degree of subsidence with time. This will reduce the changes to the geotechnical and hydrogeological attributes, for example; increased runoff. The use of impermeable material is an inevitable **direct**, **slight to moderate** effect to some extent of most types of construction particularly in greenfield sites. However, this will be mitigated by reducing the area of sealed soil to a minimal.

8.5.2.3 Clear Fell of Afforested Areas

Best practice working in specific environments such as forested areas will be adhered to including working outside of surface water or other buffer zones, and risk assessing on a case-by-case basis in terms of drainage intercepting run off, ecological and other sensitive environmental attributes.

The Forestry Report carried out by Veon (included in **Appendix 15.2**) outlines the mitigation to be employed during construction. The maximum use possible has been made of existing forest tracks and fire breaks, thereby minimising the areas of forestry that will be lost in the construction of access tracks. The following mitigation measures to be followed during felling operations:

- A felling licence will be obtained before any tree felling will be allowed. A NIS will be required to secure approval of a felling licence.
- As the trees are of such a low yield class and quality, from a cost benefit analysis point of view the cost to extract the trees post harvesting would not seem advantageous.
- This will allow the harvesting machine to use more brash under the machine when harvesting, while also eliminating the need for forwarding machinery to enter the site to further traverse the brash matts to extract timber.
- This will reduce any risk of soil erosion and impaction.
- Felling and extraction, if economical, of timber will, as far as possible, be undertaken at the same time as currently licensed extraction activities in order to minimise traffic and noise disturbance.
- Felling and extraction of timber will only be permitted by experienced and fully trained operators.
- All Forest Service guidelines will be adhered to during all harvesting activities.
- A harvest site plan including extraction routes, fuelling areas, stacking areas, turning areas and drain crossings etc. and HIRA will be designed and implemented during all harvesting operations.
- All drains crossed during extraction, if necessary, will be cleared of any debris to ensure no drainage issues will occur for the remining trees, which can be a major attributor to windblow.
- Felling and extraction of timber will be undertaken in dry weather conditions.

All timber harvesting, construction of forest tracks, including the creation of buffer zones and roadside drainage, will comply with the appropriate edition of the following specification, which have been developed by the Forest Service:

- Forest Protection Guidelines
- Forestry and Water Quality Guidelines
- Forest Harvesting and Environmental Guidelines
- Forestry - Site Assessment and Mitigation Measures
- Forest Biodiversity Guidelines
- Forestry and The Landscape Guidelines
- Forestry and Archaeology Guidelines

Mitigation measures outlined above, i.e. phased felling approaches can lessen effects to the surrounding landscape and important surface water receptors by limiting the amount of soils, vehicular movements, soil compaction, etc. introduced to the Site at one time. This in turn can be seen as a **permanent but reversable**, **slight to beneficial** effect.

8.5.2.4 Subsoil and Bedrock Removal

The removal of peat and mineral subsoil / bedrock is an unavoidable effect of the Project, but every effort will be made to ensure that the amount of earth materials excavated is kept to a minimum in order to limit the impact on the geotechnical and hydrological balance of the Site. The effects associated with this removal will be minimised using the following practices.

8.5.2.4.1 Mitigation by Avoidance

The proposed turbines and infrastructure layout was dictated to a large degree by the existing infrastructure, peat depth and the topography, locating turbines in areas where the existing infrastructure is utilised, peat is shallow, and the topography is favourable. Similarly, engineered cut and fill extents which have been designed will minimise the volumes of subsoils to be removed either directly by excavation (Turbine Foundations) or as a function of cut and fill requirements (hardstands).

8.5.2.4.2 Mitigation by Good Practices

Best practice will be applied during construction which will minimise the amount of soil and rock excavation. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor and agreed prior to any works commencing on Site.

Excavation of peat in areas where there is >1.0m in peat depth will follow appropriate engineering controls (**Section 9.5.2.3, Chapter 9: Hydrology and Hydrogeology**), such as the drainage of the peat along the proposed Site tracks in advance of excavation activity

(1 month in advance where possible) so as to reduce pore water content and thus instability of the peat substrate prior to excavation. Such drains will be positioned at an oblique angle to slope contours to ensure ground stability. Drains will not be positioned parallel to slope contours, that is, a gradient more than zero. It is noted that some drains will be close to parallel with elevation contours. This drainage will be attenuated prior to outfall (**EIAR Chapter 9: Hydrology and Hydrogeology and Surface Water Management Plan, Appendix 2.1**). It is noted that peat depth at the Site is generally shallow and management of saturated peat will be required at relatively few locations.

In those parts of the Site where excavation may intercept areas of peat that are >1.0m depth, a geotechnical engineer/engineering geologist will be onsite to supervise and manage the excavation works and confirm the necessity for supporting newly excavated peat exposures or redirect initial construction phase drainage to maintain ground stability.

8.5.2.4.3 Mitigation by Reduction

Apart from the measures taken in the design phase of the Project (avoiding the need for and reducing volumes of subsoils to be removed) there are no other reductive mitigation measures in terms of subsoil and bedrock removal, that is the layout of the Project minimises the impact of subsoil and bedrock removal in so far as practical, without compromising or reducing the development itself.

8.5.2.4.4 Mitigation by Reuse

Bedrock will be re-used for construction of site access tracks and/or Turbine Hardstands wherever possible. The bedrock will comprise predominantly sandstone and siltstone which, when crushed and graded, should provide a good sub-base for site access track construction. However, the rock type is considered relatively weak and will be prone to degrading over time under loading and plant movements, in turn potentially leading to the generation of dust and / or increased entrainment of solids in storm runoff. A more suitable, stronger rock type will be imported to the site for use as track topping.

Peat, overburden, and rock will be reused where possible on Site to reinstate excavated areas where appropriate. Where possible, the upper vegetative layer 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 landscaped peat. These measures will prevent the erosion of peat in the short and long term.

Subsoil and bedrock which are excavated as part of the initial construction (and potential Decommissioning) phase(s) will be reused onsite where possible.

Excess bedrock will be reused as backfill in areas previously excavated, or as backfill in cut and fill operations, for example; site access tracks and Turbine Hardstands. Using the local bedrock as fill will ensure that effects to hydrochemistry are minimised.

Geotechnical testing on imported material will be carried out prior to its reuse onsite particularly for reuse as a running or load bearing surface and will only be reused for those purposes if the suitability of same conforms to relevant standards.

Peat material excavated will be reused as backfill in areas previously excavated as much as possible, and/or for reinstatement works elsewhere on the Site. To facilitate this the acrotelm (living layer) and the catotelm (lower layer) will be treated as two separate materials. Catotelm peat will be used to backfill, for example around Turbine Foundations once established. Acrotelm peat will be used as a dressing on top of deposited catotelm peat in order to promote and re-establish flora and ensure the acrotelm layer becomes relatively cohesive in terms of localised peat stability (vegetated), refer to the CEMP, **Appendix 2.1.**

Similarly, all soil and subsoil types or horizons which will be identified during intrusive ground investigations and during actual construction, will be treated as separate materials and arisings separated accordingly. This includes, for example Acrotelm peat, catotelm peat, clays, subsoils (TILLS), weathered rock.

The management, movement, and temporary stockpiling of material on Site, including a materials balance assessment and plan is detailed in the CEMP, this will include identification of suitable temporary set down areas which will be located within the Project footprint and will consider and avoid geo-constraints identified in this report (**Appendix 8.1**). Temporary set down / stockpile areas will be considered similarly to active excavation areas in terms of applying precautionary measures and good practices, and mitigation measures, including those relating to control of runoff and entrapment of suspended solids (**Chapter 9: Hydrology & Hydrogeology).**

8.5.2.4.5 Mitigation by Remediation

On completion of the construction stage, any areas not required for operation will be reinstated. This may include the Temporary Construction Compound, turning areas, borrow pit and materials storage areas. Granular material will be removed as required and reinstated with peat or other soils in keeping with the adjacent soils. Drainage measures will be reinstated as required in order to minimise future erosion of the soils. The mitigation measures listed above, namely backfilling with peat in layers, are in effect remediation measures, whereby the effect of required excavation works are remediated and limited to the extent of the actual proposed infrastructure. This will be carried out at the designated reinstatement locations, infilling with material in identified soil horizons as mentioned above to revert these areas to baseline levels.

Excess subsoils and bedrock will be used for remediation and reinstatement purposes elsewhere on the Site, including areas already impacted by agricultural activities (forestry) and eroded or degraded areas.

8.5.2.4.6 Residual effects post mitigation

Mitigation measures outlined here as well as in the Peat and Spoil Management Plan of **Appendix 2.1** of the CEMP will ensure the effects arising from excavation activities are minimised to the footprint of the Project and improve some other degraded areas of the Site, thus offsetting the adverse effects of the Project . The mitigated effects associated with subsoil and bedrock removal are considered to be **not significant to slight** and **permanent, but reversible** for subsoil.

8.5.2.5 Storage and Stockpiles

8.5.2.5.1 Mitigation by Avoidance and Good Practice

As discussed previously, the opportunity to mitigate any effect is greatest at the design period. In this respect, a detailed Site selection process was carried out by the Developer. This process identified specific geotechnical constraints.

Excavation of materials is unavoidable however the effects of same can be minimised if managed appropriately. Similarly, given that excavations are unavoidable, so too are temporary stockpiles. However, if managed appropriately, the impact of same can be minimised.

Temporary stockpile locations are identified and will be used to avoid the temporary placement of any excavation arisings outside of the footprint of the Project. Temporary stockpile areas will be managed to facilitate the orderly segregation of material types, be isolated from the receiving surface water network (**Chapter 9: Hydrology &**

Hydrogeology) by the use of silt screens etc., are limited in height, and are covered in plastic sheeting during extended temporary periods and ahead of storm alerts.

One permanent stockpile, situated near the site entrance, will be managed in a similar manner to that described above, and will be allowed stabilise for a period during the construction phase, following which the material will be vegetated and managed in line with other improvement works on site. Promoting the vegetating of the material will aid in binding the material and minimising erosion and improve soil health.

Best practice will be applied during construction which will minimise the amount of soil and rock excavation and therefore also reduce storage and stockpile requirements. All works will be managed and carried out in accordance with the Construction and Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

No temporary stockpiles will be positioned or placed on areas of peat which have not been assessed or are indicated as being geo-hazards, particularly in areas of unacceptable factor of safety / stability (**Appendix 8.1**). All temporary stockpiles will be positioned on established and existing hardstand areas or in designated areas which are appropriate for short term storage. Temporary storage locations have been identified in the CEMP (**Appendix 2.1**), and these areas will also be managed in terms of potential for solids entrainment by runoff (**EIAR Chapter 9: Hydrology and Hydrogeology**). No temporary stockpile placed on established hardstands in areas of deeper peat (**Appendix 8.1 App- B**) will be in excess of 1m in height. This is due to potential localised stability and subsidence issues in relation to the peat under and in vicinity of the hardstand and stockpile.

As discussed in **Chapter 9: Hydrology and Hydrogeology**, stockpiling of material will invariably lead to the entrainment of solids in surface water runoff. Mitigation measures to address same are detailed in **EIAR Chapter 9: Hydrology and Hydrogeology**, and in **Appendix 2.1,** Peat and Spoil Management Plan which facilitates the near immediate reuse of material in so far as practical, thus reducing the potential for temporary stockpiles in general. For example, the material arising from the first excavation will be deposited in areas identified as having potential for restoration or requiring fill, the material arising from the second excavation is used as fill and reinstatement material in the first excavation location, etc.

8.5.2.5.2 Mitigation by Reduction

The volume of material to be managed including temporary stockpiling is directly proportional to the volumes of material required to be excavated, in total the volume of material is large, however when managed appropriately (ongoing reinstatement) the volume of material to be managed at any particular time will be minimised. Whenever possible, soil and rock will be re-used on the Site immediately, thereby reducing the need for double handling, reducing the requirements of stockpiles. Generally excavated rock will be used immediately for site access track construction. Topsoil and peat will be transported to the designated spoil storage areas. Peat will only be stockpiled temporarily in areas of thin or absent peat and only in areas which have been assessed for stability by a suitably experienced geotechnical engineer.

The Peat and Spoil Management Plan, **Appendix 2.1** forming part of the CEMP, identifies volumes and types of materials arising, temporary stockpiling locations, routes for reuse and remediation, requirements in terms of logistics and considerations in terms of timing and planning of movements of material. The Peat and Spoil Management Plan will ensure that the material arising from any excavation will have a predetermined plan and route for re-use / remediation, or disposal if all potential for reuse / remediation have been exhausted. Mitigation measures for stockpiles related to the Grid Connection route are as follow: stockpiles will be restricted to less than 2m in height and will be subject to approval by the Site Manager and Project Ecological Clerk of Works (ECoW). Additionally, any excavated material will be later used to backfill the trench where appropriate, any surplus material will be treated as a by-product or transported to a licensed facility.

8.5.2.5.3 Residual effects post mitigation

The mitigated effects associated with storage and stockpiles are considered to be **not significant** and **permanent but reversible**.

8.5.2.6 Vehicular Movements

Vehicular movements will be restricted to the footprint of the Project and advancing ahead of any constructed hardstand will be minimised in so far as practical. For example, excavation ahead of established hardstands will be in line with expected phases of Turbine Hardstand and site access track construction in terms of both delivery of and installation of material and site activity periods whereby excavations will not be opened ahead of site shut down periods. This will be done with a view to minimising soils / subsoils exposure to rain and runoff.

Ancillary machinery will be kept on established Turbine Hardstands, and no vehicles will be permitted outside of the footprint of the Project and will not move onto land that is not proposed for development if it can be avoided. The main mitigation measure is minimising activity to footprint of the development. Impacts to soil are unavoidable under footprint of the Project, therefore vehicular movements restricted to footprint.

Where vehicular movements are necessary outside of the Project, ground conditions will be maintained as well as possible. This includes for example replacing sods, smoothing over with excavator bucket etc. Where ground conditions are poor, or prolonged works, temporary access measures will be deployed, for example floating platforms / floating access track.

Floating tracks are applied directly to peatlands and remove the need to excavate any peat. The weight of the track structure will gradually lead to subsidence of the material, and compression of underlying peat, namely the acrotelm potentially resulting in reduced transmittance of runoff and impacting on baseline hydrological regime at the Site. This can lead to excessive wetting upgradient and peatland drying and chronic degradation of water supply down gradient of tracks. Proposed drainage as part of the Project has been designed to maintain the baseline hydrological regime as far as practical (**Chapter 9: Hydrology and Hydrogeology)**.

Vehicular traffic on Site is reduced through the re-use of excavated material on Site and the use of the on-site borrow pit which will reduce the need to source material from external quarries.

For the Grid Connection route, before starting construction, the area around the edge of each joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage.

Adequate employment of mitigation measures described will minimise the adverse effects posed by vehicular movements, and any localised unforeseen effects will trigger escalation of response ensuring locations are restored and any potential pathways to receptors are isolated.

8.5.2.6.1 Mitigation by Avoidance and Good Practice

As discussed previously, excavation volumes have been reduced during the design phase by the use of floating tracks, and also avoiding areas of deep peat, shallow bedrock and by avoiding excessive cut and fill during construction. This will result in reduced excavation volumes and therefore reduced Site traffic.

Best practice will be applied during construction which will minimise double handling, again reducing the Smite traffic. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP), which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

Excavated peat will only be moved short distances from the point of extraction and will be used locally for reinstatement, landscaping of improvement areas, reducing the on-Site traffic. Excavated rock (and any glacial till) will be used for access track construction as close to the source of extraction as possible.

8.5.2.6.2 Residual effects post mitigation

The mitigated effects associated with vehicular movements are considered to be **not significant** and **permanent**.

8.5.2.7 Ground Stability

8.5.2.7.1 Mitigation by Avoidance and Good Practice

Peat and slope stability investigations at the Site indicates that it has a generally low risk probability with respect to peat slippage and slope failure under the footprint of the Project. Nonetheless, the following mitigation measures will also be applied as recommended in the PSRA (included as **Appendix 8.1**):

- Short term temporary stockpiles will be limited to 1m height and removed for reuse/remediation purposes or transported to the designated spoil storage areas where the height will be 2m. It is envisaged that all material will be reused on the Sites, unless contaminated (for example, due to accidental hydrocarbon/fuel spill). Therefore, the risk posed by the management of material in terms of peat and slope stability is low.

Furthermore, with a view to applying the precautionary principle, the following procedures will be adopted as best practice mitigation measures at the Sites.

- All Site excavations and construction will be supervised by a geotechnical engineer/ engineering geologist.
- The Contractor's * methodology statement and risk assessment will be in line with the Construction Environmental Management Plan and will be reviewed and approved by a suitably qualified geotechnical engineer/engineering geologist prior to Site

operations. (*Contractor here refers to the chosen or contracted construction company at the commencement stage of the proposed Project).

- Particular attention and pre-construction assessment (developer / sub-contractor site specific risk assessment and method statement (RAMS) and on-site toolbox talks etc.) and mitigation planning will be given to any new infrastructure, for example, the proposed site access tracks, culverted watercourse crossings and associated hardstand / site access track.
- Groundwater level (pore water pressure) will be kept low at all times (excavation dewatering) to avoid ground stability risks (subsidence) associated with peat and careful attention will be given to the existing drainage and structures designed to be compatible with it. Draining water from the construction area will be done through advanced dewatering techniques. In particular, ponding of water will not be allowed to occur in recent excavations, particularly in any areas encountered where peat is >1m. All deliberate or incidental sumps will be drained to carry water away from the sump following rainfall to the nearest stilling pond via the constructed drainage network. Otherwise, this water would increase hydraulic heads locally (or increased bog water or groundwater levels), increase pore water pressure and can potentially lead to instability.
- In areas of saturated peatlands, prior to excavation, drains will be established to effectively drain grounds prior to earthworks. Such drains will be positioned at an oblique angle to slope contours to ensure ground stability. Drains on areas of the Site with minimal risk of bog failure as identified by Site Investigations will be positioned at a more acute angle to the slope contour in order to reduce the velocity of surface water drainage. It is noted that deeper (>2.0m) peat at the Site is generally confined to isolated pockets and the need for measures such as sheet piling is very low.
- Peat will be carefully managed particularly when in temporary storage. Temporary storage areas will be isolated from the receiving environment by means of temporary infrastructure such as boundary berms comprised of subsoils sourced at the Site, or similar material. There is potential for large volumes of bog water draining from new stockpiles which will also be managed. Mitigation will include removal of gross solids from runoff prior to bog water intercepting the wind farm drainage network. Temporary measures such as dewatering and pumping through silt bags will be employed to assist this process. Draining of stockpiled peat, will be controlled, (**Appendix 2.1**), with a view to reducing the weight and mobility of the material, therefore reducing risk in terms of localised stability. Similar measures will be applied to the management of subsoil arisings at the Site.

- Peat is required for reinstatement, therefore acrotelm peat (top living layer, c. 0.5m) will be stripped off the surface of the bog and placed carefully at the margins of the development along the Site track and hardstand margins or future use.
- Relatively high impact construction activities (e.g., excavations, movement of soils / subsoils / rock) are acceptable to be carried out throughout the year, when taking into account the various restrictions of the Project, (for example, breeding bird seasons). However, considering the variability of metrological conditions and the potential for significant events to occur at any stage of the year, the construction phase will be limited to favourable meteorological conditions. In order to mitigate for particular earth works tasks and suitable meteorological conditions, construction activities will not occur during periods of sustained significant rainfall events, or directly after such events (allowing time for work areas to drain excessive surface water loading and discharge rates reduce).
- The majority of landslides occur after an intense period of rainfall. Stability issues at a localised scale will be similarly impacted by rainfall events, particularly when dealing with exposed soils or open excavations. An emergency response system will be developed for the construction phase of the project, particularly during the early excavation phase. This, at a minimum, will involve 24-hour advance meteorological forecasting (Met Éireann download) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g. one in a 100-year storm event or very heavy rainfall at >25mm/hr), planned responses will be undertaken. These responses will include; cessation of construction until the storm event including storm runoff has passed over. Following heavy rainfall events, and before construction works recommences, the Site will be inspected and corrective measures implemented to ensure safe working conditions, for example dewatering of standing water in open excavations, etc.

Vehicular movements will be restricted to the footprint of the proposed amended Project, and advancing ahead of any constructed hardstand will be minimised in so far as practical, for example; excavation ahead of established hardstands will be in line with expected phases of Turbine Hardstand and sit access track construction in terms of both delivery of and installation of material and site activity periods whereby excavations will not be opened ahead of site shut down periods. This will be done with a view to minimising soils / subsoils exposure to rain and runoff.

Ancillary machinery will be kept on established hardstands, no vehicles will be permitted outside of the footprint of the Project and will not move onto land that is not proposed for the Project if it can be avoided. Vehicular access to any areas of deep peat (>1m) during construction will be restricted to low ground pressure vehicles, with all construction vehicles travelling on existing access tracks whenever possible.

Best practice will be applied during construction which will minimise the risk of ground instability. All works will be managed and carried out in accordance with the Construction Environmental Management Plan (CEMP, **Appendix 2.1**), which will be updated by the civil engineering contractor and agreed prior to any Site works commencing.

A Geotechnical Clerk of Works will be employed during the construction phase in order to continuously monitor areas of peat. Ongoing physical stability checks and calculations will be undertaken in order to verify that safety standards are being met.

Adhering to the mitigation measures described herewith will minimise the adverse effects posed by vehicular movements, and ultimately any effects arising will be temporary considering the initial decommissioning and construction phases will in effect reverse any impact by vehicular movement within the footprint of the Project.

8.5.2.7.2 Mitigation by Reduction

The temporary storage of construction materials, equipment, and earth materials will be kept to an absolute minimum during the construction phase. This will be achieved by means of appropriate planning and logistical considerations forming part of the CEMP (**Appendix 2.1**), similar to the measures set out in relation to the management of spoil on the Site.

For example, the excavation material for the construction of access track will not progress ahead of actual track construction (as discussed under mitigation addressing vehicular movements), therefore minimising the volume of arisings to be managed. Areas for permanent deposit of material e.g., backfill adjacent to constructed infrastructure, will be identified and suitable material deposited as it becomes available. These efficiencies will be designed into the detailed CEMP (**Appendix 2.1**).

8.5.2.7.3 Emergency Response

Mitigation measures as outlined in the previous sections will reduce the potential for stability issues arising during the construction phase. However, there remains a low risk of stability issues arising, particularly at a localised scale.

Emergency responses to potential stability incidents have been assessed and established to form part of **Appendix 2.1 - CEMP**, **Emergency Response Plan** before construction works are initiated. The following are potential emergencies and respective emergency responses to be followed in the event of an incident in:

- Peat stability issues at a localised scale during excavation works – In the event that soil stability issues arise during construction activities, all ongoing construction activities at the particular area of the Site will cease immediately, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be taken. Localised stability issues will likely occur with a broad range in severity including; minor side wall collapse with no significant impact, to relatively significant areas of peat being impacted by excavation activities, or in worst case scenarios localised stability at one location triggering a chain of events leading to significant peat or slope stability issue arising, including localised stability in close proximity to receptors. The assigned geotechnical engineer will assess each scenario and will escalate to the following mitigation scope as the need arises.
- Provision for a peat stability monitoring programme to identify early signs of potential bog slides (pre-failure indicators, for example cracks forming). This will be done in line with Scottish Governments' "Peat Landslide Hazard and Risk Assessments".
- Significant peat or slope stability issues during construction activities – In the unlikely event that soil and slope stability issues arise during construction activities, all ongoing activities in the vicinity will cease immediately, all operators will evacuate the area by foot, if safe to do so, until the area is assessed by competent person/s, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed. The area impacted will be characterised fully and risk assessments completed prior to any further works commencing at or near the location. This assessment will be phased including initial rapid response Phase 1 Assessment which will include at a minimum the prescription of exclusion zones and preliminary mitigation steps to be taken, for example; the management of runoff in or from the affected area.

Considering the highly dynamic nature of peat or soil stability issues at any particular site, it is important to establish an equally dynamic yet robust framework to follow in the event of an incident. Establishment of an emergency framework will follow relevant guidance to initially qualify any incident (by on site competent geotechnical engineer) and risk assess the area, and to then apply initial measures and design a complete emergency / contingency plan in line with an established structured emergency response. Relevant guidance includes as presented in **Section 8.2.2** will be adhered to.

Emergency response will prioritise isolating and containing any materials which is being or will be intercepted by the established drainage network or receiving surface water network. Emergency materials and equipment requirements will be identified, incorporated in the CEMP, and will be managed on Site with a view to be being easily accessible and readily available.

On Site training and toolbox talks will ensure any response to any potential incident is mobilised quickly and efficiently.

The following is a non-exhaustive list of potential emergencies identified and respective emergency responses:

- Peat stability issues at a localised scale during excavation works – In the event that soil stability issues arise during construction activities, all ongoing construction activities at the particular area of the Site will cease immediately, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed.
- Significant peat or slope stability issues during construction activities – In the unlikely event that soil and slope stability issues arise during construction activities, all ongoing activities in the vicinity will cease immediately, operators will evacuate the area by foot, the assigned geotechnical supervisor will inspect and characterise the issue at hand, corrective measures will be prescribed.

The combination with mitigation measures as described under **EIAR Chapter 9: Hydrology and Hydrogeology** whereby precautionary measures e.g., silt screen fencing etc. will be in place. Emergency response above existing or in place measures might include crudely building dams with an excavator to attenuate or direct flow until conditions stabilise, depositing subsoil or crushed rock material to dam drainage channels, and reactionary dewatering through silt bags to appropriate areas of the Site i.e., vegetated area and without impacting on problem area in terms of stability.

8.5.2.7.4 Residual effects post mitigation

The mitigated effects associated with ground stability are considered to be **not significant to slight** and **permanent but reversible** (depending on event).

8.5.2.8 Soil Contamination

Any accidental spillage of introduced materials, such as concrete, will be removed from the Site.

Soil contamination, or the potential for same, is an inherent risk associated with any development. As such, good practice during construction activities, as detailed in the CEMP (**Appendix 2.1**), will address and minimise the potential for soil contamination to occur. The CEMP will be developed to include the scheduled checks of assets (plant, vehicles, fuel bowsers) on a regular basis during the construction phase. The purpose of this management control is to ensure that the measures in place are operating effectively, prevent accidental leakages, and identify potential breaches in the protective retention and attenuation network during earthworks operations. In addition, all such management plans will be revised as 'live' documents, so that lessons learned, and improvements will be made over course of the Project.

8.5.2.9 Mitigation by Avoidance and Good Practice

8.5.2.9.1 Release of Hydrocarbons

Contaminants which pose the most significant risk to soils, namely hydrocarbons and construction materials such as cement / concrete, pose an even greater risk to surface waters and groundwaters. In the event an accidental discharge was to occur without mitigation, contaminates will likely leak or be spilled on soils initially. Protecting soils from such will in turn mitigate against the potential for contaminates reaching the hydrological network associated with the Site, however given that such features are fundamental to the potential effect of contaminants down gradient of surface water receptors, mitigation measures for contaminants are presented in detail in **Chapter 9: Hydrology and Hydrogeology.** To control and contain any potential hydrocarbon or other harmful substance spillages by vehicles during construction, it is recommended where possible to refuel plant equipment off the wind farm site, thus mitigating this potential impact by avoidance.

Where fuelling offsite is impractical (e.g., bulldozers, cranes, etc.) and fuelling must occur on Site, all oil and chemical storage facilities will be bunded to 110% volume capacity of fuels stored at the site. A "fuel station" will be designated for the purpose of safe fuel storage and fuel transfer to vehicles, located at the Temporary Contractor's Compound. Furthermore, an Emergency Response Plan is in place as part of the CEMP (**Appendix 2.1**) and will be updated before consented works are carried out. Refuelling will only occur on a hardstand with a spill kit.

As discussed, construction activities will be restricted to the footprint of the Project, therefore the potential for contaminants reaching soils is likely limited to the footprint of the Project or construction area. There remains the potential for contaminant migration through soils however, scope for migration is limited considering the site geology i.e., peat / loamy soil with low permeability and transmissivity rates, and similarly poorly productive bedrock aquifers with only localised connectivity. The highest permeability and transmissivity rates at the Site are attributed to the underlying till / gravels. It is also noted that the scale of any potential contamination impact will likely be minor in scale, for example; plant machinery leak (on exposed ground), as opposed to a fuel tank rupture (in bunded structure).

A fuel management plan will be prepared (and included in the CEMP) which will incorporate the following elements:

- Mobile bowsers, tanks and drums will be stored in secure, impermeable storage area, away from drains and open water;
- Fuel containers will be stored within a secondary containment system e.g., bund for static tanks or a drip tray for mobile stores;
- Ancillary equipment such as hoses, pipes will be contained within the bund;
- Taps, nozzles or valves will be fitted with a lock system;
- Fuel and oil stores including tanks and drums will be regularly inspected for leaks and signs of damage; and
- Only designated trained operators will be authorised to refuel plant on Site.

In the event of an accidental spill during the construction, operational or Decommissioning phase, contamination occurrences will be addressed immediately, this includes the cessation of works in the area of the spillage until the issue is resolved. In this regard, appropriate spill kits must be provided across the site to deal with the event of a spillage and made available at all times. Spill kits will contain a minimum of; oil absorbent granules, oil absorbent pads, oil absorbent booms, and heavy-duty refuse bags (for collection and appropriate disposal of contaminated matter). Staff will be trained in their use and details of personnel and location and type of spill kits will be listed in the CEMP (**Appendix 2.1**), which will be updated by the selected site Contractor. No materials contaminated or otherwise will be left on the Site. Suitable receptacles for hydrocarbon contaminated materials will also be at hand. Upon usage, spill kits will be promptly replaced.

The mitigated effects associated with hydrocarbons is considered to be **neutral and temporary**.

8.5.2.9.2 Release of Wastewater Sanitation Contaminants

A temporary compound area will be constructed on-site to contain temporary facilities for the construction phase including 'port-a-cabin' structures. The Temporary Construction Compound will be constructed on a base of geo-textile matting laid at ground level. This will be stabilised with the laying of hardcore material on top. During the construction phase, foul effluent will be periodically removed for offsite disposal.

Wastewater/sewerage from the staff welfare facilities located in the Temporary Construction Compound will be collected and held in a sealed storage holding tank, fitted with a high-level alarm. The high-level alarm is a device installed in the storage tank that is capable of sounding an alarm during a filling operation when the liquid level nears the top of the tank. Chemicals are likely to be used to reduce odours.

All wastewater will be emptied periodically, tankered off-site by a licensed waste collector to the local Kilrush wastewater sanitation plant for treatment. There will be no onsite treatment of wastewater. A wastewater or sewerage leakage is not anticipated in a properly managed Site.

The mitigated effects associated with wastewater and sewerage is considered to be **slight**, **temporary** and **neutral**.

8.5.2.9.3 Release of Construction and Cementitious Materials

In order to mitigate the potential impact posed by the use of concrete and the associated effects on surface water in the receiving environment, the following precautions and mitigation measures are recommended as outlined in the CEMP (**Appendix 2.1**).

Precast concrete will be used wherever possible i.e., formed offsite. Elements of the Project where the use of precast concrete is not possible includes Turbine Foundations. Where the use of precast concrete is not possible the following mitigation measures will apply:

- Lean mix concrete, often used to provide protection to main foundations of infrastructure from soil biome, will be minimised, limited to the requirement of turbine foundations if necessary. Lean mix concrete can alter the pH of water if introduced, which would then require the treatment of acid before being discharged to the surrounding environment. The risk of runoff will be minimal, as concrete will be contained in an enclosed, excavated area.
- The acquisition, transport and use of any cement or concrete on site will be planned fully in advance of commencing works by the Contractor's Environmental Manager and supervised at all times by the Developer appointed Ecological Clerk of Works (ECoW).
- There will be no excess cementitious material on the vehicle which could be deposited on trackways or anywhere else on site. To this end, delivery trucks, tools and

equipment will be cleaned at designated washout areas located conveniently and within a controlled area of the Site. Vehicles will undergo a visual inspection prior to being permitted to drive onto the proposed site or progress beyond the contractor's yard.

In addition, the following drainage measures will apply:

- Any shuttering installed to contain the concrete during pouring will be installed to a high standard with minimal potential for leaks. Additional measures could be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- Concrete will be poured during periods of minimal precipitation. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e., avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3mm/hour). This also will avoid such conditions while concrete is curing, in so far as practical.
- Ground crew will have a spill kit readily available, and any spillages or deposits will be cleaned/removed as soon as possible and disposed of appropriately.
- Pouring of concrete into standing water within excavations will not be undertaken. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- No surplus concrete will be stored or deposited anywhere on site. Such material will be returned to the source location or disposed of off-site appropriately.

Elements of the Project where precast concrete will be used will be identified in the CEMP e.g., structural elements of watercourse crossings (single span / closed culverts) as well as cable joint bay structures.

Supplementary mitigation measures outlined in **Chapter 9: Hydrology and Hydrogeology** to surface water receptors will also apply. The mitigated effects associated with construction waste is considered to be **slight** and **neutral**.

8.5.2.9.4 General Waste

All construction and operation waste materials will be correctly sorted, recycled or disposed of accordance with good site practice and in accordance with the measures outlined in the CEMP (**Appendix 2.1**). A policy of Prevent, Reduce, Reuse and Recycle will apply. The mitigated effects associated with general waste is considered to be **slight**, **temporary** and **neutral**.

8.5.2.9.5 Mitigation by Reduction

As discussed previously, careful design of the wind farm has reduced the amount of Site traffic required on Site by reducing site access tracks lengths, excavation volumes and double handling. Similarly, good Site practice and a robust CEMP will also result in less traffic and a lower potential for fuel spills and leakages. Any vehicles coming onto the Site will be required to be inspected and cleaned before leaving the Temporary Construction Compound before advancing to the destined construction area.

8.5.2.9.6 Emergency Response

Mitigation measures as outlined in the previous sections will reduce the potential for soil contamination during the construction phase. However, there remains the risk of accidental spillages and or leaks of contaminants onto soils.

Emergency responses to potential contamination incidents have been assessed (**EIAR Chapter 5: Population and Human Health**, have been established as a Part of **Chapter 9: Hydrology and Hydrogeology, Section 9.5.2.14,** and form part of the **Emergency Response Plan,** which is part of the CEMP, **Appendix 2.1** before construction works initiate. Potential emergencies and respective emergency responses are assessed below:

- Hydrocarbon spill or leak – Hydrocarbon contamination incidents will be dealt with immediately as they arise. Hydrocarbon spill kits will be prepared and kept in vehicles associated with the construction phase. Spill kits will also be established at proposed construction areas, for example, a spill kit will be established and mobilised as part of the turbine erection materials and equipment. Suitable receptacles for hydrocarbon contaminated materials will also be at hand.
- Significant hydrocarbon spill or leak – In the event of a significant or catastrophic hydrocarbon spillage, emergency responses will be escalated accordingly. Escalation can include measures such as the installation of temporary sumps, drains or dykes to control the flow or migration of hydrocarbons, excavation and disposal of contaminated material.
- Cementitious material – Cement / concrete contamination incidents will be dealt with immediately as they arise. Spill kits will also be established at proposed construction areas, for example, a spill kit will be established and mobilised as part of the turbine erection materials and equipment. Suitable receptacles for cementitious materials will also be at hand.

Emergency contact numbers for the Local Authority Environmental Section, Inland Fisheries Ireland, the Environmental Protection Agency and the National Parks and Wildlife Service will be displayed in a prominent position within the vicinity of works. Additionally, emergency responses, including methodologies, are specified in the CEMP **Appendix 2.1.**

In the event of a significant contamination or pollution incident e.g., discharge or accidental release of hydrocarbons / fuel to surface water systems, contamination occurrences will be addressed immediately, this includes the cessation of works in the area of the spillage until the issue is resolved. The relevant authorities, noted above and stakeholders will also be promptly informed. Refer to **Chapter 9: Hydrology & Hydrogeology** for further information.

8.5.2.9.7 Residual effects post mitigation

The mitigated effects associated with soil contamination are considered to be **not significant to slight** and **temporary to long term**.

8.5.2.10 Material and Waste Management

A Waste Management Plan has been prepared as part of the CEMP in **Appendix 2.1.** All excavated earth materials, wherever possible, will either be re-used in an environmentally appropriate and safe manner e.g., landscaping and bog restoration or removed from the Site at the end of the construction phase. No permeant stockpiles will be left on the Site, with the exception of the permanent spoil storage area near the site entrance and the borrow pit. Material arising on the Site will be reused as far as practical on the Site. Any excess material will be removed off site in an appropriate manner, as a waste or for reuse elsewhere as a biproduct.

Any surplus of natural materials (e.g., peat) to be used as backfill or deposited elsewhere in the Site will not be deposited to above existing / original ground level for the area in question. This includes infilling and restoring of the site borrow pit area. This ensures that peat used as backfill around newly established Turbine Foundations will not exceed local ground level, and any peat or natural materials deposited elsewhere, for example peat cutting areas, will not exceed original ground level. In essence, permanent peat stockpiles will be reduced to one established as a product of the construction phase of the Project, or associated restoration activities, majority of materials will be re-used as much as possible on-site.

Excavated materials onsite will be reused and recycled according to the Waste Hierarchy materials) or artificial (PVC piping, cement materials, electrical wiring etc.) will be taken offsite and disposed of at a licensed facility at the end of the construction phase, refer to **Appendix 2.1.** In the event of waste arising at the Site, management of waste arising from the construction phase of the Project will require classification, appropriate transfer, and appropriate disposal. Waste streams will vary and will include the following potential categories:

- Inert / Non-Hazardous Soils & Stones (EWC Code: 17 05 04) – greenfield subsoils and bedrock is likely to be Inert.
- Hazardous Soils & Stones (EWC Code: 17 05 03*) or oily waste (spill kit consumables) – Soils or any materials with significant hydrocarbon contamination will likely be hazardous due to Total Petroleum Hydrocarbon concentrations. Soils impacted by significantly by cementitious material contamination will likely be hazardous due to elevated pH concentrations.

Careful design will result in minimal excess soil and rock encountered during the construction phase.

All materials used on Site and wastes generated on Site will be reduced by good Site practice and attention to the CEMP. Mitigation by remediation, for example, housekeeping, maintenance etc., in terms of waste or contaminants will be an ongoing measure throughout the construction phase of the Development, that is any and all contaminants will be removed from the Site in an appropriate manner when ever produced or observed.

Waste management measures to avoid Site pollution are specified in the **CEMP Appendix 2.1** and **Chapter 15: Material Assets.** A policy of reduce, re-use and recycle will apply. All waste will be segregated and re-used where possible or removed from Site for recycling. Any waste which is not recyclable or compostable will be properly disposed of landfill.

8.5.2.10.1 Residual effects post mitigation

The mitigated effects associated with material and waste management are considered to be **not significant to slight** and **temporary to permanent**.

8.5.2.11 Construction Phase Residual Effects

Mitigation measures outlined in this report lay down the framework to reduce all potential effects of the Development on Geological receptors. It is noted that geological mitigation measures and effects are strongly connected to those related to Hydrology and Hydrogeology. Furthermore, the mitigation laid out in this chapter provides mitigation by avoidance measures for hydrology and hydrogeology effects. The Mitigated Potential

Effects lay down the achievable benchmarks provided measures are considered and implemented adequately.

8.5.3 Operational Phase

No new effects are anticipated during the operational phase of the Project on the geological, geomorphological and geotechnical environment therefore no additional mitigation measures are required.

Maintenance and monitoring during the operational phase pose similar hazards and risks associated with the construction phase but to a far lesser extent, for example, the potential for fuel spills from vehicles, etc. The mitigation measures described in this EIAR chapter will be adopted and implemented. All wastes from the control building and ancillary facilities will be removed by the appropriately authorised contractor. The operational team will carry out maintenance works (to site access tracks, Electrical Substation and turbines) and will put in place control measures to mitigate the risk of hydrocarbon or oil spills during the operational phase of the windfarm. Any vehicles utilised during the operational phase will be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected.

Regular monitoring, similar to the construction phase but on a less frequent basis will be required. For example, the wind farm site will be inspected on a routine quarterly basis and following storm events. Any potential issues arising will be noted and remedial action taken in line with construction phase mitigation.

8.5.3.1 Operational Phase Residual Effects

The potential effects on the soil and geological environment during the operational phase of the work will be mitigated through good Site practice; vehicular movements, hydrocarbon controls, sustainable use of natural resources, human health etc. as discussed previously. Overall, the residual effects from these aspects will have a **slight, permanent, adverse** effect on the Site.

8.5.4 Decommissioning and Restoration Phases

8.5.4.1 Decommissioning of Infrastructure

Following the permitted lifespan of the wind farm, decommissioning of the infrastructure will occur or the Site may be repowered with more modern turbines, subject to a separate planning application. All physical infrastructure (turbines, substation, mast etc.) will be removed, re-used or recycled as appropriate or upgraded if the Site is to be repowered.

Residual effects after the Decommissioning phase are complete include all effects classified as being long-term to permanent effects of the Project, that is, there will remain a change in ground conditions at the Site with the replacement of natural materials such as peat, subsoil and bedrock by concrete, subgrade and surfacing materials. This is a **localised, adverse, moderate** significance, **significant / moderate** weighted significance, **direct permanent** change to the materials composition at the Site. However, should the option to not repower the proposed wind farm be chosen, the carefully managed reintroduction and/or reuse of soils and peat at the Site in place of Turbine Hardstand areas, and successful habitat management, revegetating and rewilding of those areas will have **beneficial** effects, or **revert to baseline or improve on baseline conditions** of the preconstruction phase.

8.5.4.2 Decommissioning Phase Residual Effects

The residual effects associated with Decommissioning includes waste generation, hydrocarbon leakage and erosion of soil and rock. In general, effects will be similar to those at construction and operation, but of a greatly reduced magnitude.

8.5.4.3 Reinstatement of Redundant Access Track and Hardstand Areas

Where possible, redundant access tracks, turbine bases and hardstand areas will be reinstated. Some of the site access tracks and hardstanding areas, if not required during operation (for example the section of track leading to the borrow pit), will be reinstated. Areas of excess soil and rock will be reused in order to match the surrounding land as near as possible. Drainage and slopes will be restored as close to the original ground as possible if it is geotechnically and environmentally beneficial to do so.

After Decommissioning of the wind farm, all site access tracks and areas of hardstanding not required by the landowners will be returned to as close to their natural state as possible, again if it is geotechnically and environmentally feasible. Site access tracks will likely be left in-situ for use by the landowners.

8.5.4.4 Reinstatement Phase Residual Effects

An assessment of the effects likely to result from the proposed Project have been determined by RSK. The impact avoidance and mitigation measures outlined in this report lay down the framework to reduce the significance of all identified potential effects of the Project on Land, Soil and Geological receptors. These measures minimise what might otherwise be very significant adverse effects on the environment as a function of the Project.

The mitigated Potential Effects are achievable benchmarks, following implementation of the specified measures.

Table 8.11 identifies residual effects that will persist following application of the mitigation measures specified in the preceding sections. On completion of reinstatement works, following the construction phase, it is expected that the wind farm site will be returned as close to its present condition as possible. In particular, areas of peat and current drainage regimes will be reinstated and left to revegetate naturally with the passage of time and the Site will revert over time to a more natural drainage regime. It is expected that the long-term residual effects associated with the wind farm Development and Grid Connection Route will therefore be negligible.

8.6 SUMMARY OF SIGNIFICANT EFFECTS

This chapter comprehensively assesses all elements of the Project. The potential effects that could arise from the Project during the construction, operational and Decommissioning phases relate to the potential for increased stability issues and suspended sediment concentrations associated with site preparation activities and excavations for the infrastructure elements including the Turbine Foundations and cable trenches.

The unavoidable residual effects on the soils and geology environment as a function of the Project is that there will be a change in ground conditions at the Site with natural materials such as peat, subsoil and bedrock being replaced by concrete, subgrade and surfacing materials. This is a direct, localised, adverse, moderate significance at a local scale, direct permanent change to the materials composition at the Site.

Other potential effects are considered to range in significance from slight to significant and can potentially be long term to permanent including potential indirect or secondary effects on environmental receptors, namely the receiving surface water and drainage network. Providing the prescribed mitigation measures outlined in this report are fully implemented and best practice is followed on Site, the risk of such potential effects will be significantly reduced or avoided.

No new effects are anticipated during the operational phase of the Project. Similar hazards are identified when comparing the construction and operational phases of the Project, however considering that works will be far less intensive during the operational phase, the likelihood of effects is low, thus the risk is low.

No new adverse effects are anticipated during the Decommissioning phase of the Project however the phase will be considered similar in nature to the construction phase in terms of hazards and application of mitigation measures. Baseline conditions will be qualified again towards the end of the lifetime of the project (c. 35 years). Managed appropriately, the restoration of the Site following the Decommissioning phase will have neutral to beneficial effects relative to baseline conditions.

It is recommended that suitable monitoring programmes are implemented in order to ensure that there is rigid adherence both to the CEMP and to the mitigation measures outlined here during construction, operation and Decommissioning of the wind farm.

Table 8.11: Summary of potential effects on receiving environment from the Project in the absence of and with mitigation measures.

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation**	**Mitigation Applied**	**Quality**	**Significance**
Erosion and Degradation	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to Baseline (forestry)	Likely	Permanent	Section 8.5.2.1	Yes	Adverse	Neutral
Soil Sealing	Construction	Direct *	Adverse	Small to Moderate	Slight to Moderate	Development Footprint	Contrast to Baseline	Unavoidable	Long term/ Permanent	Section 8.5.2.2	Yes	Adverse	Slight to Moderate
Land Take Grid Connection Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g. public roads.	Unavoidable	Permanent but Reversible	Section 8.4.3.4.2	Yes	Adverse	Slight
Land Take Turbine Delivery Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g. public roads.	Unavoidable	Permanent but Reversible	Section 8.4.3.4.1	Yes	Adverse	Slight
Clear Felling of Afforested Areas	Construction	Direct *	Adverse	Small to Moderate	Moderate	Development Footprint and turbine buffer felling zones.	Conforms to baseline e.g. forestry tracks or operations)	Unavoidable	Permanent but Reversible	Section 8.5.2.3	Yes	Adverse to Beneficial	Slight
Subsoil and Bedrock Removal – General Excavations	Construction	Direct *	Adverse	Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g. agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Section 8.5.2.4.	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Site Access Tracks	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g. agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Section 8.4.3.6.2	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Hardstand and Foundation Areas	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g. agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible	Section 8.5.2.2.4	Yes	Adverse	Slight to Moderate
Subsoil and Bedrock Removal – Borrow Pit	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to baseline e.g. agri/forestry tracks or operations)	Unavoidable	Permanent but Reversible **	Section 8.5.2.2.4	Yes	Adverse	Slight to Moderate

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation**	**Mitigation Applied**	**Quality**	**Significance**
Subsoil and Bedrock Removal – Site Cable Trenches	Construction	Direct *	Adverse	Small to Moderate	Slight	Development Footprint	Conforms to Baseline e.g. public roads and services.	Unavoidable	Permanent / Reversible	Section 8.5.2.2.4	Yes	Adverse	Neutral
Subsoil and Bedrock Removal – Turbine Delivery Route	Construction	Direct *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g. public roads and services.	Unavoidable	Permanent / Reversible	Section 8.5.2.2.4	Yes	Adverse	Neutral
Subsoil and Bedrock Removal – Grid Connection Route	Construction	Direct *	Adverse	Moderate	Slight	Localised	Conforms to Baseline e.g. public roads and services.	Unavoidable	Permanent / Reversible	Section 8.5.2.2.4	Yes	Adverse	Neutral
Spoil Management	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint; Localised	Conforms to Baseline e.g. public roads and services.	Likely	Permanent / Reversible	Section 8.4.3.7.2	Yes	Adverse	Neutral / Beneficial
Geological Stability	Construction	Direct *	Adverse	Small to Large	Slight	Localised	Contrast to Baseline	Unlikely	Permanent	Section 8.5.2.5.7	Yes	Adverse	Neutral
Vehicular Movements - Compaction, Erosion and Degradation	Construction	Direct *	Adverse	Moderate to Large	Slight to Moderate	Development Footprint	Conforms to Baseline (forestry)	Likely	Permanent	Section 8.5.2.6.1	Yes	Adverse	Neutral
Subsidence and settlement of newly established and upgraded Site tracks	Construction	Direct	Adverse	Moderate to Large	Slight	Localised	Contrast to Baseline	Likely	Permanent	Section 8.5.2.5.7	Yes	Adverse	Slight to Moderate
Compaction, erosion and degradation arising from vehicular movement (Localised displacement)	Construction	Direct or Indirect /Secondary	Adverse	Moderate to Large	Slight to Moderate	Localised	Contrast to Baseline	Likely	Long term / Permanent	Section 8.5.2.6.1	Yes	Adverse	Neutral
Localised Stability Issue (Peat/soil stability issues arising from e.g. vehicular movement or excavations)	Construction	Direct *	Adverse	Small to Moderate	Slight (to Profound)	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary / Reversible	Section 8.5.2.7.2	Yes	Adverse	Slight

		Qualifying Criteria Pre-Mitigation										Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation**	**Mitigation Applied**	**Quality**	**Significance**
Landslide – worst case (Stability issues and slope failure arising from e.g. vehicular movement and excavations).	Construction	Direct *	Adverse	Small to Moderate	Significant (to Profound)	Localised (Potentially Regional)	Contrast to Baseline	Unlikely	Permanent	Section 8.5.2.7.1	Yes	Adverse	Neutral
Soil Contamination - Hydrocarbon	Construction	Direct *	Adverse	Small	Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Section 8.5.2.8.1.1	Yes	Adverse	Neutral
Soil Contamination - Wastewater Sanitation – Waste	Construction	Direct *	Adverse	Small	Moderate to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Section 8.5.2.8.1.2	Yes	Adverse	Neutral
Soil Contamination - Construction of Cementitious Material	Construction	Direct *	Adverse	Small	Slight to Significant	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Section 8.5.2.8.1.3	Yes	Adverse	Slight
Soil Contamination - General Waste	Construction	Direct *	Adverse	Small	Slight	Localised*	Contrast to Baseline	Likely	Long term / Permanent	Section 8.5.2.8.1.4	Yes	Adverse	Neutral
Land Take Wind Farm	Construction/ Operational	Direct *	Adverse	Small to Moderate	Slight to Moderate	Development Footprint	Conforms to baseline e.g. agri/forestry tracks or operations)	Unavoidable	Long term/ Permanent / Reversible after Decommissioning / Restoration	Section 8.4.4.1	Yes	Adverse	Slight to Moderate

Note:
* Includes Indirect / Secondary effects to receptors i.e. Hydrology/Hydrogeology. For example: Contamination of soils / peat by hydrocarbons is considered a localised effect, however if hydrocarbon contamination is intercepted by surface water features or groundwater bodies the effect is potentially regional depending in the environmental circumstances (**Chapter 9 – Hydrology and Hydrogeology**)
****** Not reversible in terms of geology e.g. replacing competent bedrock, but impacts to ground levels will reversible through reinstatement with fill.

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9 HYDROLOGY & HYDROGEOLOGY

9.1 INTRODUCTION

This chapter assesses the effects of the Project (**Figure 1.2**) on the hydrology and hydrogeology resources of the study area. This includes all elements within the Redline Boundary, the wind turbines, on-site Substation, site access tracks, turbine hardstands and all Site infrastructure, and the road realignment works on the turbine delivery route (TDR) in close proximity to the site entrance. This Chapter also provides a description of the work required along the proposed Grid Connection Route (GCR). Where adverse effects are predicted, appropriate mitigation strategies are described. The assessment will consider the potential effects during the following phases of the Project:

- Construction of the Project
- Operation of the Project
- Decommissioning of the Project (final phase).

The Project refers to all elements of the application for the construction and operation Ballykett Wind Farm (**Chapter 2: Project Description**). Common acronyms used throughout this EIAR can be found in **Appendix 1.4**.

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

- **Figure 9.1a -** Site Location & Layout Wind Farm (WF) & Grid Connection Route (GCR)
- **Figure 9.1b -** Site Location Turbine Delivery Route (TDR) works
- **Figure 9.2a -** Surface Water & Drainage Survey WF & GCR
- **Figure 9.2b -** Surface Water Survey TDR works
- **Figure 9.3 –** Surface Water Hydrochemistry Database
- **Figure 9.4 –** Preliminary Screening for Flood Risk Summary
- **Figure 9.5a -** Surface Water Network and Groundwater Resources WF & GCR
- **Figure 9.5b -** Surface Water Network and Groundwater Resources TDR works
- **Figure 9.6a -** Bedrock Aquifer WF & GCR
- **Figure 9.6b -** Bedrock Aquifer TDR works
- **Figure 9.7a -** Groundwater Vulnerability WF & GCR
- **Figure 9.7b -** Groundwater Vulnerability TDR works
- **Figure 9.8a -** WFD Status WF & GCR
- **Figure 9.8b -** WFD Status TDR works
- **Figure 9.9a -** WFD Risk WF & GCR
- **Figure 9.9b -** WFD Risk TDR works

- **Figure 9.10 -** Surface Water Flow Chart and Protected Areas WF, GCR & TDR works
- **Figure 9.11a -** Designated and Protected Areas WF & GCR
- **Figure 9.11b -** Designated and Protected Areas TDR works
- **Figure 9.12a –** Sensitive Receptor Area WF & GCR
- **Figure 9.12b** - Sensitive Receptor Area TDR works
- **Figure 9.13a -** Constraints WF & GCR
- **Figure 9.13b -** Constraints TDR works Overview

- **Appendix 9.1-** Ballykett Wind Farm Flood Risk Assessment
- **Appendix 9.2 -** Ballykett Wind Farm and TDR Photographs
- **Appendix 9.3 -** Surface Water Sampling Laboratory Certificates
- **Appendix 9.4 -** Conceptual and Information Graphics
- **Appendix 9.5 –** Section 50, Arterial Drainage Act, 1945

A Construction and Environmental Management Plan (CEMP) is appended to the EIAR in **Appendix 2.1**. This document will be developed into a site-specific Ballykett Wind Farm CEMP post consent / pre-construction once a contractor has been appointed. The CEMP will cover the construction of the Development. It will include all of the mitigation recommended within the EIAR. For the purpose of this application, a summary of the mitigation measures is included in **Appendix 17.1**.

9.1.1 Statement of Authority

RSK (Ireland) Ltd. (RSK), part of RSK Group, is a consultancy providing environmental services in the hydrological, hydrogeological and other environmental disciplines to clients in both the public & private sectors. More information can be found at www.rskgroup.com. RSK was commissioned by Jennings O'Donovan on behalf of their Client, Ballykett Green Energy Ltd., to carry out this Chapter of the Environmental Impact Assessment Report. The RSK team involved in this assessment includes:

- **Sven Klinkenbergh**, B.Sc. (Environmental Science), P.G.Dip. (Environmental Protection) – Principal Environmental Consultant, Project Manager and EIA Lead Author with c. 10 years industry experience in the preparation of hydrological and hydrogeological reports. Sven joined RSK Ireland after Minerex Environmental (8 years) were acquired by RSK Group in June 2021. Sven's current portfolio includes EIA Hydrology, Hydrogeology, Land, Soils and Geology assessments for a range of projects, a large proportion of which includes renewable energy/ wind farms. These projects very often involve peatlands and peat stability risk assessments. Sven has also worked on a large number of surface water and groundwater monitoring projects on IPC and similar sites, was team lead for site investigation and soil waste classification projects and has experience on construction dewatering and water treatment projects.

- **Jayne Stephens,** B.S.c (Environmental Science), PhD (Environmental and Infection Microbiology). Jayne is an Environmental consultant with c. 5 years' experience working in microbiology, water, and environmental disciplines. She graduated with a BSc in Environmental Science from National University of Ireland Galway in 2014, majoring in mammal ecology. Following this, Jayne was the successful Irish applicant to the Tropical Biological Association in Cambridge to complete a field course in tropical biodiversity and conservation in Tanzania. She holds a PhD (2023) in environmental microbiology. Jayne has worked on a large number of bathing water and surface water monitoring investigations, on project *Acclimatize*, an EU funded project which aimed to bridge the knowledge gap in relation to at-risk urban and rural bathing waters in Ireland and Wales. Also, she has experience with microbial contamination of water, and public involvement projects for better water quality. Jayne was team lead for site investigations for the proposed development in Ballykett.

9.1.2 Assessment Structure

In line with the EIA Directive and current EPA *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (2022) the structure of this Hydrology and Hydrogeology chapter is as follows:

- Details of methodologies utilised for both desk and field studies, in the context of legal and planning frameworks
- Description of baseline conditions at the Site
- Identification and assessment of effects to hydrology and hydrogeology associated with the Development, during the construction, operational and Decommissioning phases of the Development
- Mitigation measures to avoid or reduce the effects identified
- Identification and assessment of cumulative effects where applicable
- Identification and assessment of potential residual effects of the proposed Development following the implementation of proposed mitigation measures.
- Summary of Significant Effects and Statement of Significance.

9.1.3 Development Description

9.1.3.1 Wind Farm Site

Planning permission is being sought by the Developer for the construction of 4 no. wind turbines, permanent Met Mast, Electrical Substation and all ancillary works.

The Development **(Figure 9.1a)** will consist of the following main components:

- Erection of 4 no. 4-5MW wind turbines with an overall ground to blade tip height of 150m. The candidate wind turbine will have a rotor diameter of 136m and a hub height of 82m.
- Construction of site access tracks, Turbine Hardstand areas and Turbine Foundations
- A new site entrance with access onto the L6132 road.
- Construction of a Temporary Construction Compound for use during construction.
- Construction of 1 no. permanent Met Mast of 82m overall height.
- Construction of new internal site access tracks and upgrade of existing site track, to include all associated drainage including new clear span bridge crossing of the Moyasta 27 stream.
- Development of a site drainage network
- Construction of 1 no. permanent Electrical substation.
- All associated underground electrical and communications cabling connecting the wind turbines to the Electrical Substation.
- Ancillary forestry felling to facilitate construction of the Project.
- All works associated with the permanent connection of the wind farm to the national electricity grid comprising a 38kV underground cable in permanent cable ducts from the proposed, permanent, on-site substation to the existing Tullabrack 110kV ESBN Substation.
- Vertical realignment of an existing crest curve on the L6132 local road in order to prevent grounding of abnormal load vehicles during delivery of turbine component.

A 10-year planning permission and 35-year operational life from the date of commissioning of the entire wind farm is being sought.
In addition, the EIA also assesses temporary improvements and modifications to the existing public road infrastructure to facilitate delivery of abnormal loads and turbine delivery.

9.1.3.2 Turbine Delivery Route (TDR)

It has been proposed that the turbine nacelle, towers, hubs and rotor blades will be landed at the port of Foynes. County Limerick. From there, they will be transported to the Site via the N69 to the outskirts of Limerick city. Turbine blades may be carried from Foynes Port to the delivery site via the Shannon Tunnel (N18) but the larger /wider tower sections and generator / nacelle components will need to remain on the N69 via Dock road in Limerick City and cross the Shannon bridge unto Condell road (R527) and Ennis road (R445), and join the N18 in the Ennis / Galway direction as far as Junction 12 of the N18 to join the N85 Ennis Distributor Road. After accessing the N85 distributor road the Turbine Delivery Route will access the N68 in the direction of Kilrush and then onto the L6132 east to the new site entrance 450 metres east of Tullabrack Cross.

Temporary improvements and temporary modifications are required to the existing public road infrastructure to facilitate delivery of abnormal loads and turbine deliveries. Vertical realignment of an existing crest curve on the L6132 local road will be required in order to prevent grounding of abnormal load vehicles during delivery of turbine components.

Temporary road widening between Tullabrack Cross and the wind farm site entrance will be carried out to accommodate increased volumes of HGV vehicles associated with the construction of the wind farm. These are presented in **Appendix 8.3 Baseline Database - Turbine Delivery Route**.

All works along the TDR are assessed in **Chapter 16 Traffic and Transport** and shown on drawings attached as **Appendix 16.1**.

9.1.3.3 Grid Connection Route (GCR)

The preferred Grid Connection Route for the proposed Development is a 1.84km 38kV underground cable connection to Tullabrack 110kV substation. Further details are outlined in **Chapter 2 Project Description**.

9.1.3.4 Cable Joint Bays

Joint bays are pre-cast concrete chambers where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit. Each joint bay will typically be 6m long x 2.5m wide x 2.3m deep, pre-cast, reinforced, concrete structures installed below finished ground level. It is expected that joint bays will be located in the non-wheel and weight bearing strip of roadways, however given the narrow profile of local roads this may not always be possible.

9.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

The following sections are aligned with recommended good practice for the EIAR process (EPA, 2022) and where specific items are raised, they are assessed and discussed in detail.

9.2.1 Assessment Methodology

The following calculations and assessments were undertaken in order to evaluate the potential effects of the proposed development on the hydrology and hydrogeology aspects of the environment at the Site, the Grid Connection Route and the Turbine Delivery Route:

- Characterise the topographical, hydrological and hydrogeological regime of the Site from the data acquired through desk study and on site surveys
- Undertake preliminary water balance calculation
- Undertake preliminary flood risk evaluations
- Consider hydrological or hydrogeological constraints together with development design
- Consider drainage issues, or issues with surface water runoff quality as a result of the Development, its design and methodology of construction
- Assess the combined data acquired and evaluate any likely effects on the hydrology and hydrogeology aspects of the environment
- Where significant adverse effects are identified, assess alternatives for dealing with them and choose measures that will mitigate or reduce the identified impact.
- Present and report these findings in a clear and logical format that complies with EIAR reporting requirements.

9.2.1.1 General Approach

The Environmental Impact Assessment Report (EIAR) is a comprehensive document that assesses the potential impacts of a proposed development on the environment. It typically includes several fundamental components, including an assessment of baseline conditions, identification of site constraints, evaluation of the Project layout, identification of potential unmitigated impacts, and the identification and description of mitigation measures which will be incorporated into the Development design and associated management plans to minimise potential impacts to acceptable levels where possible, and to evaluate likely or expected residual impacts posed by the Development.

During the baseline assessment phase, the importance and sensitivity of environmental attributes are qualified relative to each chapter or discipline. This process involves considering available legal instruments, guidance, and relevant information or research to form the basis of qualifying environmental attributes or receptors. Site constraints are also identified during this phase, which are then used to inform the Project design.

The final design layout is then evaluated in terms of its likely impact on the receiving environment. Potential unmitigated impacts are identified and qualified by considering the importance and sensitivity of the receiving environment, as well as the nature, scale, magnitude, and duration etc. of the proposed activity or impact arising from the development.

Once potential impacts have been identified, the EIAR then describes mitigation measures that will be applied to minimize impacts to acceptable levels where possible. These measures are objective-driven and are applied with a view to achieving the desired end result. Mitigation by design, such as avoiding constraints, can help minimize the most significant potential impacts, but residual risks will remain. Therefore, adequate application, design and execution of described mitigation measures, ongoing monitoring, management, and escalation of emergency response mitigation where relevant will be required, and the mitigation measures may need to be redesigned, repeated or re-applied until the objectives of mitigation are being achieved.

Subject to planning consent, the mitigation measures which are outlined herein will be further developed during the detailed design and pre-construction phase and drafting of management plans such as, Construction and Environmental Management Plans (CEMP) and Surface Water Management Plans (SWMP) (see Appendix 2.1). The CEMP, SWMP or other management plans have been assessed as part of this chapter.

9.2.1.2 *Water Framework Directive Objectives Led Approach*

The sensitivity of the water environment receptors was assessed and each was classified regards their importance and sensitivity with respect to the relevant legislation, in particular the Water Framework Directive (WFD). Those classified as very important and sensitive receptors were assessed to ensure compliance with the objectives of the WFD.

Similarly, when assessing the proposed Development and related mitigation measures, the EIAR will set out to achieve mitigation and residual effect(s) aligned with the WFD objectives. For example, mitigation measures will aim to minimise any potential for contaminants reaching all sensitive receptors identified. Additionally monitoring outlined in the CEMP and **Section 9.5.2.15**, will ensure the efficacy of mitigation measures applied. In case a situation arises where the WFD objectives are not being met, then the emergency response and mitigation measures will be escalated until such time as the objectives of mitigation are being achieved and maintained.

9.2.1.3 *Striving for Nature Based Solutions and Net Benefit Impacts*

The approach to achieving objectives and net beneficial effects is mainly through the application of Nature Based Solutions, further outlined in Section 9.5.1.3. This can include improvements rooted in an ecological context, such as areas designated for ecological improvement, but a development can also be engineered to achieve Nature Based Solutions.

9.2.2 Relevant Legislation and Guidance

This study complies with the EIA Directive which requires Environmental Impact Assessment for certain types of major development before development consent is granted. This study was undertaken in accordance with following Irish legislation (transposition of the aforementioned directive):

- SI No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.
- Planning and Development Regulations 2001 – 2023.

In addition to this planning legislation, other environmental legislation relevant to hydrological and hydrogeological aspects of the environment were referred to:

- S.I. No. 293 of 1988: European Communities (Quality of Salmonid Waters) Regulations 1988
- S.I. No. 272/2009 - European Communities Environmental Objectives (Surface Waters) Regulations 2009
- S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011 as amended
- S.I. No. 684/2007 - Waste Water Discharge (Authorisation) Regulations 2007
- S.I. No. 106/2007 - European Communities (Drinking Water) Regulations 2007
- S.I. No. 722 of 2003 European Communities (Water Policy) Regulations 2003 as amended
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 as amended
- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 as amended
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010 as amended
- S.I. No. 99/2023 - European Union (Drinking Water) Regulations 2023
- S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018
- European Union Water Framework Directive (2000/60/EC) as amended

The fundamental objective of the Water Framework Directive as amended aims at maintaining "high status" of waters where it exists, preventing any deterioration in the existing status of waters and achieving at least "Good" in relation to all waters by 2027 (WFD).

This study has been prepared having regard to, inter alia, the following guidance documents;

- CIRIA (2001) Control of water pollution from construction sites. Guidance for consultants and contractors (C532)
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Technical Guidance (C648)
- CIRIA (2006) Control of Water Pollution from Linear Construction Projects – Site Guide (C649)
- CIRIA (2015) Environmental Good Practice on Site (fourth edition) (C741)
- CIRIA (2016) Environmental Good Practice on Site pocket book (fourth edition) (C762)
- Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Guidelines
- Enterprise Ireland (n.d.) "Best Practice Guide (BPGCS005) Oil Storage Guidelines"
- Inland Fisheries Ireland (IFI) (2016) "Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters"
- EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports
- Forest Service, Department of the Marine and Natural Resources (2000) Forestry and Water Quality Guidelines
- Institute of Geologists of Ireland (IGI) (2002) Geology in Environmental Impact Statements – A Guide
- IGI (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements
- Irish Wind Energy Association (IWEA) (2012) Best Practice Guidelines for the Irish Wind Energy Industry
- NRA (2008) Environmental Impact Assessment of National Road Schemes – A Practical Guide – Rev 1
- National Roads Authority (NRA) (2008) Guidelines on Procedures for the Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (*as amended) Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015) DN-DNG-03065.
- Office of Public Works (OPW) (2009) "The Planning System and Flood Risk Management, Guidelines for Planning Authorities"
- OPW (2019) "Construction, Replacement or Alteration of Bridges and Culverts"

- OPW (2019), Series of Ecological Assessment on Arterial Drainage Maintenance No. 13: Environmental Guidance: Drainage Maintenance and Construction
- Scottish Environment Protection Agency (SEPA) (2010) "Engineering in the Water Environment: Good Practice Guide – River Crossings"
- Scottish National Heritage (SNH) (2018) Environmental Impact Assessment Handbook – Version 5
- Transport Infrastructure Ireland (TII) (2014) "Drainage Design for National Road Schemes - Sustainable Drainage Options".

The Clare County Development Plan (2023-2029) Country Development Plan- i.e., Clare Wind Energy Strategy, were also consulted as part of the EIA process.

9.2.3 Study area

The study area for this assessment includes the hydrology and hydrogeology underlying the Redline Boundary, GCR and the areas along the TDR where works are proposed. Additionally, the scope of this assessment included a 10km radius of the proposed development site. However, the hydrologically connected rivers, designated areas also fall under assessment which can be downstream for up to c.50km and more. .

Constraints in the wider area outside of the Site such as SACs, SPAs, NHAs, surface water bodies, springs wells etc were mapped at the catchment and aquifer scale. This includes underlining hydrogeology, on site drainage, downstream surface water networks and associated SACs, groundwater under the site and possible connective hydrogeological features.

Connectivity has been investigated via an assessment of surface water drainage on site and how this may facilitate groundwater/ aquifer recharge. This investigation had desk and site-based elements by collecting data from open access public sources, and information collected during site visits. Groundwater features have the potential to discharge to surface water, and there are areas identified on site where there is potential for runoff to groundwater.

9.2.4 Desk Study

A desk study consisting of a review of all available datasets, information, and literature resources relevant to the Site has been completed. The most current datasets and information maintained by the Environment Protection Agency (EPA), Geological Survey of Ireland (GSI) and the Office of Public Works (OPW) were reviewed to assist in establishing the hydrological and hydrogeological characterisation of the Site.

Relevant documents and datasets used to assist in compiling the desk study included EPA water quality data, topography maps and GSI hydrogeological data. The following full list of sources and information were utilised to establish the baseline environment:

- Department of Housing, Planning and Local Government, National River Basin Management Plan 2018-2021 [Accessed on 02/02/2024] https://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021
- Department of Housing, Planning and Local Government DRAFT River Basin Management Plan for Ireland [Accessed on 02/02/2024] https://assets.gov.ie/199144/7f9320da-ff2e-4a7d-b238-2e179e3bd98a.pdf
- EPA Map Viewer, Water Framework Directive (WFD), surface water and hydrogeological features [Accessed on 02/02/2024] https://gis.epa.ie/EPAMaps/Water
- EPA HydroNet, Surface water levels, flows and groundwater levels [Accessed on 02/02/2024] http://www.epa.ie/hydronet/#Water%20Levels
- Office of Public Works (OPW), Preliminary Flood Risk Assessment (PFRA) [Accessed on 02/02/2024] https://www.gov.ie/en/publication/1c7d0a-preliminary-flood-risk-assessment-pfra
- Office of Public Works (OPW), National Flood Information Portal [Accessed on 02/02/2024] https://www.floodinfo.ie
- Ordnance Survey Ireland, Map Viewer [Accessed on 02/02/2024] https://www.geohive.ie/
- National Parks and Wildlife Service (NPWS), Protected Sites Map-Viewer [Accessed on 02/02/2024] https://www.npws.ie/protected-Sites
- The Geological Survey of Ireland (GSI), groundwater data and maps [Accessed on 02/02/2024] https://www.gsi.ie/en-ie/data-and-maps/Pages/Groundwater.aspx
- The Geological Survey of Ireland (GSI), karst features database [Accessed on 02/02/2024] https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-irish-karst/Pages/Karst-databases.aspx
- Myplan.ie; National Planning Application Map Viewer [Accessed on 02/02/2024] https://myplan.ie/national-planning-application-map-viewer
- Sustainable Energy Authority of Ireland (SEAI), Wind Atlas [Accessed on 02/02/2024]

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- Met Éireann Meteorological Data [Accessed on 02/02/2024] https://www.met.ie/climate/available-data/historical-data
- Department of Housing, Planning and Local Government, EIA Portal [Accessed on 02/02/2024] https://www.housing.gov.ie/planning/environmental-assessment/environmental-impact-assessment-eia/eia-portal

9.2.5 Field Work

Preliminary field investigations were carried out at the Site of the between June, November 2022 and November 2023. These works consisted of the following:

- Site walkover including recording and digital photography of significant features.
- Drainage distribution and catchment mapping.
- Field hydrochemistry of the drainage network (electrical conductivity, pH and temperature).
- Recording of GPS co-ordinates for all investigation and monitoring points in the study.
- Baseline sampling of surface water for analytical laboratory testing. Two baseline sampling events were carried out i.e., targeting low and high flow conditions.

9.2.6 Evaluation of Potential Effects

In line with relevant guidelines (EPA, 2022), and consideration of the criteria listed in Annex III of the Directive 2014/52/EU of the European Parliament and the council of April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, effects should be described by reference to the individual environmental factors and their sensitivities;

a) the **magnitude** and **spatial extent** of the effect (for example hydrological area and size of the population likely to be affected);
b) the **nature** of the effect;
c) the **transboundary nature** of the effect;
d) the **intensity** and **complexity** of the effect;
e) the **probability** of the effect;
f) the **expected onset, duration, frequency** and **reversibility** of the effect;
g) the **cumulation** of the effect with the impact of other existing and/or approved projects;
h) the **possibility of effectively reducing the impact**.

9.2.6.1 Sensitivity

Sensitivity is defined as the potential for a receptor to be significantly affected by a proposed development (EPA, 2022). The EPA provides guidance on the assessment methodology, including defining general descriptive terms in relation to magnitude of effects however, in terms of qualifying significance of the receiving environment the EPA guidance also states that:

"*As surface water and groundwater are part of a constantly moving hydrological cycle, any assessment of significance will require evaluation beyond the development Site boundary.*" (EPA, 2015)

To facilitate the qualification of hydrological and hydrogeological attributes, guidance specific to hydrology and hydrogeology as set out by National Roads Authority (NRA) 2008, has been used in conjunction with EPA guidance. **Table 9.1** presents rated categories and criteria for rating Site attributes (NRA, 2008).

Table 9.1: Criteria for rating the quality of site attributes – hydrology and hydrogeology specific (NRA, 2008)

Importance	Criteria
Extremely High	Attribute has a high quality or value on an international scale.
Very High	Attribute has a high quality, significance or value on a regional or national scale.
High	Attribute has a high quality, significance or value on a local scale.
Medium	Attribute has a medium quality, significance or value on a local scale.
Low	Attribute has a low quality, significance or value on a local scale.

Considering the above categories of rating importance and associated criteria, the following **Table 9.2** presents rated sensitivity categories adapted from www.sepa.co.uk (SNH, 2013):

Table 9.2: Criteria for rating site sensitivity (Adapted from www.sepa.co.uk)

Importance	Criteria
High Sensitivity	Receptor is of high environmental importance or of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as 'High' and salmonid spawning grounds present. All public drinking water supplies, including drinking water rivers, lakes, GSI Public – Source protection areas and NFGWS Group Scheme Source Protection Areas. Nutrient sensitive rivers and downstream sensitive receptors such as Shellfish areas. Receptor has a very low capacity to accommodate the proposed form of change. GSI groundwater vulnerability "Extreme" classification and "Regionally" important aquifer
Medium Sensitivity	Sensitive Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as 'Good'. Salmonid species may be present and may be locally important for fisheries.

Importance	Criteria
	Abstractions for private water supplies. Receptor has a low capacity to accommodate the proposed form of change. GSI groundwater vulnerability "High" classification and "Locally" important aquifer.
Low Sensitivity	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as 'Moderate' and 'Poor', fish sporadically present or restricted). Heavily engineered or artificially modified waterbodies that may dry up during summer months. No public or private water supplies. Receptor has some tolerance to accommodate the proposed change. GSI groundwater vulnerability "Low" – "Medium" classification and "Poor" aquifer importance.

9.2.6.2 *Magnitude*

The magnitude of potential effects arising from the Development are defined in accordance with the criteria provided by the EPA, as presented in Error! Reference source not found. (EPA, 2022). These descriptive phrases are considered general terms for describing potential effects of the Development, and provide for considering baseline trends, for example, a "*Moderate"* effect is one which is consistent with the existing or emerging trends.

Table 9.3: Describing the Magnitude of Effects (EPA, 2022)

Magnitude of Impact	Description
Imperceptible	An effect capable of measurement but without noticeable consequences
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	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.

In terms of hydrology and hydrogeology, magnitude is qualified in line with relevant guidance, as presented in the following tables (**Table 9.4** & **Table 9.5)**(NRA, 2008). These descriptive phrases are considered development specific terms for describing potential effects (in the hydrological/hydrogeological environment) of the Development, and do not provide for considering baseline trends (associated with 'do nothing' scenarios). These descriptive phrases are utilised to qualify effects in terms of weighting effects relative to Site attribute importance, and scale where applicable.

Table 9.4: Qualifying the magnitude of effect on hydrological attributes

Magnitude of Impact	Description	Examples
Large Adverse	Results in loss of attribute and/or quality and integrity of attribute	• Loss or extensive change to a waterbody or water dependent habitat, or • Calculated risk of serious pollution incident >2% annually, or • Extensive loss of fishery
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Partial reduction in amenity value, or • Calculated risk of serious pollution incident >1% annually, or • Partial loss of fishery
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Slight reduction in amenity value, or • Calculated risk of serious pollution incident >0.5% annually, or • Minor loss of fishery
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	Results in minor improvement of attribute quality	• Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Moderate Beneficial	Results in moderate improvement of attribute quality	• Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Major Beneficial	Results in major improvement of attribute quality	• Reduction in predicted peak flood level >100mm

Table 9.5: Qualifying the magnitude of effect on hydrogeological attributes

Magnitude of Impact	Description	Example
Large Adverse	Results in loss of attribute and /or quality and integrity of attribute	• Removal of large proportion of aquifer, or • Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems, or • Potential high risk of pollution to groundwater from routine run-off.
Moderate Adverse	Results in impact on integrity of attribute or loss of part of attribute	• Removal of moderate proportion of aquifer, or • Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems, or • Potential medium risk of pollution to groundwater from routine run-off.

Magnitude of Impact	Description	Example
Small Adverse	Results in minor impact on integrity of attribute or loss of small part of attribute	• Removal of small proportion of aquifer, or • Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems, or • Potential low risk of pollution to groundwater from routine run-off.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Calculated risk of serious pollution incident <0.5% annually.

9.2.6.3 Significance Criteria

Considering the above definitions and rating structures associated with sensitivity, attribute importance, and magnitude of potential effects, rating of significant environmental effects is carried out in accordance with relevant guidance as presented in the Error! Reference source not found. below (NRA, 2008). This matrix qualifies the magnitude of potential effects based on weighting factors depending on the importance and/or sensitivity of the receiving environment. In terms of Hydrology and Hydrogeology, the general terms for describing potential effects (Error! Reference source not found.**: Describing the Magnitude of Effects**) are linked directly with the development specific terms for qualifying potential effects (Error! Reference source not found.**: Qualifying the Magnitude of Impact on Hydrological Attributes** and **Table 9:5 Qualifying the Magnitude of Impact on Hydrogeological Attributes**). Therefore, qualifying terms (Error! Reference source not found.) are used in describing potential effects of the proposed Development.

Table 9.6: Weighted rating of significant environmental effects

Sensitivity (Importance of Attribute)	Magnitude of Effect			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Extremely High	Imperceptible	Significant	Profound	Profound
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound
High	Imperceptible	Moderate / Slight	Significant / Moderate	Profound / Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

9.2.6.4 Scoping Responses and Consultation

Information has been provided by a number of consultee organisations during the assessment, and this is summarised in Error! Reference source not found.. The response to each point raised by consultees is also presented within the table, demonstrating where the design of the Development has addressed responses to specific issues indicated by respective consultees. For further information on consultations, please refer to **Chapter 1 Table 1.6** and in **Appendix 1.3**.

Table 9.7: Scoping responses and consultation

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
Irish Water	Response to EIA Scoping Request – Proposed wind farm development located in the townland of Ballykett, Co. Clare. 22.09.2022	*a) Where the development proposal has the potential to impact an Irish Water Drinking Water Source(s), the applicant shall provide details of measures to be taken to ensure that there will be no negative impact to Irish Waters Drinking Water Source(s) during the construction and operational phases of the development. Hydrological / hydrogeological pathways between the applicant's Site and receiving waters should be identified as part of the report.* *b) Where the development proposes the backfilling of materials, the applicant is required to include a waste sampling strategy to ensure the material is inert.* *c) Mitigations should be proposed for any potential negative impacts on any water source(s) which may be in proximity and included in the environmental management plan and incident response.* *d) Any and all potential impacts on the nearby reservoir as public water supply water source(s) are assessed, including any impact on hydrogeology and any groundwater/ surface water interactions.* *e) Impacts of the development on the capacity of water services (i.e. do existing water services have the capacity to cater for the new development). This is confirmed by Irish Water in the form of a Confirmation of Feasibility (COF). If a development requires a connection to either a public water supply or sewage collection system, the developer is advised to submit a Pre-Connection Enquiry (PCE) enquiry to Irish Water to determine the feasibility of connection to the Irish Water network. All pre-connection enquiry forms are available from https://www.water.ie/connections/connection-steps/.* *f) The applicant shall identify any upgrading of water services infrastructure that would be required to accommodate the proposed development.*	• (a) Baseline section of Report identifies receptors; **Sections 9.3.14, 9.3.15, 9.3.17** and **9.3.18, Section 9.5** for Mitigation Measures • (b) Explained in **Section 8.5.2.2.4** of EIAR Chapter 8: Soils and Geology • (c) **Section 9.5.2.16** as well as appended CEMP • (d) All potential effects assessed and mitigated against as part of the EIAR process. **Section 9.3.12** and **Section 9.3.18, Section 9.4.3.11** • (e) Not applicable; Project will not be connected to the public water supply; **Section 9.4.4.6.3** • (f) Not applicable •

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		g) In relation to a development that would discharge trade effluent – any upstream treatment or attenuation of discharges required prior to discharging to an Irish Water collection network. *h) In relation to the management of surface water; the potential impact of surface water discharges to combined sewer networks and potential measures to minimise and or / stop surface waters from combined sewers.* *i) Any physical impact on Irish Water assets – reservoir, drinking water source, treatment works, pipes, pumping stations, discharges outfalls etc. including any relocation of assets.* *j) When considering a development proposal, the applicant is advised to determine the location of public water services assets, possible connection points from the applicant's Site / lands to the public network and any drinking water abstraction catchments to ensure these are included and fully assessed in any pre-planning proposals. Details, where known, can be obtained by emailing an Ordnance Survey map identifying the proposed location of the applicant's intended development to datarequests@water.ie.* *k) Other indicators or methodologies for identifying infrastructure located within the applicant's lands are the presence of registered wayleave agreements, visible manholes, vent stacks, valve chambers, marker posts etc. within the proposed Site.* *l) Any potential impacts on the assimilative capacity of receiving waters in relation to Irish Water discharge outfalls including changes in dispersion / circulation characterises. Hydrological / hydrogeological pathways between the applicant's Site and receiving waters should be identified within the report.* *m) Any potential impact on the contributing catchment of water sources either in terms of water abstraction for the development (and resultant potential impact on the capacity of the source) or the potential of the development to influence / present a risk to the quality of the water abstracted by Irish Water for public supply should be identified within the report.*	• (g) Not applicable; no discharging of trade effluent anticipated as part of the Project. • (h) Not applicable; Project will not discharge to combined sewer networks. • (i) Not applicable; Project will not interfere with Irish Water assets. • (j) N/A • (k)N/A. • (l) **Section 9.5.1.2** • m) Not applicable; Water abstraction is not anticipated works as part of the Project.

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		n) Where a development proposes to connect to an Irish Water network and that network either abstracts water from or discharges wastewater to a "protected"/ sensitive area, consideration as to whether the integrity of the Site / conservation objectives of the Site would be compromised should be identified within the report. *o) Mitigation measures in relation to any of the above ensuring a zero risk to any Irish Water drinking water sources (Surface and Ground water).*	• (n) Not applicable; Project does not propose to connect to an Irish Water network • (o) **Section 9.5**
National Parks and Wildlife Services (NPWS)	G Pre00240/2022 Proposed Pre Planning Development: Ballykett Green Energy: Request for Scoping Opinion on information to be included in the preparation of an Environmental Impact Assessment (EIA) for Ballykett Wind Farm, Ballykett, Co. Clare 27.10.2022	*(a) Wetlands are important areas for biodiversity and ground and surface water quality should be protected during construction and operation of the proposed development. The EIAR should include a detailed assessment of the hydrological impacts on wetlands from the proposed development. Any watercourse or wetland which may be impacted on should be surveyed for the presence of protected species and species listed on Annexes II and IV of the Habitats Directive. For example, these species could include Otter (Lutra lutra) which are protected under the Wildlife Acts and listed on Annex II and IV of the Habitats Directive as amended, Salmon (Salmo salar), Lamprey (three species in Ireland) listed on Annex II of the Habitats Directive as amended, Freshwater Pearl Mussel (Margaritifera species) and White-clawed Crayfish (Austropotamobius pallipes) which are both protected under the Wildlife Acts* as amended *and listed on Annex II of the Habitats Directive as amended, Frogs (Rana temporaria) and Newts (Trituris vulgaris) protected under the Wildlife Acts and Kingfishers (Alcedo atthis) protected under the Wildlife Acts as amended and listed on Annex I of the Birds Directive (Council Directive 79/409 EEC).* *(b) Flood plains, if present, should be identified in the EIAR and left undeveloped to allow for the protection of these valuable habitats and provide areas for flood water retention (green infrastructure). If applicable, the EIAR should take account of the guidelines for Planning Authorities entitled "The Planning System and Flood Risk Management" published by the Department of the Environment, Heritage and Local Government In November 2009.*	• (a) Covered in **EIAR Chapter 6: Biodiversity and Chapter 7: - Aquatic Ecology** • (b) **Appendix 9.1 Ballykett Wind Farm Flood Risk Assessment**

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
National Parks and Wildlife Services (NPWS)	G Pre00240/2022 Proposed Pre Planning Development: Ballykett Green Energy: Request for Scoping Opinion on information to be included in the preparation of an Environmental Impact Assessment (EIA) for Ballykett Wind Farm, Ballykett, Co. Clare 27.10.2022	*(a) Wetlands are important areas for biodiversity and ground and surface water quality should be protected during construction and operation of the proposed development. The EIAR should include a detailed assessment of the hydrological impacts on wetlands from the proposed development. Any watercourse or wetland which may be impacted on should be surveyed for the presence of protected species and species listed on Annexes II and IV of the Habitats Directive. For example, these species could include Otter (Lutra lutra) which are protected under the Wildlife Acts and listed on Annex II and IV of the Habitats Directive, Salmon (Salmo salar), Lamprey (three species in Ireland) listed on Annex II of the Habitats Directive, Freshwater Pearl Mussel (Margaritifera species) and White-clawed Crayfish (Austropotamobius pallipes) which are both protected under the Wildlife Act and listed on Annex II of the Habitats Directive, Frogs (Rana temporaria) and Newts (Trituris vulgaris) protected under the Wildlife Acts and Kingfishers (Alcedo atthis) protected under the Wildlife Acts and listed on Annex I of the Birds Directive (Council Directive 79/409 EEC).* *(b) Flood plains, if present, should be identified in the EIAR and left undeveloped to allow for the protection of these valuable habitats and provide areas for flood water retention (green infrastructure). If applicable, the EIAR should take account of the guidelines for Planning Authorities entitled "The Planning System and Flood Risk Management" published by the Department of the Environment, Heritage and Local Government In November 2009.*	• (a) Covered in **EIAR Chapter 6: Biodiversity and Chapter 7: Aquatic Ecology** • (b) Refer to **Section 9.3.13 and Appendix 8.1** Ballykett Flood Risk Assessment
Inland Fisheries Ireland	Email sent on Tuesday 11 October 2022 Subject: Ballykett Windfarm Consultation	a) *Particular attention should be paid to the hydrology of any site where excavations, including excavations for borrow pits and road construction are being undertaken. It is important that natural flow paths are not interrupted or diverted in such a manner, as to give rise to erosion or instability of soils caused by an alteration in water movement either above or below ground.* b) *Attention should be paid to drainage during both the construction phase and the operational phase. This includes waters being pumped from foundations or other excavations. It is particularly important during the construction phase that*	a) Potential effects due to excavation activities are addressed in **Section 9.4.3.3** and **Section 9.4.3.12**. **b)** Covered in **Section 9.4.3.12** and **9.4.3.14**, attenuation features are discussed in **section 9.5.1.15** and mitigation measures

Consultee	Type and Date	Summary of Consultee Response with Relevance to This Chapter	Addressed
		sufficient retention time is available in any settlement pond to ensure no deleterious matter is discharged to waters. We strongly recommend that settlement ponds are maintained, where appropriate, during the operational phase to allow for the adequate settlement of suspended solids and sediments and prevent any deleterious matter from discharging. In constructing and designing silt traps particular attention should be paid to rainfall levels and intensity. The silt traps should be designed to minimise the movement of silt during intense precipitation events where the trap may become hydraulically overloaded. It is essential that they are located with good access to facilitate monitoring sampling and maintenance. c) *In relation to watercourse crossings for the road or grid connection please be advised that IFI will require to be consulted well in advance in relation to all watercourse crossings or the use of any temporary diversions. We strongly recommend that these crossings should be kept to a minimum. We will also require that any instream structures or bridge crossings are approved by the IFI. In designing crossings, the length, slope and width of any instream structure will be important. Clear span bridges are the preferred option for all crossings especially in upland areas.* d) *Please also note that any instream works or other works which may impact directly on a watercourse should only be carried out during the open season which is from 1st July to 30th of September in each year (so as to avoid impacting on the aquatic habitat during the spawning season.) It would be important that appropriate scheduling of works is allowed for.* e) *The EIAR should indicate proposals to monitor the impact on watercourses within the site. In the event that environmental damage to the aquatic habitat and associated riparian zone is caused, the EIAR should indicate the steps that may be taken to rectify any damage to the aquatic habitat including liaison with the appropriate authorities. In relation to wind farm structures and infrastructure it is important that a sufficient bank side riparian zone is maintained to absorb and attenuate overland flows*	such as silt fencing is further discussed in **Section 9.5.2.3- 9 5.2.4** c) All watercourse crossings are outlined in **Section 9.3.8**, potential effects are outlined in **Section 9.4.3.13** and mitigation measures discussed in **Section 9.5.2.10** d) Instream works have been assessed in **Section 9.4.3.15**. No Instream works taking place. e) Water quality monitoring is outlined in **Section 9.5.2.15**

9.3 BASELINE DESCRIPTION

9.3.1 Introduction

An investigation of the existing hydrologic and hydrogeologic characteristics of the Site, GCR and TDR was conducted by undertaking a desk study, consultation with relevant authorities and site-based fieldwork surveys. All data collected has been interpreted to establish the baseline conditions within the Study Area and the significance of potential adverse effects have been assessed. These elements are discussed in detail in the following sections.

9.3.2 Wind Farm Site Description

The wind farm Site is situated approximately 3.5km northeast of the town of Kilrush and 3km south-west of Coorraclare village, south-west Co. Clare**, Figure 9.1a.** Located within the townlands of Ballykett and Tullabrack East, the proposed Development is situated within an area comprised of agricultural livestock grazing farmland, cutaway bog and conifer forestry plantation. There are a number of established wind farms in the area, for example, Moanmore Wind Farm, located c.1.3km to the west and Tullabrack Wind Farm, located c.1.5km to the northwest of the Site (refer to **Table 2.1, EIAR Chapter 2 Project Description).**

Access at the Site is limited due to its afforested nature, access to locations within the proposed Redline Boundary was limited to firebreaks, access roads, and some cleared (brashing) linear pathways through thicker growth (carried out by the Hydrology Team).

The layout and location of the GCR is presented in **Figure 9.1b** as well as TDR works and high load vehicle Route**.**

9.3.3 Site Walk Over and Observations

Site walk over surveys were tailored in line with the Site layout and conducted between June and October 2022; additional survey work was completed in November 2023. Photographs obtained during site surveys are presented in **Appendix 9.2 Plates 1 - 11.**

9.3.4 Topography

The topography of the Site is relatively even with no projections or depressions. The Site is located on relatively level ground, at elevations ranging from 34m AOD in the northern side of the Site, where the site access track is proposed, to 32m AOD towards the middle of the Site. Topography is discussed in greater detail in relation to stability and constraints in **EIAR Chapter 8: Soils and Geology**.

9.3.5 Land Use & Environmental Pressures

The Clare County Development Plan (2023-2029) classifies the surrounding area as managed grassland, semi-natural grassland, lines of trees and scrub, unexploited peat bogs, conifer forest, natural grassland, transitional woodland, continuous urban fabric, natural lakes. The Plan also shows the area is open for consideration (wind energy) (Clare County Development Plan (2023-2029 – Volume 2 Maps).

The mapped land use for the Wind Farm, Underground Cable Route and Turbine Delivery Route are presented in Chapter 8 Soils and Geology, Section 8.3.3, Error! Reference source not found.

A review of the Corine (2018) Land Use maps (EPA) indicates the site and the preferred GCR is comprised of a combination of 'Pastures', 'Transitional woodland scrub' and 'Coniferous Forests'. As much of the site is mapped as 'Transitional woodland scrub', the area is however significantly impacted by commercial forestry practices including extensive land works involving drainage and excavation and manipulation of natural soil profiles or horizons through Forestry practices.

9.3.6 Regional and Local Hydrology

This section describes the available desktop information on the local and regional surface water hydrological environment. This section identifies the geographical distribution of WFD management areas and provides an assessment of the available water quality information relative to the proposed Site.

The proposed wind farm and Grid Connection Route to the Tullabrack 110kV substation are situated within the Shannon Estuary North catchment (ID: 27, Area: c.1651.27km^2).
The Turbine Delivery Route works are situated across two catchments

- Shannon Estuary North (ID: 27, Area: c.1651.27km2)
- Mal Bay catchment (ID:28, Area: c.846.56km^2).

Surface water networks draining the Site are mapped and presented in **Figures 9.2a.** Surface water networks that are associated with the Turbine Delivery Route are presented in **Figure 9.2b.**

The Site and its surroundings are located upstream of the Shannon Estuary which is located approximately 7.68km from the Site boundary at the closest extent near the proposed turbine T1 turbine position. The Site has indirect hydraulic connectivity to the estuary via natural and artificial drainage that connect to the headwaters of the Moyasta River which drain the Site.

The Mouth of the Shannon (EU Code: IE_SH_060_0000) has an area of 335.14km^2 and is designated as the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA.

The Moyasta_010 River has an overall catchment area of 43.95km^2 and rises further from the north-eastern end of the Site to the west of the N68, flowing through forested area before entering the proposed redline boundary. The Moyasta River generally flows in a westward direction before draining to the Paulnasherry Bay and into the Shannon Estuary.

The proposed spoil storage areas (i.e., Borrow Pit and spoil deposition areas) are located just south of the proposed location of turbine T3. Located approximately 400m south of the proposed Spoil Storage Area and Borrow Pit location are the headwaters of the Moyasta_010 River. The Site, as mentioned above is drained by the Moyasta River, which is classified as having "Moderate" water quality under the current cycle of the WFD.
The surface water runoff associated with the Site runs into the Wood_SC_010 Sub Catchment and then flows into the Moyasta 010 river sub basin. All surface waters drainage from the Site eventually combine in the mouth of the Shannon Estuary, from which waters eventually enter into the Atlantic Ocean.

The Grid Connection Route drains into one sub catchment and one river sub basin, which contains one river which is presented in **Figure 9.2a.**

The Turbine Delivery Route 'works fall into two sub catchments:

- Sub Catchment: Wood_SC_010;
  River Sub Basin: Moyasta_010
- Sub Catchment: Doonbeg_SC_010;
  River Sub Basin: Doonbeg_020, Doonbeg_030

The rivers associated with the TDR works in these river subbasins drain into one of the following; Doonbeg Estuary and into the Shannon Plume (HAs 27;28) or the mouth of the Shannon into the Atlantic Ocean. That is the Tullagower and Brisla East, flow to Doonbeg_030 and then into the Doonbeg Estuary and Shannon Plume. The Gowerhass flows into Moyasta_010 and then to the Mouth of the Shannon and Atlantic Ocean. Local river names identified using the "Indicative Flow" layer (e.g. the river Gowerhass) on EPA maps website have been included as well as the WFD river section ID (e.g. Moyasta_010), which aligns with the overall WFD catchment or sub-catchment name. For the purpose of this Chapter, the WFD naming convention will be used primarily, however it is important to note that the WFD river section IDs can on occasion repeat and include more than one tributary, and therefore reference to local naming conventions are important. This level of river detail is further assessed for potential effects in the Aquatic Ecology Chapter.

9.3.7 Water Framework Directive Water Body Status & Objectives

The Water Framework Directive (WFD) surface water body status (2016 – 2021) and the associated objectives assigned for the surface water network within the study area were identified and reviewed with available data on the EPA Map Viewer online database (2022) **Figures 9.8a** and **9.8b**. The wider Shannon Estuary North, encompassing the proposed Site boundary spans over 1,651km^2. The WFD status of river water bodies associated with the Shannon Estuary North Catchment ranges from "*Good*" to "*Poor*". Surface water bodies within this catchment are limited to headwaters which directly drain to the mouth of the Shannon Coastal Waterbody. The Moyasta River, which drains the proposed Development Site and the Grid Connection Route, has a WFD Status of "*Moderate*". However, under the previous WFD review program (2013-2018), the Moyasta held a status of "*Good*", hence the water quality has deteriorated in recent years.

Surface water bodies with *Good* or *High* status have an overall objective to retain this status, that is that no deterioration in water quality is the objective for these water bodies. Surface water bodies assigned "*Moderate*" status are "*At Risk*" of not meeting WFD objectives. The objective is to restore the status to at least "*Good*" status by 2027 under the third cycle of the Water Framework Directive. The Moyasta River, which drains the proposed development, is classified as "*Under Review*" with an objective of meeting at least "*Good*" status by 2027. However, there are noted significant pressures on the water quality from Agriculture and Pasturelands, see **Figures 9.9a** and **9.9b**.

Surface water bodies that have been identified along the Turbine Delivery Route have been assigned statuses that range from "*Poor*" to "*Good*" and are at various stages of risk from "*Under review*" to "*Not at Risk*". The status and risk of the rivers associated with TDR works are presented in **Table 9.8**.

Table 9.8: Surface water WFD Status and Risk for watercourses associated with the proposed TDR works

Groundwater body	ID	Status	Risk
Moyasta_010	IE_SH_27M04900	Moderate	Under Review
Doonbeg_030	IE_SH_28D020650	Poor	At Risk

9.3.7.1 *Groundwater Body Status*

The Kilrush (EU_Code: IE_SH_G_123) groundwater body (GWB) underlying the Project was assigned "*Good Status*" under the Water Framework Directive (WFD, 2016-2021) **Figure 9.8a**. This classification is based on an assessment of the chemical and quantitative status of the GWB. Additionally, this GWB is categorised as "Under Review" for the WFD objectives of 2027, although no significant pressures have been identified.

The GWB under the proposed developments is classified as having Good status and "Not at Risk" under the WFD. Therefore, no mitigation measures are proposed in the WFD, as shown in **Figure 9.8a, Figure 9.8b** and **Table 9.9.**

Table 9.9: Groundwater body status along the TDR works

Groundwater body	ID	Status	Risk
Kilrush	IE_SH_G_123	Good	Not at Risk
Milltown Malbay	IE_SH_G_167	Good	Not At Risk

9.3.8 Watercourse Crossings

9.3.8.1 *Watercourse Crossings Wind Farm Site*

Six watercourse crossings will be required for the construction of the internal site access tracks to the proposed location of turbines from the Site entrance over the Moyasta River. The locations of watercourse crossings, both pre-existing and proposed, are outlined in **Figure 9.2a** and detailed in **Table 9.10** below.

Table 9.10: Wind Farm Watercourse Crossings and Coordinates

Crossing Number	Crossing Type	Category	Approximate Centre Coordinates of Crossings (ITM)	
			Easting	Northing
WCC 1	Drain	Bottomless Culvert	501400.52	658729.85
WCC 2	River	Single Span Bridge	501423.23	658541.70

Crossing Number	Crossing Type	Category	Approximate Centre Coordinates of Crossings (ITM)	
			Easting	Northing
WCC 3	Drain	Bottomless Culvert	501454.83	658299.63
WCC 4	Drain	Bottomless Culvert	501424.59	658531.88
WCC 5	Drain	Bottomless Culvert	501421.62	658555.88
WCC 6	Drain	Bottomless Culvert	501845.27	657983.66

9.3.8.2 Grid Connection Route

There are no watercourse crossings along the proposed Grid Connection Route to the Tullabrack 110kV substation; see **Appendix 2.2**, the Grid Connection Study for more details.

9.3.8.3 Watercourse Crossings on the Turbine Delivery Route Works

As discussed in Chapter 7 (Section 7.5.2.2), for abnormal load deliveries on the TDR, steel plates will be placed along the road in ecologically sensitive areas (where the route traverses any watercourses), resting against the existing carriage way and supported on the verge by sandbags. This includes all three TDR river crossings (i.e., the GOWERHASS TULLAGOWER, and BRISLA EAST stream). An Ecological Clerk of Works ("ECoW") will be on-site to oversee the watercourse crossings, and the steel plates will only be in use for the duration of the turbine delivery as outlined in **Appendix 16.2** (Traffic Management Plan); the plates will be removed afterwards leaving no significant effect on the surrounding area.

The locations of watercourse crossings, existing and category of the crossing, are outlined in **Figure 9.2b** and detailed in **Table 9.11**.

Table 9.11: TDR Watercourse Crossings and Coordinates

Crossing Number	Crossing Type	Category	Approximate Centre Coordinates of Crossings (ITM)	
			Easting	Northing
WCC 7	River Gowerhass	Culvert	501972.67	659231.86
WCC 8	River Tullagower	Culvert	505159.74	659754.73
WCC 9	River Brisla East	Culvert	506873.68	659798.08

9.3.9 Site Drainage

In addition to the EPA mapped rivers, transitional and coastal water bodies discussed above, the Site is characterised by a relatively extensive network of non-mapped natural and artificial drainage channels. Drainage channels identified during desk study assessment and during site surveys are presented in **Figure 9.2a**. Photographs of some significant features are presented in **Appendix 9.2**. The existing surface water runoff is contained within natural and artificial drainage channels that include stream and river waterbodies, drainage ditches, and other minor natural and artificial manmade drainage features.

Mapping of minor natural or artificial drainage channels has been completed. Brashing within the forestry provided for additional site access and further details of the drainage on site. The survey confirmed the afforested areas contain extensive forestry drainage channels. There are likely to be additional culverts associated with afforested areas or with minor existing access trails and minor drainage channels. In line with the extensive drainage network identified, the number of existing surface water crossings (culverts and/or bridges) is moderate. Existing surface water crossings associated with surface water features and relatively significant drainage features were identifiedand are presented in **Figure 9.2a**.

Drainage channels are mapped using four categories of significance:

- Forestry Drainage
- Inferred Drainage
- Significant Drainage

Note: Aerial Lidar survey data (topographical elevation data, accuracy 1m) and recent aerial photography, as well as historical maps were interrogated and some additional drains were identified. These are discussed in the constraints section 9.5.1.9.

The forestry plantation, location of firebreaks and subsoils also have a bearing on the forestry drainage network. The forestry drainage network is the main drainage vector for the hydraulic movement of water from the forest to the surrounding natural waterbodies with the Moyasta River being the major receiving water of the forestry drainage network. The water course crossings identified as part of the desk study are listed in **Table 9.10** and shown on **Figure 9.2a.** All forestry contains drainage which will flow into the surface water network and therefore are likely to have significant effects. All sections of the forestry have been walked and drains identified. Where drains are shown on the maps this indicates forest drainage which was identified during the site walkover survey, and consists of a linear parallel format of drains every 3-5m, flowing into one perpendicular drain and then into significant drains. Mitigation measures are outlined in **Section 9.4.4.9** and this has been conceptualised in **Appendix 9.4 – Conceptual & Information Graphics – Plate 2 Culvert Watercourse Crossing – General Considerations.**

9.3.10 Baseline Site Run-off Volumes

Preliminary water balance calculations, presented in **Table 9.12**, used the river sub-basin as a 'catchment' area associated with the proposed development Site, upstream of the baseline surface water sampling locations **(Figure 9.2a),** to estimate baseline storm runoff discharge rates at the Wind Farm Site.

The runoff discharge rates provide context in terms of the hydrological response for the Site. Potential effects of the Project in terms of run-off and flood risk are assessed using the same meteorological and hydrogeological conditions. However, the calculation was focused on the potential net increase in runoff associated with the footprint of the Project, (i.e. the installation of hardstand surface area which is granular and typically has a permeability 'c' value of 0.6 - 0.8). The net increase in runoff as a function of the Project was compared to Baseline Runoff Volumes (1 in 100 Year Hour Storm Event). The significance of these calculations aid the design considerations to attenuation and ensure the safe discharge of stormwater run-off; for example 0.024m3/sec during a 1 in 100 year storm event. Maintaining Greenfield runoff rates. The proposed bridge construction must facilitate unimpeded discharge during a 1 in 100 year storm event, plus allowing for climate change (+20%).

Table 9.12: Catchment Areas and Baseline Runoff Volumes (1 in 100 Year Hour Storm Event)

Proposed Dvelopment Baseline Run off Volumes (1 in 100 Year Hour Storm Event)										
Proposed Development	Approximate Area (m2)	1 in 100 Year Rainfall Event (m/hour Rain)	Capped Recharge Capacity. Percentage of Effective Rainfall (Conservative Value for Water Balanace Calc's)	Rejected Recharge / Runoff (m/hour Rain)	Runoff Discharge Rate (m3/hour)	Runoff Discharge Rate (m3/sec)	Net Increase (m3/sec)	Net Increase as percentage against baseline micro-catchment runoff (%)	Indicative High Water Discharge (Q) Rate <15km downstream. (m3/sec)	Net increase of run off from site in percentage
Ballykett WF	19,979.00	0.0213	20.00%	0.01704	340.44	0.09	0.024	25.00%	20.00	0.12%
				Total	340.44216	0.09	0.024	25.00%	20.00	0.12%

9.3.11 Surface Water Hydrochemistry

The Environmental Protection Agency (EPA) conducts an ongoing monitoring programme as part of Ireland's requirements under the WFD. The monitoring programme includes an assessment of biotic indices (biological quality ratings ranging from 1-5) known as Q-Values. Only historical monitoring data was available for the EPA monitoring points along the Moyasta River, which directly drains the Site. Details of the closest EPA monitoring points relative to the Site and the latest Q-Values are outlined in **Table 9.13.**

Table 9.13: EPA Monitoring Points and Latest Available Q-Values

Station ID	**RS27M040400**
Station Name	MOYASTA – Bridge N. of Moyadda
WFD Waterbody Code	IEMRRS27M040400
Type	River
Latest Monitoring Year	1991
Latest Status	Poor
Latest Q-Value	2 – 3
Distance from the Proposed EIAR Boundary	704 metres (downstream)
Easting	100742
Northing	158064
Local Authority	Clare County Council

The most recent assessment of the Moyasta River by the EPA was carried out on 31st December 1991 which indicated that the river had a Q-Value of 2 – 3 or "Poor"; this was a decline to the previous monitoring year which recorded a Q-Value score of 3 – 4 or 'Moderate' WFD Status. In consultation with the EPA's WFD database, the Moyasta River currently holds an 'unassigned' status and is under review. According to the WFD Cycle 2 Sub catchment Assessment, the pressures on the Moyasta River are those from agriculture, predominately from pastures.

Table 9.14: Water Quality Sampling Rounds and Dates

Sampling Round	Sampling Dates	Sampling locations	Field parameters measured	Laboratory paramenters
Round 1	13th of September 2022 (Dry)	Four sample sites, SW1 – SW4	Temperature, DO, pH	Conductivity, pH, Carbon (diss filt), Ammoniacal Nitrogen, BOD, Nirate, Nitraite, Nitrogen Kjeldahl,

Sampling Round	Sampling Dates	Sampling locations	Field parameters measured	Laboratory paramenters
				Orthophosphate, Suspended solids, Turbidity, Copper (diss filt) Phosphorus (diss filt). Zinc (diss filt), Copper (tot.unfilt) CaCO3, Zinc (tot.unfilt) TPH
Round 2	25th of October 2022 (Wet)	Four sample sites, SW1 – SW4	Temperature, DO, pH	Conductivity, pH, Carbon (diss filt), Ammoniacal Nitrogen, BOD, Nirate, Nitraite, Nitrogen Kjeldahl, Orthophosphate, Suspended solids, Turbidity, Copper (diss filt) Phosphorus (diss filt). Zinc (diss filt), Copper (tot.unfilt) CaCO3, Zinc (tot.unfilt) TPH
Round 3	22nd of November 2023 (Dry)	Samples taken at WCC7, WCC8 AND WCC9, at 2 of the TDR water crossing locations	Temperature, DO, pH	Conductivity, pH, Carbon (diss filt), Ammoniacal Nitrogen, BOD, Nirate, Nitraite, Nitrogen Kjeldahl, Orthophosphate, Suspended solids, Turbidity, Copper (diss filt) Phosphorus (diss filt). Zinc (diss filt), Copper (tot.unfilt) CaCO3, Zinc (tot.unfilt) TPH

Water samples were taken to establish a water quality baseline. Four (4 no.) different water quality sampling locations were analysed during Round 1 & 2 (**Table 9.14**) for a suite of laboratory and field measured parameters in line with Indicative Limits set out for Bathing (Bathing Water Directive (2006/7/EC)), Drinking (S.I. No. 106/2007 and S.I. No. 99/2023) and Surface Water (S.I. No. 272/2009) Regulations. The third round of sampling included surface water hydrochemistry in the field on three (3 no.) road culverts on the TDR works section of the L6132.

The water quality sampling locations have been mapped and are shown on **Figure 9.5a**, These sampling points were selected upstream downstream of proposed works on WF and GCR. They are located in all river subbasins that could be potentially impacted (in this case one; Wood_SC_010). Two rounds of sampling were indicative of both low flow (Round 1; dry) and high flow (Round 2; wet) conditions..

Note: Location SW1 during the first round of sampling was inaccessible due to dense overgrowth of trees and brush along the riverbank. WCC9 during the third round of hydrochemistry was also inaccessible due to dense overgrowth.

A number of water quality parameters are unstable and must be analysed in-situ immediately after collection with a field monitoring multi-parameter meter. The pH values across the Site ranged from between pH 6.23 during Round 2 (**Table 9.16**) to pH 8.16 during Round 1 (**Table 9.15**). However, these could be outliers when compared to laboratory test results which recorded a pH of 7.5 for the same representative waterbody. One reason for these differences is the effect low flow and or dry conditions may have at the time of the sampling. The majority of the pH concentrations recorded were relatively pH neutral or slightly acidic. Slightly acidic conditions were consistently recorded at all four locations during the second round of sampling, where pH concentrations ranged from pH 6.23 to pH 6.88. During the third field sampling, at two (WCC7, WCC8) of the three watercourse crossings involving temporary road widening, the recorded pH concentrations ranged from 7.27 to 7.37. It should be noted, slightly acidic pH concentrations are not uncommon in waterbodies of a catchment containing acidic peatland soils and dense conifer forestry.

Electrical conductivity is a measure of the ability of an aqueous solution to carry an electrical current. Conductivity is useful as a general measure of water quality, it is primarily used as an indicator of saline intrusion although it also increases if contamination by most ionic species is present in a water body. There are no nationally recognised environmental quality standards (EQS) for electrical conductivity in surface waters with an EQS of 2,500 µS/cm being the upper acceptable concentration for drinking water. Significantly elevated electrical conductivity can indicate that unknown pollutions have entered the waterbody. Conductivity values recorded across the three monitoring rounds ranged from between 262 µS/cm during monitoring Round 1 to 440 µS/cm during the same monitoring event. The relatively high electrical conductivity values recorded during both monitoring rounds indicated the presence of polluted surface waters. This is further confirmed through site observations, where the team documented the presence of cattle with direct access to the surface waterbody **(Appendix 9.2 – Plate 3).** Round 3 conductivity value recorded was 217 µS/cm at WCC8 on the TDR (**Table 9.17**).

Water temperature influences Dissolved Oxygen (DO) concentrations in a river or stream; DO generally increases as the water temperature decreases. The flow rate or movement of water in a river or stream can also impact upon the DO concentration. Rapidly moving water, as was observed during the second round of sampling, tends to contain higher DO concentrations since the movement of the water allows for a greater mixing of air whereas low flow or still water, seen during the Round 1 sampling event, typically contains lower DO concentrations. Lower concentrations of DO in stagnant water is also due to the enhanced consumption of dissolved oxygen by plants and microbial life.

Surface water temperatures ranged from between 12.6°C during monitoring Round 2 to 18.7°C during monitoring Round 1. Round 3 of watercourse crossings on the L6132 (TDR) ranged between 10.9°C to 14.0°C. The significant temperature differential of 13.09°C between the maximum and the minimum results across the 3 monitoring rounds is representative of natural seasonal surface water temperature fluctuations with air temperature and direct sunlight being the dominant factors in influencing seasonal surface water temperatures.

Table 9.15: Field Hydrochemistry Results from water sampling Round 1

Field Sampling Location	sampling Date	pH	Specific Electrical Conductivity @20°C (μS/cm)	Temperature (°C)
SW1	13/09/2022	N/A	N/A	N/A
SW2	13/09/2022	7.58	262	18.5
SW3	13/09/2022	8.16	293	16.9
SW4	13/09/2022	7.44	440	18.7

* Sampling locations are considered to be representative of the finali design layout

Table 9.16: Field Hydrochemistry Results from water sampling Round 2

Field sampling Location	Sampling Date	pH	Specific Electrical Conductivity @20°C (μS/cm)	Temperature (°C)
SW1	25/10/2022	6.25	265	12.6
SW2	25/10/2022	6.23	249	13.3
SW3	25/10/2022	6.80	278	13.4
SW4	25/10/2022	6.88	291	13.6

* Sampling locations are considered to be representative of the finalised design layout

Table 9.17: Field Hydrochemistry Results from water sampling Round 3

Field sampling Location	Sampling Date	pH	Specific Electrical Conductivity @20°C (µS/cm)	Temperature (°C)
WCC7	22/11/2023	7.38	220	14.0
WCC8	22/11/2023	7.27	217	10.9
WCC9	22/11/2023	-	-	-

Surface water samples were collected at four locations and laboratory analysis was completed for range of physiochemical parameters during the two sampling rounds. Copies of the laboratory analysis certificates from Eurofins Chemtest Ltd. (2022), for each round of monitoring are contained in **Appendix 9.3**. The results from the laboratory analysis from the two samplingrounds are compared to various screening criteria in **Figure 9.3**. The sample locations have been mapped and are shown on **Figure 9.5a.**

Total suspended solids (TSS) were reported above the laboratory limit of detection (5.0mg/L) in 5 out of 7 samples analysed across the two monitoring rounds. A maximum concentration of 28mg/L TSS was recorded at monitoring location SW2 during monitoring Round 1. This result is above the threshold value of 25mg/L TSS for both salmonid and cyprinid species as set out in EC Directive 2006/44/EC on the quality of fresh waters needing protection or improvement in order to support fish life.

The ammonia as Nitrogen concentrations were detected above the laboratory limit of reporting (0.05mg/L) in two of the seven samples. All of the recorded ammonia as N concentrations were below both the "Good" status and "High" status thresholds of 0.065mg/L and 0.04mg/L respectively as set out in the *European Communities Environmental Objectives (Surface Waters) Regulations 2009* as amended, with the exception of maximum concentrations of Ammoniacal nitrogen (0.059 and 0.058mg/L) that were recorded at locations SW3 and SW4 during sampling round 1. A maximum concentration of 1.8mg/L for nitrate was recorded at sampling location SW2 during sampling round 2 which is below the 50mg/L threshold value set out in the *European Union Drinking Water Regulations 2023.* For nitrite, all results were below the laboratory limit of detection in all samples analysed.

A maximum concentration of total phosphorus 0.039mg/L for total phosphorous was recorded at location SW4 during sampling round 2. This is considered a less than good status of total phosphorous, as outlined by Surface Water Regulations SI no.77/2019.

Zinc (total unfiltered) was elevated and above the reference value set out in surface water regulations of 30 µg/l at two of the seven sampling locations. Zinc (total unfiltered) levels at SW1 and SW2 during the second round of sampling returned laboratory results of 36 µg/l and 37 µg/l, respectively.

Water colour can change the quantity and quality (wavelengths) of light in water, as well as reducing its overall depth of penetration. It is associated with transparency and phytoplankton biomass (Chlorophyll *a*). Colour concentrations generally increase as the dissolved organic carbon (DOC) concentrations increase. Higher colour concentrations in a waterbody also generally result in increased growth of angiosperms. The primary source of increased colour in Ireland is peatland disturbance, forestry streams can often also appear dark or brownish-yellow. Run-off of heavy rainfall also enables the transport of organic material, nutrients and minerals into lakes and rivers.

9.3.12 Hydrogeology

9.3.12.1 Bedrock Aquifer

The underlying bedrock within the EIAR Site boundary is that of Namurian Undifferentiated rock units with sandstone, siltstone and mudstone. Consultation with GSI Groundwater maps indicates that the Wind Farm Site and Grid Connection Route is underlain by a bedrock formation underlying the Site is classified as a 'Locally Important Aquifer – Bedrock' which is Moderately Productive only in Local Zones, see **Figure 9.6a, Figure 9.6b**. There are no mapped karst features within 32km of the Project.

The Turbine Delivery Route is underlain by a 'Locally Important Aquifer – Bedrock' which is Moderately Productive only in Local Zones.

According to the GSI (2023) Kilrush Groundwater Report, the groundwater body (GWB) is bounded to the south by the Shannon Estuary. In the west, the coast bounds the GWB. The northern and eastern boundaries are surface water catchment divides. The GWB is elongated east-west. The Kilrush groundwater body (GWB) is classified as being composed of rock with a transmissivity in the range 2–20m^2/d although it is noted higher values may be achieved in faulted zones. Aquifer capacity is classed as low. According to the GSI, the effective thickness of the upper part of the aquifer is likely to be about 10m, comprising a weathered zone of a few metres and a connected fractured zone below this. However, deep water strikes (30 – 90m) are noted in this aquifer, and are associated with better yields and productivities, and wells are often overflowing. Permeable zones are met at deeper levels than in other rocks. Recharge occurs diffusely through the subsoils and via outcrops.

The groundwater body is composed primarily of low permeability rocks. Groundwater flows along fractures, joints and major faults. The rocks underlying the area are folded into relatively small folds with wavelengths of about 3km. The fold axes trend WSWENE and strata dip at right angles to the fold axis at angles from 10 -50°. No major faults are mapped the area; however, it is noted that fractures and jointing may be more open on the fold axes.

Most flow in this aquifer will occur near the surface; the effective thickness of the unconfined part of the aquifer is likely to be about 10m, comprising a weathered zone of a few metres and a connected fractured zone below this. The water table is from 0-9m below ground level and follows topography. Unconfined flow path lengths are relatively short, and in general are between 30m and 300m. Confined flow paths may be significantly longer. Groundwater discharges to the numerous small streams crossing the aquifer, and to the springs and seeps. Local unconfined flow directions are oblique to the surface channels. Overall, east of Poulnasherry Bay, the flow direction is to the west and south. West of the bay, flow is to the north and south of the promontory leading to Loop Head.

The Turbine Delivery Route works traverse Groundwater bodies including Kilrush and Miltown Malbay, as presented in **Table 9.16**.

Table 9.16: Groundwater bodies beneath the TDR works

Groundwater body	ID	Description	Area
Kilrush	IE_SH_G_123	Poorly productive bedrock	404.30
Milltown Malbay	IE_SH_G_167	Poorly productive bedrock	769.57

9.3.12.2 Groundwater Vulnerability & Recharge

Groundwater vulnerability is a measure of the inherent geological and hydrogeological characteristics which determine the ease at which groundwater may potentially become contaminated via human activities at the surface. The vulnerability of groundwater is dependent upon multiple factors. These include the intrinsic toxicity of the contaminants in question, the quantity of contaminants that can reach the groundwater, the rate at which contaminants can flow to the groundwater and the attenuating capacity of the geological deposits through which the water travels. These factors are controlled by the types of subsoil that overlie the groundwater, the way in which the contaminants recharge the geological deposits (point or diffuse source) and the unsaturated thickness of geological deposits from the point of contaminant discharge.

The GSI groundwater vulnerability rating for the aquifer throughout the Site is predominantly "*Moderate*" vulnerability, with an inferred desk-based depth to subsoils of 0.0 – 5.0mBGL, **Appendix 8.1 – Appendices A** and **B**. The GSI groundwater vulnerability rating for the aquifer underlying the proposed 2 no. spoil storage areas (i.e., the proposed borrow pit location and spoil deposition area at the site entrance), is predominantly classified as ranges from "*Extreme*" and "*Rock at or Near the Surface*" **Figure 9.7a**. The extreme vulnerability classifications are reflective of the considerably variable and often shallow or non-existent depths of subsoil and blanket peat in the area. The extreme vulnerability classification is also consistent with bedrock outcrops at the surface and the shallow blanket peat which was observed during site investigations **(Appendix 9.2 – Plate 5).** Extensive peat probing at the Site confirmed that the depth to the top rock, or potential glacial tills, ranged from depths of between in 0m – 5.5m. This is consistent with the GSI groundwater vulnerability classification for the Site as Moderate.

A range of GSI groundwater vulnerability classifications have been mapped along all the proposed Grid Connection Route. The proposed GCR to the existing Tullabrack 110kV substation traverses groundwater vulnerability ranges from '*Moderate'* to '*High'* **Figure 9.7b.**

The works for TDR traverse areas with groundwater vulnerability ratings ranging from 'Moderate Vulnerability' to 'Extreme Vulnerability' **Figure 9.7b**. It should be noted however that these works and those of the GCR are predominantly located within the existing road network.

Blanket peat and poorly draining soils are also low permeability materials which are dominant within the EIAR Site boundary. These low permeability materials protect underlying groundwater and restricts recharge. Where sufficiently thick, such low permeability materials may confine groundwater. Flow paths are expected to be short with groundwater discharging rapidly to nearby streams and small springs, thus restricting the potential for significant groundwater flux to the uppermost part of the aquifer. The GSI Kilrush Groundwater Report states, diffuse recharge will occur over the entire groundwater body via rainfall soaking through the subsoil. A percentage of rainfall will not recharge the aquifer but will runoff and most recharge will occur where overlying subsoils are thinner. In peat areas associated with the Site, the mapped groundwater recharge coefficient is as low as 20% of effective rainfall. This recharge coefficient is considered very low. Whereas areas where bedrock is at or near the surface the mapped groundwater recharge coefficient is 85% of effective rainfall. This recharge coefficient is considered very high. However, the maximum recharge capacity of the aquifer will limit recharge to groundwaters by rejecting additional rainfall for runoff that does not infiltrate saturated soils.

Areas of the Site, GCR and TDR works underlain by Locally Important (LI) aquifer possess a maximum annual recharge capacity of 200mm effective rain fall per annum. For additional context, the maximum recharge capacity of 200mm per annum equates to a recharge coefficient of approximately 15% of effective rainfall respectively, in line with peat which is considered highly impermeable with a recharge coefficient <20%. Considering all of the above, the Site is characterised by low to very low recharge rates in overburden (soils/subsoils) and very low recharge capacity in the underlying bedrock aquifer. This suggests that, particularly during seasonally wet or extreme meteorological conditions, the majority of water (rain) introduced to the Site will drain off the Site as surface water runoff, and the rejected recharge water volumes will likely discharge to surface waters relatively rapidly and locally. As such, the surface water network associated with the Site is characterised as having a rapid hydrological response to rainfall. This is indicative of lands comprising of blanket peat or catchments with elevated peat cover [1] [2].

In the event that contaminants were to be accidentally released on Site, it is likely that their mobility within the groundwater would be limited and would remain relatively localised to the source of contamination. It is more likely that contaminants released at the surface would flow to nearby watercourses within surface runoff than to groundwater. As a result, surface waters such as rivers, lakes, streams and drains are likely to have a higher vulnerability to potential contamination at the Site than groundwater.

It is noted that Horizontal directional drilling (HDD) methodology will not be utilised during the construction phase of the Project, therefore it does not fall within the scope of this assessment.

Table 9.18: Groundwater Vulnerability Classes

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil permeability (type) and thickness			Unsaturated zone	Karst features
	High permeability (sand/gravel)	Moderate permeability (e.g. sandy till)	Low permeability (e.g. clayey till, clay, peat)	Sand/gravel aquifers only	(<30m radius)
Extreme I	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-

[1] Misstear B., Brown L. (2008) Water Framework Directive – Recharge and Groundwater Vulnerability. EPA STRIVE Report, EPA, Ireland.
[2] Jennings S. (2008) Further Characterisation Study: An Integrated Approach to Quantifying Groundwater and Surface Water Contributions of Stream Flow, RPS, Ireland

High (H)	>3.0m	3.0m – 10.0m	3.0m – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0m – 10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Source: Strive Report Series No. 6, Water Framework Directive – Recharge and Groundwater Vulnerability, Environmental Protection Agency, 2008

9.3.13 Flood Risk Identification

A Site Flood Risk Assessment (SFRA) Stages 1 & 2 for the Ballykett Wind Farm Site has been prepared as part of this EIAR; the report is presented in **Appendix 9.1 – Ballykett Flood Risk Assessment**. This SFRA assessment details site-specific rainfall and evapotranspiration rates as well as a preliminary water balance assessment for the estimated baseline runoff conditions and the estimated post Development conditions at the Site. A Preliminary Screening for Flood Risk is presented in **Figure 9.4.**

The following is copied from SFRA Conclusions:

FRA Stage 1

- Fluvial flood zones A, B and C on site, and the proposed new watercourse crossing with the flood plain require FRA Stage 2.
- The nature of the development is industrial as opposed to residential or leisure, and as such, this type of development is categorized as a 'Less Vulnerable Development', according to FRM Guidelines. Therefore, the development is considered an 'appropriate' development for Flood Zone C.
- In keeping with the Stage 1 Flood Risk Assessment, the review of available information has identified flood hazards for the proposed Development.
- The proposed Development has the potential to lead to a net decrease in recharge potential and net increase in the hydrological response to rainfall at the site, potentially leading to adverse effects on flood risk areas downstream of the site. The extent of the risk of flooding and potential effect of a development on flooding elsewhere (downstream) requires FRA Stage 2.

FRA Stage 2

- The portion of the Development likely within a low probability flood plain is limited to a portion of site access track and a new watercourse crossing.
- The design of the proposed new clear span bridge and associated portion of site access track will be done in line with the requirements of appropriate guidelines, OPW (2019) as outlined in Section 9.2.2. As a result, the constructed bridge will allow adequate sizing and freeboard to facilitate peak flows and flood heights, and maintain overland flow in the flood plain. Loss in flood zone capacity will be regained through appropriate measures, which will be considered in line with the proposed drainage

design and comply with SuDS recommendations during the detailed design phase / FRA Stage 3.

- A 1 in 100 year storm event scenario results in a net increase of surface water runoff associated with the Development, calculated to the Site area (Redline Boundary). This net increase relative to the scale of the Site or the scale of the associated catchment is considered an adverse but imperceptible or negligible effect of the development.
- The proposed Development will include in its design and use the latest best practice guidance to ensure that flood risk within or downstream of the Site is not increased as a function of the Development, i.e., a neutral impact at a minimum. This means that the attenuation capacity in the constructed drainage network associated with the Development will have capacity to attenuate the calculated net increase during a 1 in 100 year storm event.
- Considering the development significantly effects a probable flood risk area, FRA Stage 3 including advanced flood / discharge modelling is required.
- A detailed Surface Water Management Plan (SWMP) based on the SWMP contained in **Appendix 2.1** CEMP will be prepared prior to the construction phase, with a view to ensuring that the surface water runoff at the site is managed effectively and does not exacerbate flood risk to the surrounding areas downstream. This will be done in consultation with relevant stakeholders.
- A Section 50 application (Arterial Drainage Act 1945) for the construction of the proposed new bridge will be completed prior to the construction phase to ensure that the site meets the standards set out by the OPW.
- As the associated drainage – some of which is permanent for the lifetime of the Development, will be attenuated for greenfield run-off, the Development will not increase the risk of flooding elsewhere in the catchment. Based on this information, the Development complies with the appropriate policy guidelines for the area and is at no risk of flooding

9.3.14 Wells

Mapping and searches of the EPA Water Framework Directive (WFD) and GSI well databases confirms that there are a number of mapped wells located within 2km of the EIAR boundary used for agriculture and domestic use, outlined in **Table 9.19** and presented in **Figure 9.5a** and **Figure 9.5b**. There are no dwellings located within the Redline Boundary, however 146 dwellings are located within 2km of the Site. All houses located within 2km of the proposed turbines are shown in **Figure 1.3**. Wells are given 100m buffer zones, taking a conservative approach that all nearby dwellings have access to a well.

- The closest dwelling to the proposed turbine position (T3) is situated approximately 550m from the Redline Boundary, to the south-east (involved landowner),

- A dwelling is situated approximately 375m to the east, of the proposed Redline Boundary,
- The closest dwelling is situated approximately 350m to the west from the proposed Redline Boundary.

Table 9.19: Closest Wells, Springs, Boreholes to proposed Wind Farm Site

Type	Year	ID	Townland	Closest Turbine	Distance	Direction
Dug well	1962	0815NEW032	Tullabrack	T1	c.0.88km	North
Dug well	1973	0815SEW032	Gowerhass	T4	c.0.43km	Northeast
Dug well	1962	0815SEW038	Gowerhass	T4	c.0.43km	Northeast
Dug well	1962	0815NEW028	Brisla West	T3	c.0.65km	Southwest
Dug well	1964	0815NEW026	Brisla West	T3	c.0.65km	Southwest
Borehole	1973	0815SEW039	Moyadda	T3	c.1.22km	South
Dug well	1961	0815SEW040	Moyadda more	T3	c.1.85km	South
Borehole	1970	0815SEW047	Ballykett	T2	c.1.2km	Southwest
Borehole	1962	0815SEW037	Ballykett	T2	c.1.2km	Southwest
Dug well	1972	0815SEW036	Ballykett	T2	c.1.1km	Southwest

Mapping and searches of the EPA Water Framework Directive (WFD) and GSI well databases confirms that there are a number of mapped wells used for agriculture and domestic use that are located within 20km of the Grid connection Route, and they are presented in **Table 9.20**. It should be noted that the TDR/GCR works are predominantly along/within the existing road network.

Table 9.20: Closest Wells, Springs, Boreholes to Grid Connection Route

Type	Year	ID	Townland	Distance	Direction
Borehole	1899	0815NEW036	Aughagarna	c.0.34km	North
Dug well	1962	0815NEW032	Tullabrack	c.065km	South
Dug well	1962	0815SEW035	Breaghva	c.0.2km	in vicinity

Mapping and searches of the EPA Water Framework Directive (WFD) and GSI well databases confirms that there are a number of mapped wells located within 20km of the Turbine Delivery Route used for agriculture and domestic use and they are presented in **Figure 9.5b**.

In addition, all Water Framework Directive (WFD) groundwater bodies have been identified as Drinking Water Protected Areas (DWPA) due to the potential for qualifying abstractions of water for human consumption as defined under Article 7 of the WFD. The Drinking Water

Protected Areas (DWPA) designation applies to all groundwater bodies nationally, regardless of the productivity status of the underlying aquifer.

The Kilrush GWB (IE_SH_G_123) underlies the entire EIAR Site boundary and surrounding areas. The EPA notes that Locally important aquifers are capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or good yields (100-400m^3/d). In the bedrock aquifers, groundwater predominantly flows through fractures, fissures, joints or conduits.

Given that the existing GSI groundwater well database is an incomplete dataset, it is conservatively assumed that all dwellings located within 2km of the EIAR Site boundary have the potential to maintain a groundwater well for abstraction.

9.3.15 Groundwater Levels, Flow Direction & Groundwater hydrochemistry

Groundwater flow patterns, or the water table of an entire aquifer, can often mimic surface water flow patterns. Overall, groundwater will follow the regional topographical gradient of a given area, moving along flow paths from areas of recharge to areas of discharge, i.e., surface waterbodies. Therefore, groundwater flow directions at the Site are presumed to follow the topography of the area, and flow paths are considered to be short due to the poorly productive underlying bedrock aquifer. Groundwater flow likely circulates in the upper overburden saturated zone, recharging and discharging in local zones with a high flowrate; thus, the groundwater is considered to be 'young'. The implications for 'young' groundwater is that it will be more vulnerable in terms of water quality from a pollution incident. Blanket bog which is the dominant surface layer at the Site normally forms in areas where the underlying bedrock is effectively impermeable. In such instances, the overlying bog typically forms part of a fully saturated perched aquifer system. According to the GSI, for the Kilrush GWB, groundwater levels are 0-9m below ground level (median 4mbgl) and follow the topography.

Deeper water levels, up to 18 metres below ground level (mbgl) have been observed in the area, however, which indicate that there may be zones that are hydraulically isolated from the rest of the aquifer. Unconfined groundwater flow paths are short (30-300m), with groundwater discharging to seeps, small springs and streams. Groundwater perched in the subsoil is shallow (median 2 mbgl). Artesian conditions and deep inflow levels indicate that the lower part of the aquifer is confined by shales in the succession. Groundwater travel times in this zone are relatively slow.

There is no groundwater hydrochemistry data currently available for the Site, GCR and TDR works, and only limited GSI groundwater hydrochemistry data is available for the wider region. The Kilrush GWB Report (GSI) has noted for comparison that the groundwaters in the Ballylongford GWB (on the opposite side of the Shannon Estuary) are moderately hard (120-270mg/l $CaCO_3$) and have moderate alkalinities (170-240mg/l $CaCO_3$). Measured electrical conductivity ranges from ~440-560 µS/cm. Spring waters (Tarbert WS) have a calcium bicarbonate signature. Groundwater sampled from a borehole (Glin WS) has a signature varying from $Ca\text{-}HCO_3$ to $Na/K\text{-}HCO_3$ and alkalinities greater than total hardness. Furthermore, it is noted that reducing conditions may also occur and that both iron and manganese can exceed allowable concentrations, these components coming from the shales. Background chloride concentrations will be higher than in the midlands, due to proximity to the sea. The Namurian bedrock strata of this aquifer are classified as siliceous.

Groundwater quality monitoring is generally not conducted for proposed wind farm developments due to the limited excavation nature of such developments. Effects on groundwater quality are also generally not expected to occur from such developments, given that there are no identified direct connections to groundwater.

9.3.16 Designated Sites & Habitats

The Site is not positioned within, adjacent to, or immediately upstream of any designated or protected area (SPA, SAC, NHA).

There are seven (7 no.) designated European Natura 2000 sites within a 15km radius of the Wind Farm Site and Grid Connection Route (BioSphere Environmental Services, April 2023, Ballykett Wind Farm Project – NIS). Some of these designated areas are downstream of the site and are important to consider in terms of potential secondary, downstream impacts of the Project. The nearest downstream designated areas include the following as outlined in **Figures 9.10** and **Figure 9.11a,** approximately 8.1km to the west of the Site**.**

- Lower River Shannon SAC (EU Site Code: IE0002165) for Habitats. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. Both the Fergus and inner Shannon Estuaries feature vast expanses of intertidal mudflats. Overall, the Shannon and Fergus Estuaries support the largest numbers of wintering waterfowl in Ireland. A number of species listed on Annex I of the E.U. Birds Directive breed within the Site along with five species of fish listed on Annex II of the E.U. Habitats Directive are found within the Site.
- River Shannon and River Fergus Estuaries SPA (EU Site Code: IE0004077), is a SPA under the E.U. Birds Directive, for special conservation interest for multiple wetland & waterbird species. The estuaries of the River Shannon and River Fergus are known

to form the largest estuarine complex in Ireland and have vast expanses of intertidal flats which provides a rich food resource for the wintering birds. Salt marsh vegetation frequently fringes the mudflats and this provides important high tide roost areas for the wintering birds.

The Turbine delivery route, and related works near the proposed development site are hydrologically connected to the following designated sites (i.e., SAC, SPA, NHA): River Shannon and River Fergus Estuaries SPA, Lower River Shannon SAC (i.e., via the Gowerhass river (Moyasta_010)) and the Carrowmore Dunes SAC and the Mid-Clare Coast SPA (i.e., via the Brisla east and Tullagower rivers (Doonbeg_030)). The designated areas within a 15km radius are presented in **Table 9.21** and in **Figure 9.11b.**

Table 9.21 Designated areas within 15km of the TDR works

Designated Site	Type	ID	Distance
River Shannon and River Fergus Estuaries SPA	SPA	IE0004077	c.6.5km downstream
Lower River Shannon SAC	SAC	IE0002165	c.6.5km downstream
Carrowmore Dunes SAC	SAC	IE0002250	c.13km downstream
Mid-Clare Coast SPA	SPA	IE0004182	c.13km downstream

9.3.17 Water Resources

In consultation with available EPA and GSI databases, no surface waterbodies in the wider Shannon Estuary North catchment have been identified as Drinking Water Protected Areas (DWPA) or Register of Protected Aras (RPA) for drinking water rivers based on water abstraction data on the abstraction register. Therefore, the proposed Development is not at risk of influencing any Designated Area. There are no dwellings located within the proposed Site boundary. The closest dwellings are located c.16m north and south of the proposed Redline Boundary incorporating the Grid Connection route Options. There are no National Federation of Group Water Schemes (NFGWS) or GSI Public Supply Source Protection Areas located in the vicinity of the Site nor along the preferred Grid Connection Route, **Figures 9.5a.**

The Turbine Delivery Route works were assessed and there was no Drinking water Rivers, National Federation of Group Water Schemes (NFGWS) or GSI Public Supply Source Protection Areas located along it (**Figures 9.5b**). Drinking water rivers along the TDR are presented in (**Figure 9.12b**). Considering no works are taking place in the buffer zones of these rivers, no potential effects have been identified.

The EPA and GSI maintain a register of water abstractions in accordance with the *Water Environment (Abstractions and Associated Impoundments) Act 2022).* All persons that abstract a volume of 25 cubic metres (25,000 litres) per day or more from rivers, lakes and groundwater are required to register. Grid references are rounded to the nearest kilometre to protect the identity of individual households and businesses, who may also use the abstracted water for private domestic use. The publicly available abstraction register has identified a number of abstractions within 10km of the proposed Development for the purpose of agricultural and domestic use.

9.3.18 Receptor Sensitivity

All receptors associated with the proposed development i.e., groundwater, streams and rivers, are considered highly sensitive (in accordance with the criteria in Error! Reference source not found.**2)** when considering;

- Water Framework Directive (WFD) status (2016-2021) generally ranging from "*Good*" to "*Poor*", with some sections ranging to Poor. The principal objective of the WFD is to achieve good status or higher in all waters and to ensure that status does not deteriorate in any waters.
- The down-stream designations (sensitive protected areas e.g., SAC, SPA) associated with the catchment and the sensitive habitats and species associated with same.
- The down-stream Doonbeg_010 subcatchment (EU Site Code: IE_SH_28D020650) from the TDR works, contains Freshwater Pearl Mussel (FPM)
- There are no Salmonid River or Nutrient Sensitive Rivers in the vicinity of the Site, or the GCR. There is one crossed by the TDR (**Figure 9.12b**) , however no works are proposed in this area.
    1. Fergus – Salmonoid River; IE_SH_27F010700.
- Designated Shellfish areas exist in the Shannon Estuary catchment; downstream of the Site and GCR in the Mouth of the Shannon (Has 23;27) Code: IE_SH_060_0000 (**Figure 9.12a & 9.12b**)
    1. West Shannon Ballylongford; Code: IE_SH_060_0000
    2. West Shannon Poulnasherry Bay; Code: IEPA2_0021
    3. West Shannon Carrigaholt; Code: IEPA2_0022
    4. West Shannon Rinevella; Code: IEPA2_0023
    5. Kilrush Groundwater in shellfish Areas; Code: IE_SH_G_123

This information is considered as part of this assessment because there is hydrological connectivity between the Project and the downstream sensitive receptors/ shellfish. Ultimately, all surface water and groundwater associated with the Site are considered sensitive and important attributes in their own right and must be protected in accordance with the WFD to achieve and maintain at least 'Good' status.

However, waterbodies associated with additional receptor sensitivities such as designated and protected areas (e.g., FWPM, SAC, SPA), should be considered at the highest level on the sensitivity scale, due to the increased risk associated with specific additional ecological attributes they possess. For instance, while a potential effect, e.g., sediment stock-pile collapse into a surface waterbody, could have a temporary impact on the river or stream itself, where suspended solids would be washed away from the incident and 'diluted' with the assimilative capacity of the river; on the other hand, the effects could be long lasting and potentially lead to the collapse of a species.

Risk to receptors must consider both the hazard and likelihood of adversely impacting on any given sensitive receptor, and therefore parameters such as distance from the potential source of hazard to receptor, pathway directness and/or connectivity, and assimilative capacity of the receiving water body should also be considered.

In terms of surface water sensitivity, the vast majority of potential contaminants or unmitigated adverse effects would likely infiltrate to surface water bodies rather than to groundwater bodies. Sensitive receptors (from WFD rivers outlined in Section 9.3.6 km from the site, to designated shellfish areas downstream of the site c. 60km) -are of variable distance from the Development and the pathways are of variable condition (slopes, soils, peat depth) for each proposed turbine location and for any part of the Development, once mitigation measures are applied (Section 9.5.1.9) these risk will be significantly reduced.

In terms of groundwater sensitivity and susceptibility, as discussed in previous sections, all groundwater associated with the Site is protected as a source of drinking water, under the European Communities (Drinking Water) Regulations 2014 (S.I. no. 122/2014). However, the bedrock aquifer underlying the Site and surrounding area is Locally Important (LI), which can be expressed as an aquifer with relatively low to moderate production and connectivity, and therefore the risk of potential adverse effects on groundwater will be limited to localised zones within the Site. It is noted, with reference to **Section 9.3.14,** that no wells have been identified within the 100m buffer zone of shallow excavations; also, there are none within 100m buffer along the Grid Connections. The Turbine Delivery Route works taking place are outside the 100m buffer zones of the wells.

9.4 ASSESSMENT OF POTENTIAL EFFECTS

9.4.1 Assessing the Magnitude of Potential Effects

The receiving environment associated with the Project is considered as ranging from Low to Very High Sensitivity. With reference to **Section 9.2.5**, receptor sensitivity is qualified as follows:

- Surface Water; Very High
- Groundwater; Bedrock Aquifer; High
- Bog Water - In areas of cut over peat, forestry or where existing drainage networks exist; Medium
- Bog Water - In areas of intact habitat and/or designated areas e.g., blanket bog / SAC; Medium

Surface water rivers, groundwater, bog water and designated areas are discussed further in the **sections 9.4.3.8, 9.4.3.10, 9.4.3.11 and 9.4.3.13**. The potential effects associated with the Project will be limited to magnitudes associated with respective environmental characteristics, as presented in the **Table 9.22.**

Table 9.22: Magnitude of potential effects relative to receptor sensitivity (EPA 2022)

Sensitivity (Importance of Attribute)	**Magnitude of Effect**			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Very High (Surface water, Bog water in intact or designated peat)	Imperceptible	Significant / Moderate	Profound / Significant	Profound
Medium (Bog water in existing impacted areas)	Imperceptible	Slight	Moderate	Significant
Low (Groundwater, relative to the scale of the site)	Imperceptible	Imperceptible	Slight	Slight / Moderate

9.4.1.1 Assessing the Magnitude of Potential Effects – Surface Water

The European Communities Directive 2000/60/EC established a framework for community action in the field of water policy known as the Water Framework Directive (WFD). Ireland has published the draft River Basin Management Plan (2022-2027) which defines the actions that will be taken to improve water quality and achieve "good" ecological status in rivers, lakes, estuaries and coastal waters by 2027. The WFD is the overarching mechanism by which water quality management areas are divided and assessed.

The receiving environment in terms of **SURFACE WATER** associated with the proposed Development is considered as being of **Very High Importance** and **Highly Sensitive** (EPA 2022), and therefore classification of any potential effects associated with the Development will be limited to Magnitudes associated with Very High Importance, as presented in the following table.

Table 9.23: Weighted Rating of Significant Environmental Effects – Surface Water Systems – Limited to Very High (EPA 2022)

Sensitivity (Importance of Attribute/s)	Magnitude of Impact			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Very High	Imperceptible	Significant / Moderate	Profound / Significant	Profound

In terms of determining and assessing the magnitude of effects on surface water features, categories of magnitude relating to the potential effect on the status of the attribute. In terms of determining and assessing the magnitude of impacts on surface water features, categories of magnitude relate to the potential effect on the status of the attribute. That is, the attribute driving the classification of sensitivity is the current WFD status (if applicable) and condition of the surface water feature/s, the risk of not reaching WFD objectives (if applicable) and the potential for the surface water system to support, or function as part of designated and protected areas (SAC, SPA, NHA etc).

9.4.1.2 Assessing the Magnitude of Potential Effects – Groundwater

The receiving environment in terms of **GROUNDWATER** associated with the proposed Development is considered as being of **High Importance** and **Medium Sensitivity.** Therefore, as a conservative approach, classification of any potential effects associated with the Development will be assigned magnitudes associated with Medium Importance, as shown in Table 9.24.

Table 9.24: Weighted Rating of Significant Environmental Effects – Groundwater Systems –Medium Sensitivity (EPA 2022)

Sensitivity (Importance of Attribute/s)	**Magnitude of Impact**			
	Negligible (Imperceptible)	**Small Adverse (Slight)**	**Moderate Adverse (Moderate)**	**Large Adverse (Significant to Profound)**
Medium	Imperceptible	Slight	Moderate	Significant

In terms of determining and assessing the magnitude of effects on groundwater features, categories of magnitude relate to the potential effect on the status of the attribute, i.e. the attribute driving the classification of sensitivity is the aquifer potential classification and use as a drinking water source, the proximity of the Site to groundwater wells, condition of the groundwater feature/s, the risk of not reaching WFD objectives, the GSI groundwater vulnerability classification and the potential for the groundwater system to support, or function as part of designated and protected areas (SAC, SPA, NHA etc.).

9.4.2 Do Nothing Impact

The "Do Nothing Impact" is the effect on the Site should the proposed wind farm not be constructed. Site investigations and assessment of the baseline hydrological and hydrogeological conditions at the Site indicate that parts of the Site have already experienced effects to baseline conditions. through the planting and the installation of drainage networks associated with commercial forestry (**Appendix 9.2; Plates 6, 9 and 10).**

Planting of commercial forestry and agriculture / land reclamation activities (reconstitution of soils and drainage) have had a significant impact to the Site relative to (hypothetically) perfect natural conditions with regard to the hydrology or hydrogeology of the Site in terms of drainage infrastructure in particular. Those activities are likely to apply pressure to the receiving surface water network and potentially regularly contribute nutrients and/or suspended solids to the receiving surface water systems. Release of contaminants will likely peak on occasion particularly during intrusive activities such as felling or after heavy rainfall events.

Should the Development not proceed, the existing land-use practice of commercial afforestation, will likely continue with associated gradual alteration of the existing environment and associated pressures on surface water and groundwater quality.

9.4.3 Construction Phase Potential Effects

9.4.3.1 Increased runoff from site due to earthworks

The construction phase of the proposed Development will involve the following primary excavations activities which may have the potential to adversely impact on surface water and groundwater:

- Construction of site access tracks
- Temporary Construction Compound
- Turbine Foundations and hardstand areas
- Foundations for the proposed substation
- Foundations for the proposed Met Mast
- Construction of a clear span bridge
- Trenching for underground electrical cabling, including along the proposed Grid Connection route.
- Temporary and permanent stockpiling of peat, subsoils and bedrock.
- Road widening; a trench in the verge, placing geotextile and geogrid at the base of the trench and backfilling the trench with granular material compacted in layers.

All of the above mentioned excavations which will be required will necessitate the removal of vegetation, the excavation of peat and mineral subsoils. Such excavations and associated ground disturbance may increase the risk of either point source or diffuse sediment laden run-off to sensitive receptors via drainage channels and discharge routes. The proposed earthworks therefore have the potential to result in the release of elevated suspended solids to surface waters, particularly during prolonged heavy rainfall events. The release of elevated suspended solids to watercourses would adversely affect water quality and potentially adversely affect aquatic habitats downstream of the discharge source point if not mitigated against. The most vulnerable areas to surface water quality deterioration through the release of elevated suspended solids are considered to be:

- Proposed site access track crossing of the Moyasta River with a clear span bridge
- Verge widening and strengthening along the Turbine Delivery Route in close proximity to roadside drainage systems along the L6132
- Turbine Hardstand and infrastructure development, particularly in close proximity to existing waterways

The potential release of elevated suspended solids to surface waters is considered to be a **direct and indirect, adverse, large** in scale **moderate to significant**, effect of the Development. This potential impact is considered to be **unavoidable** and **conforms to baseline** conditions (e.g., forestry operations). Considering the mobility characteristics of surface waters to downstream receptors, it is not considered reversible and has the potential for indirect impacts to receptors downstream. However, with appropriate mitigation measures in place (**Section 9.5.2.1**) and via the implementation of environmental engineering controls, this potential risk can be significantly reduced. Potential effects impacting on water quality are discussed in greater detail in the following sections.

9.4.3.2 Clear Fell of Afforested Areas

Felling of forestry at the Site will be necessary for areas of the Project in afforested sections within the Redline Boundary. This is an **unavoidable** consequence of the Project. Turbines T1, T2 and T3 are within afforested areas. Subsequently, tree felling will be required as part of the Project. To facilitate the construction of site access tracks, civil works, Temporary Construction Compound, spoil storage areas, ecological enhancement area and Turbine Hardstands, approximately 17.58ha coniferous forestry will need to be clear-felled. The likely felled area of approximately 17.58ha will represent approximately 56.5% of the proposed Site area (Redline Boundary of 31.13ha). In a spatial or land use context this is considered a **moderate** impact. There is no clear felling taking place along the GCR or TDR works section.

The clear fell of afforested areas is in line with baseline conditions and future activities as part of Do-Nothing impact. Therefore, in the context of the Development, the clear fell of forestry overall is considered **neutral**, however there is a range of potential **adverse** impacts associated with the activity which will require management and mitigation. Potential effects include.

1. Soil erosion, compaction and degradation: The removal of trees and underbrush during clear-felling can expose soils to wind and water erosion, leading to soil loss, compaction and degradation. This is mainly caused by vehicular movements (**Section 9.4.4.4 Figure 9.1a**).
2. Geology: Clear-felling can cause changes in the geology of an area, leading to soil instability, landslides, and other geological hazards (**Chapter 8: Soils and Geology)**
3. Hydrology & Hydrogeology: The removal of trees and vegetation can lead to changes in hydrological processes, causing changes in water flow rates and patterns, such as the lowering of water tables.
4. Water quality: Clear-felling can cause increased sediment runoff and nutrient pollution in waterways, which can impact water quality, negatively affecting aquatic ecosystems and downstream water users.
5. Soil nutrient loss and nutrient loading of receiving waters: Clear-felling removes vegetation and leaves soil bare, exposing it to weathering, which can cause the entrainment of solids and/or the loss of soil nutrients, essential for plant growth. This in

turn will lead to an increase in nutrients i.e., Nitrogen and Phosphorous compounds, dissolved organic carbon, potassium etc. in receiving waters flowing from the Site, which is considered a negative effect of the Project.

The overall potential effects here are considered to be of **moderate** significance**, permanent but reversible**, and **adverse**, though this is of a minor scale in comparison to the normal forestry activities taking place at the Site (i.e., small-scale felling proposed). If the Project does not take place, it is likely that the forestry at the Site will eventually either be clear felled, or felled in larger volumes than the amount proposed as a part of this Project. Therefore, the resulting incremental felling of the afforested area will benefit the receiving environment, namely the receiving surface water network by means of reducing the potential magnitude of impacts, namely erosion, solids entrainment, and shock nutrient and sediment loading. With appropriate mitigation measures **Section 9.5.2.9**, planning and management this impact can be reversed, and disturbance minimised.

9.4.3.3 Release of Suspended Solids

Excavation and construction activities, associated with the Project, such as stockpiling material and vehicular movements of plant machinery introduce the risk of solids being entrained in runoff. Runoff contaminated with suspended solids will add turbidity to the receiving surface water body, can block fish gills and smother spawning grounds, reduce light penetration for flora growth, and promote bacteria and algae production. Nutrients that are associated with the solids (inorganic nutrients such as phosphorus and organic such as hydrocarbons) can lead to eutrophication of the water environment and eventually to fish-kills due to lowering of oxygen supply.

The degree to which inorganic solids are entrained in runoff is related to the particle sizing of the soil components. Smaller inorganic particles (e.g. clay) will be easily entrained and will remain in suspension for a longer period than larger particles (silt / sand), and will require lower flow rates and longer retention rates to settle out of the water column when given the opportunity. Peat, comprising mostly of organic matter, will behave in a similar manner to a fine grained soil whereby much of the material will remain in suspension for a relatively long period of time, but will also dissolve and degrade within the water body, dramatically impacting on water quality.

- Forestry operations will continue at the Site. With reference to **Chapter 8: Soil and Geology**, forestry operations, harvesting and planting, will likely lead to a release of solids and nutrients entrained in surface water runoff.
- Release of suspended solids can be attributed to enhanced nutrient enrichment. This is highly dependent on the type of soil, for example peat released in water will

disintegrate and most of the constituents of the peat material (carbon) will eventually dissolve into the water column and / or be consumed by micro-organisms. However, peat and other soils / subsoils will contribute varying degrees of loading of various compounds and nutrients, including Nitrogen (N) and Phosphorous (P) compounds, which are attributed to Nutrient Enrichment, or excessive loading of N and P in waters leading to eutrophication and potentially profound adverse effects on ecological attributes downstream of the Site.

- Given the historical land use of the Site, i.e., agricultural forestry, there is likely to be trace amounts of fertiliser in the vicinity of the afforested Site. Teagasc (2017) has stated routine fertiliser application is undertaken following chemical analysis of foliar (tree leaf) samples. If thresholds are not met, fertiliser is applied manually between the months of April and August, avoiding drains and a 20m buffer zones to waterlogged and aquatic areas. Ground Rock Phosphate (GRP) is used in two forms: Granulated Rock Phosphate (c. 11% P) and Ungranulated Rock Phosphate (c. 14% P), in application process, given there are no adverse environmental effects, e.g. deterioration in water quality status.
- Peat soils behave differently to mineral soils, when it comes to some nutrients such as phosphorous. High organic matter soils (OM > 20%, i.e. peat) do not adsorb P in the same way that mineral soils do. Therefore, P does not bind to peat soil particles, however mineral soils associated with forestry do have the capacity to build up or increase the store of phosphorous they hold.

During excavation, storage and reuse of materials, it is likely that a high volume of suspended solids will be entrained by surface water runoff and intercepted by surface water networks associated with the Project, particularly during sustained rainfall events and when in close proximity to receptors, i.e. permanent material storage area next to site entrance and drains linked to the Moyasta River, **Figure 9.2a.**

The aspects of the Project most likely to impact surface water quality and result in deterioration are:

- Exposed soils / peat generally, including new drainage channels, temporary stockpiles.
- Turbine hardstand and infrastructure development, particularly in relatively close proximity to surface water receptors, and in areas characterised by extensive existing drainage networks which present a direct connection to mapped surface water features.
- Construction of infrastructure within surface water buffer zones (site tracks and internal cabling will cross buffers in a perpendicular direction i.e., so as to minimise any potential effects), and/or instream works associated with proposed watercourse crossing locations.

The areas of verge strengthening along the L6132 for TDR works including the replacement of soils with aggregate are minor in scale, presented in **Appendix 8.3 Baseline Database -Turbine Delivery Route**. Vertical realignment of the L6132 will be required at one location between the N68 and the wind farm site entrance. Realignment works will involve reducing the road level by approximately 150mm at an existing crest curve to reprofile the road for abnormal vehicles, maintain axle loading and prevent grounding. Realignment works will be carried out in the existing road boundary with surfacing to match the existing L6132.

The TDR works will require minor ground disturbance and removal of soils/subsoils within the grass verge of the existing roadway. Verge strengthening is limited to shallow works in the existing grass verges along the public road, and therefore there is no significant source of contamination or effect to the receiving surface water network or underlying groundwater bodies i.e. Hydrological and Hydrogeological receptors associated with the TDR works. The use of steel plates at the watercourse crossings will further ensure there is no significant source of silt/contamination.

Earthworks in relation to reinstatement must also be considered. In addition to potentially direct adverse effects on ecological sensitivities downstream of the Site, runoff of suspended solids will potentially impact on the WFD status and objectives associated with the surface water networks both within and downstream of the Project. Considering the '*Moderate'* quality of the baseline surface waters draining from the Site and the spoil storage areas, in addition to the sensitivity and 'Very High' importance of the associated surface water networks, any introduction of contaminants is considered an adverse impact of high significance.

Mechanism/s:	• Construction activities; Excavation, handling/transport, temporary storage of soils / subsoils / bedrock, vehicle tracking. • Erosion in areas impacted by construction activities. • Erosion in areas with newly formed preferential pathways for water runoff. • Peat / slope stability, significant or localised. • Reinstatement activities; similar to construction.
Impact	• Release of suspended solids and nutrients entrained in runoff, intercepted by surface water network.
Receptor/s:	• Surface Water. Surface water quality, ecological sensitivities and WFD status.

The potential release of elevated suspended solids to surface waters is considered an **unavoidable, direct and indirect, adverse, moderate to profound significance, small to moderate scale** effect of the Project. This potential impact is considered to conform to baseline conditions when considering the intensive nature of the construction phase, however forestry practices (felling activities will occur on Site, and therefore occasional temporary release. Considering the long ranging mobility of surface waters, this potential impact **is not considered reversible** and can have indirect impacts upon receptors downstream (i.e., potential regionally). However, with the implementation of mitigation measures and appropriate environmental engineering controls, **Section 9.5.2.5**, this impact can be reduced to within water quality regulatory limits.

There is not likely to be a significant effect posed by entrained solids on groundwater due to the natural process of filtration associated with percolation of water through soils. This principle is particularly relevant to this Site, where a combination of low permeability subsoils beneath the peat and low recharge rates are anticipated.

Chapter 8: Soils and Geology indicates that peat depths are generally shallow with some moderately deep points. With reference and upon review of the Peat Stability Assessment result data and maps as presented in **Appendix 8.1**, indicate that the Factor of Safety is generally acceptable and very low to low stability risk across the Site with the exception of three minor isolated areas or pockets of deeper peat. There are three marginally stable points, two of these points are to the east of proposed turbine T3 where there is moderately deep peat with a gentle slope (c. 2.5°), and one point at the borrow pit where there is a moderate slope (c. 5.3°). No spoil storage is located in an area of elevated risk.

The Development will invariably alter drainage at the Site which if unmanaged has the potential to create new preferential pathways for runoff potentially leading to erosion of soils / construction materials and entrainment of solids in runoff in the process.

9.4.3.4 Ground Stability and Compaction

During the construction phase of the Project, vehicles will cross over, or excavate into areas in order to construct the proposed access tracks, hardstands, and gain access to the proposed Development areas. There is the potential for soil compaction, erosion and degradation during such vehicular movements. Localised stability issues, and erosion or degradation of soil by e.g., vehicular movements, have the potential to increase the potential for entrainment of suspended solids in surface water runoff, impact or obstruct established drainage networks, and increase the amount of excavation works required generally which in turn increases the potential for standard effects associated with earthworks. Earthworks in relation to reinstatement must also be considered.

For the Turbine Delivery there will be heavy vehicles traversing the route. Verge strengthening along the L6132 will assist the road in taking such heavy loads. Sandbags and steel plates will be added either side of the three (3 no.) watercourse crossings. The verge strengthening is **temporary and reversible**. This is considered an **unavoidable, direct, adverse**, **moderate to significant**, **localised** effect on receiving surface waters. While **small to moderate** in scale this effect is considered to **conform to Baseline**

Potential localised peat stability issues, and erosion or degradation of peat such as by vehicular movements have the potential to increase entrainment of suspended solids in surface water runoff, impact or obstruct established drainage networks, and increase the amount of excavation works required generally which in turn increases the potential for standard effects associated with earthworks. This is considered an **unavoidable, direct and indirect, adverse**, **moderate to significant**, **localised and potentially regional** effect on receiving surface waters. However, with the implementation of mitigation measures and appropriate environmental engineering controls (**Section 9.5.2.6**), this impact can be reduced. While **small to moderate** in scale this effect is considered to **conform to Baseline** (e.g., forestry operations).

Assuming mitigation measures described in **Chapter 8: Soils and Geology** and in this chapter are implemented and adhered to, localised stability issues are unlikely to give rise to effects on surface water networks associated with the Project.
With reference to **Appendix 8.1 Peat Stability Risk Assessment** and **Chapter 8: Soils and Geology**, the risk of mass movement of peat is considered to be low. Of the 146 No. peat probe localities surveyed, under both Factor of Safety Scenario A and FoS Scenario B yield a result that the risk of a peat slide occurring at any proposed turbine or infrastructure element location are considered to be "Low".

9.4.3.5 Release of Hydrocarbons and Storage

Due to their inherent toxicity Hydrocarbons are a pollutant risk to all flora and fauna. Hydrocarbons chemically repel water and do not readily dissolve in polar solvents such as water. Most hydrocarbons are light non-aqueous phase liquids (L-NAPL's) that they are less dense than water. If hydrocarbons are accidentally released to water, they will float on the water's surface. Hydrocarbons adsorb onto the majority of natural solid objects they come in contact with, such as peat, soil, vegetation and animals. Hydrocarbons will burn most living organic tissue they come in contact with due to their volatile chemistry. Hydrocarbons also represent a nutrient supply for adapted micro-organisms; this process in turn can rapidly deplete dissolved oxygen and thus result in fish kills or mortality of water based vertebrate and invertebrate life.

During the construction phase, vehicles and plant associated with excavation, material transport, and construction activities introduce the risk of hydrocarbon spillages and leaks from fuels and oils. The risk is increased when regular refuelling is required which in turn implies the requirement of a designated refuelling area which will likely require fuel storage on Site. Alternatively, the fuel could be supplied by fuel tanker scheduled to refuel the plant and equipment directly.

Hydrocarbons or any other forms of toxic chemicals such as paints or adhesives etc. accidentally released to the environment will likely be intercepted by drainage and surface water networks at the Site. It is considered that most of potential contaminants such as fuel/chemical spills would likely infiltrate to surface water systems rather than recharge via percolation into groundwater. These potential effects are common to all construction Sites. All potential contamination sources will be carefully managed during the construction and operational phases (see **Appendix 2.1**). The low permeability subsoils beneath the peat and low recharge rates at the Site will inhibit the spatial distribution and temporal variation of hydrocarbon mass and concentration on groundwaters should an accidental spill occur. This results in limited potential for contaminant movement through peatland. Therefore, the risk to subsoils / peat is limited, and in turn the risk to groundwater at a significant scale is also limited.

Mechanism/s:

- Lubricants and other construction consumables – minor in scale.
- Fuel leak from personnel vehicle – minor in scale.
- Fuel leak from plant machinery – minor in scale.
- Fuel spill during refuelling – significant in scale.
- Fuel leak from storage - significant in scale.

Impact

- Release of hydrocarbons in runoff, intercepted by surface water network.
- Release of hydrocarbons to ground, intercepted by groundwater.

Receptor/s:

- Surface Water. Surface water quality, ecological sensitivities and WFD status.

- Groundwater. Groundwater quality for the purposes of extraction.

With regards to surface waters at the Site, an accidental hydrocarbon spillage is considered a **likely, adverse, direct and indirect, small in scale, moderate to profound, localised (potentially regional), permanent but reversible** effect of the Project, which is in contrast to Baseline conditions. However, with implementing mitigation and best practice the risk of an accidental spill can be greatly reduced, refer to **Section 9.5.2.7.**

In terms of groundwater associated with the Site, an accidental hydrocarbon spillage is considered to be a **likely, indirect, adverse, small** in scale**, moderate to profound, localised (potentially regional), permanent but reversible** effect of the Project, which is in contrast to Baseline conditions. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks can be significantly reduced, refer to **Section 9.5.2.7.**

In terms of Surface waters associated with the GCR and TDR works an accidental hydrocarbon spillage is considered to be an **unlikely, indirect, adverse, small** in scale**, moderate to profound, localised (potentially regional), permanent but reversible** effect of the Project, which is in contrast to Baseline conditions. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks can be significantly reduced, refer to **Section 9.5.2.7.**

With regards to groundwater waters along the GCR and TDR works, an accidental hydrocarbon spillage is considered an **unlikely, adverse, direct and indirect, small in scale, moderate to profound, localised (potentially regional), permanent but reversible** effect of the Project, which is in contrast to Baseline conditions. However, with implementing mitigation and best practice the risk of an accidental spill can be greatly reduced, refer to **Section 9.5.2.7.**

9.4.3.6 Release of Wastewater Sanitation Contaminants

The installation of permanent sanitation facilities at the Site will not be required for the operational phase of the Project. The Project does however include for temporary sanitation facilities for site workers during the construction phase. Therefore, the Project has the potential to result in the accidental leakage of wastewater or chemicals associated with wastewater sanitation onto peat/soils and ultimately into surface waters during the construction phase of the project.

Accidental release of wastewater to surface waters would likely result in an increase in biochemical oxygen demand (BOD) which in turn would lower the dissolved oxygen concentration and adversely impact on aquatic life. Wastewater sanitation chemicals are also pollutant risks due to their inherent toxicity to aquatic flora and fauna and their potential to adversely impact on the productivity or status of surface water systems. The level of risk posed by such temporary facilities is dependent upon the following key factors:

- The location of the proposed temporary sanitation facilities relative to sensitive receptors
- The condition, emptying schedule and maintenance of the facilities
- The level of toxicity of the chemical agents used to aquatic flora and fauna.

In addition to direct adverse effects on ecological sensitivities downgradient of the site, runoff of suspended solids and/or other contaminants could potentially impact on the WFD status and objectives associated with the receiving surface water networks associated with the Development. Considering the quality of the surface water draining from the site (baseline), and the 'Very High' sensitivity and importance of the associated surface water networks downstream, any introduction of contaminants is considered a potentially profound adverse effect of the Development.

Potential incidents of release of contaminants at the Site will likely be short lived or temporary, however the potential effects to downstream receptors can be long term. With appropriate mitigation measures (**Section 9.5.2.9**), these potential effects can be significantly reduced.

Mechanism/s:	• Wastewater leak – minor in scale. • Chemical leak – minor in scale
Impact	• Release of wastewater / chemicals in runoff, intercepted by surface water network.
Receptor/s:	• Surface Water. Surface water quality, ecological sensitivities and WFD status. • Groundwater. Groundwater quality for the purposes of extraction.

A potential worst-case scenario(s) associated with wastewater sanitation is the potential for wastewater or sanitation chemicals to accidentally spill or leak and to be intercepted by surface water drainage features, ultimately discharging to surface waters. This is considered to be a **likely, adverse, direct and indirect,** and therefore **localised and**

potentially regional effect. While **small** in scale**,** it is considered to be **moderate to significant**, **temporary to long term but reversible** effect of the Project, which is in contrast to baseline. With the implementation of appropriate mitigation measures and environmental engineering controls (**Section 9.5.2.9**), these potential risks can be significantly reduced.

In terms of groundwater associated with the Site an accidental wastewater sanitation leak or spillage is considered to be a **likely, indirect, adverse, small** in scale**, moderate to profound, localised (potentially regional), permanent but reversible** effect of the Project, which is in contrast to Baseline conditions. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks can be significantly reduced, refer to **Section 9.5.2.9.** However, this is not a potential effect along the Grid connection Route or the Turbine Delivery Route.

9.4.3.7 Release of Construction or Cementitious Materials

The construction phase of the Project has the potential to result in the accidental spillage or deposition of construction waste into peatland or soils. This in turn has the potential for waste materials to leach out toward preferential drainage flow paths that may ultimately be connected to the surrounding surface water network.

The accidental leaching of cementitious wastes such as concrete, lean mix or cement etc., can result in an adverse change to hydrochemistry which can adversely impact on sensitive aquatic flora fauna. Cementitious materials are highly alkaline and if accidentally released to surface waters can significantly elevate the pH concentration above the tolerance range of fish such as cyprinid and salmonid species. Freshly poured or wet concrete has greater potential to leach out towards preferential flow paths when compared to set concrete which is considered inert in comparison, the risk from wet concrete is further increased during periods of heavy rainfall. Surface water runoff that comes into contact with concrete will be impacted to a lesser extent than water percolating through lean mix concrete which will be impacted significantly. Regardless of the nature of the construction waste in question, the deposition of any construction materials or waste deposited at the Site that does not form part of the constructed Project, even if inert, is considered contamination.

Mechanism/s:	• Accidental spillage or unmanaged deposition of construction materials such as wet concrete which is intercepted by drainage or surface water networks associated with the Project.

	• Dust generation in relation to the production of concrete and management of raw materials. • Transport of material on Site and washout of plant machinery. • Pouring, forming, deposition of concrete during construction. • Generation of waste.
Impact	• Release of cementitious material in runoff, intercepted by surface water network.
Receptor/s:	• Surface Water. Surface water quality, ecological sensitivities and WFD status. • Groundwater. Groundwater quality for the purposes of extraction.

This process also gives rise to the accidental spillage or deposition of construction waste into soils and in turn impact on surface water runoff, or accidental spillages directly intercepted by drainage or surface water networks associated with the Project. The accidental spillage or deposition of construction materials such as wet or lean mix concrete which is intercepted by drainage or surface water networks is considered a **likely, adverse, direct and indirect,** and therefore **localised and potentially regional** effect. While **small to moderate** in scale**,** it is considered to be **a moderate to significant**, **temporary to medium term** effect of the Project, which is in contrast to baseline. With the implementation of appropriate mitigation measures and environmental engineering controls (**Section 9.5.2.8**), these potential risks can be significantly reduced.

In terms of groundwater associated with the Site, an accidental spillage is considered to be a **likely, indirect, adverse, small** in scale**, moderate to profound, localised (potentially regional), permanent but reversible** effect of the Project, which is in contrast to Baseline conditions. With the implementation of appropriate mitigation measures and environmental engineering, these potential risks can be significantly reduced, refer to **Section 9.5.2.8.** This is not a potential effect along the Grid connection Route or the Turbine Delivery Route.

9.4.3.8 Hydrologically Connected Designated Sites

The drainage and surface water network associated with the Project has been designed to intercept potential contaminants arising as a product of the construction or operation of the Project. The Site, GCR and TDR works is hydrologically connected and situated upstream of the following designated sites which are discussed in detail in **Section 9.3.15**:

- Lower River Shannon SAC (EU Site Code: IE0002165)
- River Shannon and River Fergus Estuaries SPA (EU Site Code: IE0004077)
- Poulnasherry Bay Proposed NHA (EU Site Code: 000065)
- Doonbeg_030 catchment (EU Site Code: IE_SH_28D020650) presence of FPM
- Carrowmore Dunes SAC (EU Site Code: IE0002250)
- Mid-Clare Coast SPA (EU Site Code: IE0004182)

For this reason, maintaining surface water quality is a key component of environmental objectives, and therefore any contaminants arising could hold potential to potentially adversely impact on downstream designated site. Any accidental release of potential contaminants to the environment as a result of the Development will likely be intercepted by the drainage and surface water network at the Site. Therefore, any contaminants potentially released will subsequently impact on a designated site. The potential of the Development to introduce contaminants to surface waters and in turn impact on the designated areas downstream is considered to be a **likely**, **indirect**, **localised (potentially regional**), **adverse, moderate to profound**, **temporary to long-term** effect of the Development which conforms to Baseline (e.g., cumulative upstream impacts), while being **small to moderate** in scale.

However, with the implementation of appropriate mitigation measures and environmental engineering controls, discussed in **Section 9.5.2** these potential risks can be significantly reduced and are considered not likely to be significant.

The Development will not compromise the ability of waterbodies affected to maintain good status or achieve any improved status or on any European site and that it has been concluded in the NIS, there will be no adverse effect on the integrity of any European site in view of their conservation objectives.

The assimilative capacity of the surface water systems will buffer against any potential contaminants introduced. In the event of accidental release of contaminants to surface waters at the Site, they will become more diluted in receiving waterbodies as the distance from the Site increases. This principle does not lessen potential adverse effects in the immediate vicinity and it does not reduce the need for robust mitigation measures to be implemented.

9.4.3.9 Drilling of Boreholes and Extraction of Groundwater

Drilling of boreholes in general is not likely to have potentially significant effects on groundwater. Extraction of groundwater is considered to have potentially significant effects on groundwater and on associated sensitive receptors. The Project will not require the installation of boreholes for groundwater extraction purposes during the construction or operational phase. However, borehole drilling will likely occur in the geotechnical testing during the design phase. All fresh water required during the construction phase of the project will be delivered to the Site via tank trucks. Therefore, there is no potential for the Project to impact on groundwater due to drilling of boreholes for extraction purposes which is not included in the works for this Project.

9.4.3.10 Local Groundwater Supplies and Bog Water

The Project has the potential to impact on groundwater levels proximal to excavation and dewatering activities. Dewatering of excavations in particular can create a relatively significant cone of depression or lowering of the water table in the surrounding area. The degree to which the water table is lowered is dependent on the baseline static water level, is proportional to the depth of the particular excavations and/or depth at which the pump is placed, and the hydrogeological characteristics of the surrounding geology / aquifer.

The potential productivity and connectivity of groundwater in the underlying bedrock aquifer/s is considered moderate (Baseline, **Section 9.3.8**) however the availability of groundwater in a social or agricultural sense is considered important, therefore the importance of groundwater quantities underlying the Site, GCR and the section of L6132 where TDR works take place, is considered 'Medium to High' sensitivity and importance. Any impact to the availability of groundwater for use (lowering of water level in wells) is considered a **potentially significant adverse** effect of the Project.

Contaminants released due to an environmental incident have the potential to infiltrate soils/subsoils potentially reaching the water table and in turn adversely impacting on groundwater quality. The Project does not interfere with any Public Source Protection Areas as mapped by GSI (2022) or Zones of Contribution under the National Federation of Group Water Schemes as outlined in **Section 9.3.18** and mapped by the EPA and GSI (2022).

Considering the quality of the groundwater underlying the Site (Baseline, **Section 9.3.7**), and the 'Medium to High' sensitivity and importance associated with groundwaters nationally, any introduction of contaminants is considered an **unlikely, direct and indirect, adverse, slight**, **temporary** effect of the Project which conforms to Baseline (e.g., other shallow excavations). With the implementation of appropriate mitigation measures and environmental engineering controls, these potential risks can be significantly reduced. They are outlined in the design phase and discussed in **Sections 9.5.1.1** and **9.5.1.8.**

The release of suspended soils does not have significant potential to adversely impact on groundwater due to the natural process of filtration associated with percolation of water through soils and bedrock (Potential exception: Karst geology). There is no indication of karst geology underlying the Site (Baseline, **Section 9.3.8**). Hydrocarbons (e.g., diesel) pose the most significant risk to groundwater quality and can persist for many years.

It is noted:

- Excavations will be of c. 3.4m depth for Turbine Foundations (**Chapter 2: Project Description)**. Some deeper excavations will occur, for example, the proposed borrow pit.
- The recommended buffer distance determined by relevant Industry Guidance (**Section 9.3.2)**, for existing wells in relation to Turbine Foundations is 250m.
- Governing Industry Guidelines (**Section 9.2.2)** stipulate a groundwater buffer zone of 100m is required of from wells used for drinking water abstraction in relation to the proposed Site Access Roads and cable trenches i.e., shallow excavations.

There are no mapped wells (GSI, 2022) within the Site, or within 430m of the Project. The nearest wells are presented in Table 9.14. Given the incomplete nature of the GSI well database and the rural location, it has been assumed on a worst case scenario that all dwellings in the vicinity of the Site are utilising a private groundwater well and that groundwater flow direction in the underlying aquifer mimics the local topography. In other words, the groundwater flow paths are expected to be from topographic high points to lower elevated discharge points at streams, flushes, bog pools, lakes and rivers. Utilising this conceptual model of groundwater flow, dwellings that are located down gradient of the Site can be identified as potential receptors. The groundwater flow direction in the area of the Site is expected to be predominantly in a north to south direction. There are no dwellings located within the Redline Boundary, 146 dwellings are located within 2km of the Site (see **Figure 9.1a)**. It is anticipated that any potential groundwater effects will have significantly attenuated across these distances in the underlying poorly productive aquifer. However, the Project does not encompass groundwater abstraction, excavations for the borrow pit and hardstands would be an insignificant abstraction effecting the quantity which is significantly reduced as outlined in **Chapter 8: Soils and Geology – 1.5.**

Considering the baseline data and Project characteristics, the risk of lowering groundwater levels to a significant extent is not considered likely. Furthermore, there are no mapped wells (**Figure 9.12a**) within the Redline Boundary. One mapped well identified within a 250m buffer along the proposed Grid Connection (**Table 9.20**).

A combination of low permeability soils (i.e. peat), the temporary nature of the construction works, and moderate recharge rates at the Site is expected to result in a **likely, neutral to adverse, slight to moderate significance, localised** effect of the Project which conforms to Baseline (forestry drains). With appropriate mitigation measures in place, the potential effects on groundwater can be managed and reduced to Imperceptible to Slight. Mitigation measures are outlined in **Chapter 8: Soils and Geology.**

9.4.3.11 Potential effects on Groundwater and Surface water associated with GCR / verge strengthening

9.4.3.11.1 Wind Farm Cabling

The Project has the potential to impact on bog water levels proximal to excavations and/or drainage channels. Existing drainage at the Site, particularly in forestry areas are intended to drain the respective area, however these drains can also impact on bog water levels. Lowering of the water table in peat lowers the potential for peat growth i.e., sub-optimal conditions. This will lead to the gradual decline in productivity in the acrotelm (living layer of peat), and in time the degradation of the drained peat area, potentially leading to erosion.

In peat, the effect can be minimal in scale initially but over time and as the acrotelm layer degrades and recedes the impact can continue to progress slowly/chronically, potentially leading to profound impacts in worst case scenarios. However, it is noted that the Site is characterised by moderately deep and shallow peat or peaty soil with isolated minor areas of moderately deep saturated peat (**Chapter 8: Soils and Geology**). Therefore, the scale of such impact is likely limited to the extent of those isolated pockets, if impacted. Furthermore, the Site is generally characterised as having extensive existing drainage features, and therefore impacts arising from drainage can be in line with baseline conditions.

- The proposed wind farm internal cabling will follow the hardstand and road alignment and will be predominantly buried within shallow cable trenches. It has been assumed on a worst case scenario that all dwellings in the vicinity of the Site are utilising a private groundwater well and that groundwater flow direction in the underlying aquifer mimics the local topography. The closest inhabited dwelling to a proposed turbine position (T2) is situated approximately 570m to the south-west (a financially involved landowner), and this dwelling is located approximately 450m to the west of borrow pit.
- The closest dwelling to the proposed Electrical Substation and Temporary Construction Compound is situated approximately 480m to the west.

Due to the alignment of the internal cable works with the proposed site access tracks, shallow trenching, absence of proximal groundwater wells and the sealed nature of the internal cable works at the two proposed crossings as a result of which the internal cable works are expected to result in a **likely, adverse, direct and indirect, small to moderate scale, slight significance, localised, permanent but reversible** effect which conforms to Baseline conditions (forestry drains). With appropriate environmental engineering controls and measures (i.e., Mitigation measures), these potential risks can be significantly reduced. Additionally, in areas impacted by draining activities, if considered adequately, mitigation measures have the potential to have a **positive beneficial** impact on bog water levels, particularly in places already impacted by drainage.

9.4.3.11.2 Grid Connection Cable Works

The GSI well database shows there are a number of mapped wells located along or within the vicinity of the Grid Connection route. Given the incomplete nature of the GSI well database and the rural location, there is a potential for more private wells to be in use along the Grid Connection route Option 1. Shallow trenching (c. 1,220mm deep) which will be backfilled is expected to be required for the proposed Grid Connection, the shallow trenching will not breach the groundwater table. Horizontal directional drilling will not be required during the proposed works.

Due to the vast majority of the gird connection requiring shallow trenching that will be backfilled and the temporary nature of the construction works, it is expected to result in a **likely, direct and indirect, adverse, small in scale, localised, slight significance and temporary** effect which conforms to the Baseline (e.g., public roads and services). With appropriate environmental engineering controls and measures (i.e., Mitigation measures), these potential risks can be significantly reduced.

9.4.3.11.3 TDR Verge Strengthening Works

The GSI well database has indicated that there are a number of mapped wells located along or within the vicinity of the Turbine Delivery Route. Given the incomplete nature of the GSI well database and the rural location, there is a potential for more private wells to be in use along the Turbine Delivery Route. The temporary verge strengthening is limited to shallow works in the existing grass verges along the L6132 section of the public road, the shallow works will not breach the groundwater table, the Watercourse crossings are discussed in **Section 9.4.3.13.**

Due to the vast majority of the Turbine Delivery Route not requiring shallow works and the nature of the minimal limited construction works, it is expected to result in a **likely, direct and indirect, adverse, small in scale, localised, slight and permanent** but **beneficial** effect which conforms to the Baseline (e.g., public roads and services). With appropriate environmental engineering controls and measures (i.e., Mitigation measures), these potential risks can be significantly reduced.

9.4.3.12 Excavation Dewatering & Construction Water

The dewatering of excavations during construction is likely to have significant adverse effects on surface water runoff quality in the absence of mitigation measures. Should dewatering of open excavations, Turbine Foundations etc. be required, the receiving engineered drainage and attenuation features will likely receive water discharges with elevated suspended solids. The potential overflow of such sediment laden water into the receiving downstream surface waters is considered to be a likely, direct, adverse, potentially moderate to significant effect of the Project.

This effect is considered to be in contrast to baseline conditions although it is also **temporary**. Although temporary, considering the mobility characteristics associated with flowing surface waters, it is not considered reversible. Potential effects impacting on water quality are discussed in greater detail in the following sections of this report.

Potential dewatering through drainage in advance of excavation activities, or dewatering via pumping during excavation activities, will likely impact on groundwater and hydrogeological flow regimes at a localised scale but not at a regional scale. This is considered to be a **likely, adverse, direct and indirect localised (potentially regional), temporary to permanent** effect of the Project which is in contrast to the baseline conditions. While **small to moderate** in scale it is considered to be **moderate to profound in significance**. With appropriate environmental engineering controls and measures (i.e., Mitigation measures, **Section 9.5.2.2**), these potential risks can be significantly reduced.

The potential effects on groundwater during the proposed operational phase of the Project is considered to be not significant[3].

Considering the nature of the site i.e. greenfield, it is assumed that there is no significant source of ground contamination at the Site and therefore the potential to draw in contaminants during dewatering activities is not significant.

[3] The effect is only significant if it will be likely to breach any standard in water management legislation.

9.4.3.13 Watercourse Crossings - Bridges & Culverts over Mapped Rivers and Non-Mapped Drains

In terms of mapped streams and rivers, the Project will require a new bridge (WCC2). In terms of non-mapped surface water features and drains, there are a number of new culverts required and some existing culverts within the Site . Although more minor in scale, and less significant in terms of ecological importance and sensitivity, such culverts must be considered similarly to watercourse crossings in terms of potential impacts associated with poor design and construction.

Note: existing culverts were observed during site surveys and/or from desk top assessment of aerial imagery and site drainage mapping, including recent Lidar and Aerial Survey data (BlueSky) available for the site. There is potential for buried stone culverts/ land drains to be present on Site which are not mapped here, and which could be discovered during excavations.

Through the design and construction and operation of watercourse crossings, examples of associated activities or impact mechanisms include:

- Significant changes to the hydrological regime at the Site.
- Construction activities (Earthworks, addressed under Release of Suspended Solids)
- Construction activities (Earthworks) within existing drainage channels and/or streams and rivers.
- Connecting new and existing drainage channels.
- Poor design and/or installation of watercourse crossings.
- Poor design and/or installation of culverts.
- Upgrading of existing bridges where necessary.
- Upgrading of existing culverts where necessary.
- Poor design and/or installation of drainage infrastructure including culverts attenuation features.

Potential impacts arising from such activities include:

- Release of suspended solids or other contaminants, intercepted by surface water network.
- Significant surge release of suspended solids, intercepted by surface water network.
- Altering hydrological regime at a particular location. Potentially leading to erosion / deposition not in line with baseline conditions.
- Restricting water flow.

Receptors include Surface Water, and in terms of: surface water quantity and flood risk, Surface water quality, ecological sensitivities and WFD status.

Mechanism/s:	• Significant changes to the hydrological regime at the Site. • Construction activities (Earthworks, addressed under Release of Suspended Solids) • Construction activities (Earthworks) within existing drainage channels. • Connecting new and existing drainage channels. • Poor design and/or installation of drainage network • Poor design and/or installation of drainage infrastructure including culverts. • Upgrading of existing culverts where necessary. • Poor design and/or installation of drainage infrastructure including culverts attenuation features.
Impact	• Drying - Lowering of bog / groundwater table proximal to respective drainage features. • Wetting – Excess discharge in a particular area (local flooding) • Increasing hydrological response to rainfall. • Release of suspended solids, intercepted by surface water network. • Significant surge release of suspended solids, intercepted by surface water network.
Receptor/s:	• Surface Water. Surface water quantity and flood risk. Surface water quality, ecological sensitivities and WFD status. • Groundwater. Groundwater / bog water quantity for water dependent terrestrial habitats.

Watercourse crossings and associated portions of site access track are naturally in very close proximity to or directly within sensitive receptor buffer zones i.e., surface waters or drainage features discharging to surface water features. As sited in **Chapter 8: Soils and Geology** it is very important to consider the potential for ground stability issues arising. Due to the close proximity to the receptor, minor, or localised stability issues arising can potentially have profound impacts on surface water features.

Potential effects with regards to upgrading and installing watercourse crossings at the Site are considered to be **unavoidable, adverse, direct and indirect, small to moderate** in scale**, moderate to profound significance, localised (potentially regional** when considering the extensive downstream surface water network), and **permanent** which conforms to baseline conditions (e.g., existing bridges and roads in the area. However, with implementing mitigation and best practice the risk of an accidental spill can be greatly reduced, **Section 9.5.2.9 and Section 9.5.2.10.**

9.4.3.13.1 Wind Farm

The Project has been assessed at EIA stage in terms of the intersection of the Project footprint and existing surface water and drainage features at the Site. As outlined in **Table 9.1**, and illustrated in **Figure 9.2** and **Figure 9.3a**, are the six (6 no.) watercourse crossings required for the site access tracks as part of facilitating access to the proposed turbines.

One river crossing (WCC2, **Appendix 9.2 Plate 11**) will comprise a single span bridge over the Moyasta river. This location relates to where the Project footprint intersects with an EPA mapped river. While located c. 4km from the headwaters of the river, the proposed clear span bridge will be located just north of the proposed location for turbine T1.

A number of existing minor drains along the existing and proposed site access track network within the Site (**Figure 9.3a, Appendix 9.2 – Plates 6, 9 and 10**) will require upgrading to accommodate the increased width of the road. These minor surface drains can be dry and receive flows only following heavy rainfall events throughout the year. However, due to their connectivity to mapped surface water network within the catchment, appropriate measures outlined in the Mitigation **Section 9.5.2.10**. This is further discussed in Section 5.4.5.13 of **Appendix 2.1 CEMP**.

Table 9.10 lists culvert locations of crossings over non-mapped drains**.** Five (5 no.) water crossings (WCC 1, 3,4,5 and 6) are small streams or drainage channels on the Site. These water crossings will be constructed using precast bottomless culverts. Proposed crossing designs are shown on **Figures 2.6**(**a to d**) (and **Planning Drawings 6777-JOD-BKWF-XX-DR-C-1201 to 6777-JOD-BKWF-XX-DR-C-1208)**. The Project has the potential to result in the release of contaminants, particularly suspended solids during the construction phase due to the proposed instream works (i.e., culverting and clear-span bridge crossing), careful consideration is recommended in terms of potential direct effects arising from the Project when considering instream works.

Construction of any new watercourse crossing will have an inherent risk of resulting in adverse effects to surface waters due to the required ground disturbance through excavations and the movement of heavy plant and machinery and the proximity to the primary sensitive receptor which is the watercourse itself. Release of elevated suspended solids to surface waters due to excavations or other earthworks etc., or the accidental release of any form of anthropogenic contaminant such as fuels or chemicals during construction of new watercourse crossings are both potential significant adverse effects. This is considered **a likely, adverse, significant, but temporary** effect of the Project which contrasts to baseline conditions. The effects relating to the release of contaminants during earthworks is addressed in **Section 9.4.3.1** of this chapter. Mitigation measures for this potential effect is outlined in **Section 9.5.2.9** of this chapter. Outlined in **Section 9.5.2.49.4.3.3** of this report are the requirements during construction to avoid siltation or other pollutants entering the drainage network.

9.4.3.13.2 Grid Connection Route

The Development has been assessed at EIA stage in terms of the intersection of the Project footprint and existing surface water and drainage features at the Site. As outlined in **Table 9.11**, and illustrated in **Figure 9.3b**, The preferred Grid Connection Route will not cross any watercourses.

9.4.3.13.3 Turbine Delivery Route works

The Project has been assessed at EIA stage in terms of the intersection of the Project footprint and existing surface water and drainage features at the Site. There are no works to upgrade three existing watercourse crossings (WCC 7 – WCC 9) on the L6132 road **Figure 9.2b.** These will be temporarily strengthened by the placement of sandbags and steel plates at 10m set backs. There will be no direct likely significant effects at these watercourse crossings.

Elsewhere along the L6132 section of the TDR temporary strengthening of the road will be provided with the use of gravel/stone along the existing road margin. These are within 10m of a mapped watercourse. This is considered **a likely, adverse, significant, but temporary** effect of the Project which contrasts to baseline conditions.

9.4.3.14 Constructed Drainage, Diversion or Enhancement of Drainage

Drainage features constructed at a Site as part of a wind farm Project have the potential to significantly adversely effect the baseline hydrological regime. In particular areas of intact peatland habitat, but equally in peatland areas impacted by artificial drainage and forestry operations. There is the potential for the Project to have a beneficial effect to the hydrological regime and to peatland regeneration. Interceptor drains and attenuation features will reduce increases in water volumes following intense rainfall periods. Peatland groundwater levels are generally dependent on rainfall.

Rainfall infiltrates and percolates into peat/soil (recharge), initially through vegetated / root conduits in the acrotelm peat (living vegetated layer) or upper soil horizons, however percolation and/or permeability rates in peat, particularly the catotelm (decomposing lower layer) are poor and therefore peatland areas are characterised by rapid hydrological responses to rainfall i.e., rapid surface water runoff intercepted by the receiving drainage and surface water network. Due to this characteristic, peatlands require consistent rainfall to ensure adequate wetting of water dependant blanket peat habitats.

Poor drainage design has the potential to drain excess surface water runoff and draw water away from areas of peatland, thus reducing the potential of recharge to ground in those areas and creating an even greater hydrological response to rain fall in the receiving surface water network via more direct connections to the surface water network i.e., bypassing the peatland. Furthermore, uncontrolled surface water runoff interacting with the Project footprint has the potential to lead to adverse impacts including the development of new preferential pathways, erosion and peat degradation – particularly during and immediately after construction phase whereby unvegetated soils are exposed and wetting and/or drying of peat areas potentially occurs.

The Project will likely result in the diversion, alteration and/or enhancement of the existing drainage networks at the Site during the construction of the project relative to baseline conditions. The existing drainage network at the Site is mapped and presented in **Figure 9.2a.** Diversion of artificial drainage channels will be required at locations where the Project layout intercepts existing artificial drainage networks. This includes minor modifications where existing drainage will be aligned with proposed culverts etc. and/or where Project drainage interacts or connects with existing drainage networks. This has the potential to introduce contaminants directly to the surface water feature, potentially leading to significant effects to water quality and downstream ecological attributes sensitive to contaminant loading, including suspended solids.

Considering that pre-existing natural and artificially established drainage networks are present at the Site, the diversion, enhancement or introduction of additional drainage features is considered an **unavoidable, direct and indirect, adverse, localised (potentially regional**) and **permanent** effect of the Project which conforms to baseline conditions. While small in scale the effect is considered to be of **moderate to profound**

significance. There are potential risks associated with the earthworks required to carry out such drainage works, and it is very important to recognise the drainage and surface water network are connected, that is in terms of assessing source pathway receptor, the construction or diversion of drainage is connecting source, pathway, and receptor. With appropriate environmental engineering controls and measures (i.e., Mitigation measures presented in **Section 9.5.2.10**), these potential risks can be significantly reduced.

The potential impacts of excavations are addressed in **Section 9.4.4.1** and in **Chapter 8: Soils and Geology**. Management of storm and construction water runoff to prevent loading of the receiving network with contaminants in detailed in the later sections, that is; these potential impacts can be mitigated.

9.4.3.15 In-stream Works

There will be no in-stream works with the use of a single span structure over a significant receptors. There will be no tracking of machinery across any watercourse. All machinery will stay within designated routes (working corridor) within the Site Boundary. Five (5 no.) water crossings (WCC 1, 3, 4, 5 and 6) are small streams or drainage channels on the Site. These will be crossed using bottomless culverts and as such will have no effect on the receptor.

Potential effects with regards to instream works at the Site are considered to be **unavoidable, direct and indirect, small in scale, imperceptible significance, localised (potentially regional when considering the extensive downstream surface water network), and temporary** which conforms to baseline conditions (e.g., existing bridges and roads in the area. However, with implementing mitigation and best practice the risk of an accidental spill can be greatly reduced, **Section 9.5.2.9 and Section 9.5.2.10.**

9.4.4 Operational Phase Effects

The Project has the potential to result in increased volumes of runoff during the operational phase relative to baseline conditions. This is a function of the progressive excavation and removal of vegetation cover and replacement with hardstanding surfaces (effectively or assumed impermeable) and installation of constructed drainage along the Project footprint, thus removing the hydraulic absorption / buffer control from this part of the Site. The completed site footprint will comprise of Turbine Hardstand areas, site access tracks, Onsite Substation & Control Building and Met Mast. Such an increase in surface water runoff, or an increased hydrological response to rainfall, has the potential to exacerbate flooding events and impact on hydro morphology of waterbodies downstream of the Project, and/or to exacerbate flooding and erosion within the boundary of the Site.

Mechanism/s:	• Significant changes to the hydrological regime at the Site. • Replacement of vegetated land with respective recharge capacity with impermeable (assumed) hardstand surfaces. Introduction of constructed drainage intercepting greenfield runoff. Construction activities (Earthworks) within existing drainage channels and/or streams and rivers. • Connecting new and existing drainage channels.
Impact	• Increase in runoff at the Site. • Increase in hydrological response to rainfall at the Site and in downstream surface water bodies.
Receptor/s:	• Surface Waters. Site hydrological response to rainfall and potential downstream flood risk areas.

9.4.4.1 Increased Surface water runoff

Considering the existing infrastructure associated with the site, water balance calculations allow for the addition of the area of hardstand required (land take) for the construction of the Project. The resulting 1 in 100 year scenario net increase of surface water runoff associated with the Project is calculated to be c. .024m³/sec or 86.4m³/hour (or 0.12%), (Note: assessment at catchment scale presumes the same environmental conditions across the entire catchment during the event).

This net increase relative to the scale of the Site or the scale of the associated catchment is considered an adverse but imperceptible to slight effect of the Project. However, considering the cumulative impacts in regard to increased runoff generally (catchment / national scale), the potential for increasing rainfall amounts and frequency (climate change), and considering the sensitive receptors a relatively short distance downstream (probable flood risk areas), any net increase in runoff is considered a significant impact.

Mechanism/s:	• Significant changes to the hydrological regime at the Site. • Replacement of vegetated land with respective recharge capacity with impermeable (assumed) hardstand surfaces. Introduction of constructed drainage intercepting greenfield runoff. Construction

	activities (Earthworks) within existing drainage channels and/or streams and rivers. • Connecting new and existing drainage channels.
Impact	• Increase in runoff at the Site. • Increase in hydrological response to rainfall at the Site and in downstream surface water bodies.
Receptor/s:	• Surface Waters. Site hydrological response to rainfall and potential downstream flood risk areas.
	• Surface Water - Negative, direct, significant, likely, permanent.

During prolonged heavy rainfall events, additional surface water runoff at increased flow velocity could increase hydraulic loading. Increased runoff, or an increased hydrological response to rainfall has the potential to exacerbate flooding events and impact on hydro-morphology of waterbodies downstream of the Project (which in turn has the potential to result in enhanced erosion of watercourses and adverse impact on aquatic ecosystems), and/or to exacerbate flooding and erosion within the boundary of the Site. The installation of constructed drainage for the purposes of collecting either clean water or construction run off have the potential to also drain sensitive areas of the Site, specifically areas of intact or designated peat or water dependent terrestrial ecosystems.

Preliminary water balance calculations indicate that the Project will lead to a net increase of surface water runoff of approximately 0.024m^3/sec or 86.4m^3/hour (or 0.12%) during a 1 in 100-year storm. This calculation, as shown in **Table 6 of Appendix 9.1,** assumes that all road and hardstand surfaces would be fully impermeable as a precautionary scenario which is **unlikely** to be considered as an option during the detailed design phase. This is considered to be an **unavoidable, direct and indirect, adverse, slight, permanent** effect of the Project which conforms to Baseline (e.g., existing forestry tracks). The increase in hardstand area associated with the Project will likely impact on groundwater and hydrogeological flow regimes at a localised scale but not at a regional scale.

With appropriate environmental engineering controls and mitigation measures, i.e., attenuation features, these potential effects can be significantly reduced. Furthermore, if considered adequately, mitigation measures have the potential to have a **beneficial** impact on the hydrological response to rainfall at the Site, whereby, if the Project can reduce discharge rates at the Site below estimated greenfield or baseline runoff rates, the Project will have a beneficial impact by reducing the Site hydrological response to rainfall and mitigate against potential flood events downstream. Additionally, these measures promote the recovery and development of blanket peat habitats (e.g., Wet Heath and Blanket Bog). This is considered a **beneficial** impact in areas of existing cutover peat and a neutral impact in areas of intact blanket peat habitats.

Minimal land take is associated with the GCR, considering all proposed works will traverse already existing public roadways (i.e., site access tracks to be constructed as part of the Project) public and local road networks.

Temporary Land take is required for the Turbine Delivery Route (5,806m²), off the L6132 in the form of widening of existing portions of roads which typically involves digging out road verges to c. 0.4m and replacing with compact stone for facilitate a turning point along the route for large plant machinery and vehicles. Works involving existing portions of roads which traverse greenfield / green verge areas are considered to be small scale of disturbances (shallow excavation, superficial paving) the impact is considered slight. During the operational phase of the Project, the verge strengthening will provide beneficial effects whereby the residual rock aggregate can be considered an infiltration pit and will likely enhance recharge runoff in the grass verge. Similarly, there is unlikely to be an increase in the rate of runoff from the construction of both these routes due to utilization of pre-existing road infrastructure.

The overall conclusion is that the effects of surface water runoff rates and quality, as well as groundwater bodies, will be insignificant and possibly beneficial on site.

9.4.5 Decommissioning Phase

Decommissioning of the Project would result in the cessation of renewable energy generation at the end of the operational life of the wind farm with the removal of various infrastructural elements. The drainage network of the Site will be inspected by a SuDS hydrologist prior to any works commencing. The Decommissioning phase, as outlined in the Ballykett Decommissioning Plan, **Appendix 2.1**, will involve the removal of the above ground elements of the wind farm which will require:

- De-energising of the Site via a high voltage (HV) disconnection followed by low voltage (LV) disconnection of turbines
- Controlled dismantling of turbine components such as blades, blade hub & nose cone, tower, nacelle (generator and gearbox) and transformer
- Controlled removal of the Met Mast
- Removal of de-energised underground cables and electrical control systems from ground and disposed of to a licensed recycling facility.

It is anticipated that the following elements of the wind farm and TDR works will be left in place after Decommissioning:

- The reinforced concrete Turbine Foundations
- The Turbine Hardstand Areas adjacent to the turbines
- All Site Access tracks
- Substation
- Grid Connection
- Realignment works on the TDR.

There will not be a requirement for additional drainage measures to be implemented during the Decommissioning phase of the Project. With the passage of time, the constructed drainage network will likely become full of deposited sediment and revegetation will naturally occur which will render the drainage system less effective over time. The Site will therefore revert over time to a more natural drainage regime. All anticipated effects are similar in nature to those already highlighted during the construction phase of the Project, i.e., release of hydrocarbons, wastewater / sanitation and suspended soils through the excavation of material in order to remove cabling from joint bay locations. The works to be completed during the Decommissioning phase are expected to be an **imperceptible to slight, neutral, permanent impact** on the hydrological and hydrogeological setting surrounding the Site.

9.4.5.1 Reinstatement of Redundant Access Track, Hardstand Areas, Borrow Pits and Verge strengthening

Redundant site access tracks and Turbine Hardstand areas, that would be utilised for the construction phase of the Project will become redundant following the completion of construction activities at the Site. The Control Building and Compound will be owned and operated by the ESBN once operational and so will not be decommissioned as part of the works, unless required by ESBN. Redundant site access tracks and hardstand areas will require the removal of the top layer of hardstand and temporary access tracks. The underlying peat or soil will not be significantly exposed during such top layer surface removals. Any excess peat from the top layer removals will be transported to the designated spoil storage area or borrow pit. Approximately 50% of the spoil will be temporarily stored in the temporary storage area beside the borrow pit for later use in reinstatement (permanent storage) in the borrow pit.

Depositing of acrotelm (or vegetated peat) over the areas in question will be carried out following the removal of the surface layers. Catotelm peat will not be used to reinstate redundant Turbine Hardstand areas or site access tracks as it is prone to rapid erosion. There is potential for elevated suspended solids to become entrained by surface water runoff during the reinstatement of such areas. Any effects to the receiving hydrological and hydrogeological environment during reinstatement are likely to be **direct, adverse, slight to potentially profound** (similar to potential impacts on water quality during construction phase) and **small** in scale within the Project footprint. Reinstatement of redundant infrastructure following the Project construction phase is considered a **neutral or beneficial** effect of the Project. Reinstatement will serve as a foundation for the promotion and establishment of new blanket bog and associated ecological and biodiversity benefits.

The road widening and verge strengthening are temporary works and will therefore be reinstated (Drawing **ref. 677-JOD-XX-DR-C-HR-250** Road Widening and Strengthening Works on the TDR. Stream Crossings **6777-JOD-XX-DR-C-HR-253, 6777-JOD-XX-DR-C-HR- 260, 6777-JOD-XX-DR-C-HR-262.)**

The potential effects arising through decommissioning and reinstatement of the Project will be similar to the construction phase. As discussed, the potential effects will mitigate and managed, and reducing potential magnitude of effects in alignment with mitigation objectives.

9.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

The Development has associated potential effects as described in the previous sections of this report. The following sections outline mitigation measures to be implemented during the design, construction, operational and Decommissioning phases of the Development. Potential residual effects after mitigation measures are implemented are also described in the following sections.

9.5.1 Design Phase

9.5.1.1 Mitigation by Avoidance

The fundamental mitigation measure to be implemented during each stage of the Development will be avoidance of sensitive hydrological or hydrogeological receptors wherever possible. This principle has been adopted during the design of the turbine and associated infrastructure layout across multiple design iterations. Hydrological constraints maps have been developed which identified areas of the Site where surface water and drainage constraints resulted in areas of the Site being deemed less suitable for development. The constraints map is presented in **Figure 9.13a** for the Wind Farm site and GCR. The constraints along the L6132 for TDR works is presented in **Figure 9.13b**. The identified constraints have been extensively discussed in consultation between RSK Ireland Ltd. and the design team. The final Site layout plan has been identified as the optimal layout design available for protecting the existing hydrological regime of the Site, with due regard to overlaying engineering and other environmental constraints.

9.5.1.2 Mitigation by Design

The descriptive mitigation measures outlined in this report will be applied to the development design and construction methodologies with a view to avoiding and/or minimising any potential adverse effects to water quality in the receiving surface water network. Details on how such measures will be applied (objectives, design considerations, layout) will be contained in a Surface Water Management Plan (SWMP) (appended to the CEMP in **Appendix 2.1**). The aims and examples of important considerations in relation to mitigation measures described in the EIAR are further clarified here.

9.5.1.3 Nature Based Solutions

Nature Based Solutions (NBS) will be adopted for the Project where possible. NBS include Sustainable Drainage Systems (SuDS), which will be employed to attenuate runoff and reduce the hydrological response to rainfall at the Site. Extending or maximising this approach sufficiently has the potential to attain net beneficial effects i.e., a net reduction in runoff rates at the Site, beneficial effects to water quality and reducing flood risk to downstream flood risk areas. Coupling SuDS with ecology and biodiversity mitigation can also provide opportunities to attain net biodiversity gain.

In peatland areas, one of the main objectives of Nature Based Solutions and SuDS is to create an array of runoff stilling areas / standing water and promote diffuse discharge and recharge of runoff on peatland. Generally, and as is the case on the subject site, peatlands have been subject to peat cutting and forestry operations which include extensive drainage networks and draining of peatland bogs. Lowering bog water levels leads to increased erosion, release of carbon to atmosphere and the receiving surface water network and reduces the productivity and general health of the bog, potentially leading to chronic degradation and decline. The objective of nature based solutions in peatlands will be to reverse this impact where there is the opportunity and where it is appropriate through surveying and risk assessment. This is further outlined in **Section 9.5.1.8** and will be executed under the supervision of the ECoW as outlined in the CEMP.

Runoff attenuation features or SuDS will be included as part of the Project as detailed in the following sections of this report. It is important to follow best practice and relevant guidance in the design and construction of drainage features. The following sections outline design considerations for working towards effective nature based solutions and net beneficial impact, for example; maximising the distribution of check dams and stilling ponds and similar features where appropriate *, with the objective of attenuating as much water as possible safely, and to promote diffuse discharge to vegetated lands where valued *, and to promote and maintain high bog water levels and healthy peatland conditions.

* Relevant guidance on the Wise Use of Mires and Peatlands (Joosten H, Clarke D, 2022) outlines principles for decision making through considering the cultural, or other values held by stakeholders associated with the subject peatland. It is noted that active peat cutting, and commercial forestry operations require networks of drainage channels, with the objective of reducing and maintaining relatively low bog water levels. This is on contrast to promoting and maintaining higher bog water levels for healthy peatland function. Much of the mitigation outlined in the following sections is intended to attenuate water on site and promote the diffuse discharge and recharge of runoff on peatland at the site. Nature based solutions including SuDS will be designed in a manner that respects the ongoing land uses and stakeholder values, where valid and in line with local, national, and international, law, policy and guidance. That is, where stakeholders have a right, and value the peatland, and intend to maintain existing drainage arrangements, the Project drainage design will incorporate checks on suitability particular features at given locations, and to direct runoff on site to suitable locations for targeting rewetting, or the promotion and maintaining of high bog water levels.

9.5.1.4 Constructed Drainage

Drainage features constructed at a Site as part of a wind farm Project have the potential to significantly adversely impact on the baseline hydrological regime, particularly in areas of intact habitat such as Wet Heath or Blanket Bog, but equally in peatland areas impacted by peat cutting there is the potential for the Project to have a beneficial impact to the hydrological regime and to peatland regeneration. Peatland groundwater levels are generally dependent on rainfall. Rainfall infiltrates and percolates into peat/soil (recharge), initially through vegetated / root conduits in the acrotelm peat (living vegetated layer) or upper soil horizons, however percolation and/or permeability rates in peat, particularly the catotelm (decomposing lower layer) are poor and therefore peatland areas are characterised by rapid hydrological responses to rain fall i.e., rapid surface water runoff intercepted by the receiving drainage and surface water network. Due to this characteristic, peatlands require consistent rainfall to ensure adequate wetting of water dependant blanket peat habitats such as Wet Heath and Blanket Bog.

Poor drainage design has the potential to drain excess surface water runoff and draw water away from areas of peatland, thus reducing the potential of recharge to ground in those areas and creating an even greater hydrological response to rain fall in the receiving surface water network via more direct connections to the surface water network i.e., bypassing the peatland. Furthermore, uncontrolled surface water runoff interacting with the Project footprint has the potential to lead to adverse effects including the development of new preferential pathways, erosion and peat degradation – particularly during and immediately after construction phase whereby unvegetated soils are exposed and wetting and/or drying of peat areas potentially occurs.

The drainage design for the proposed Site (Surface Water Management Plan in **Appendix 2.1**) will be such that drains are positioned adjacent to the footprint of the Project, therefore the proposed drainage infrastructure can be considered part of the Project footprint. The scale of the impact a shallow drain poses on the surrounding peatland area is minor particularly in areas impacted as baseline conditions are in their current form. Therefore, the potential magnitude or scale of impact to waters posed by the introduction of the proposed drainage extends beyond the footprint of the Project to potential receptors downstream. However, it is important to consider the gradual degradation over time.

The design of the proposed drainage network will facilitate:

- The collection of surface water runoff from upgradient of the Project footprint (clean runoff interceptor drains) and the buffered redistribution of clean runoff downgradient of the Project footprint by means of culverts and buffered outfalls to vegetated areas with a view to maintaining or improving the hydrological regime at the Site.
- The collection of surface water runoff from the footprint of the Project i.e., the construction area (construction runoff interceptor drains) and management of potentially contaminated runoff in the constructed treatment train. Where possible the buffered outfalls from the treatment train / stilling ponds will be redistributed with a view to maintaining or improving the hydrological regime at the Site.
- Where extensive drainage networks exist, collected / diverted runoff will likely be diverted back into the existing network. In such instances it is important to include the existing drainage network in designing and specifying the treatment train and attenuation features, including improving, modifying, and constructing attenuation features in drainage channels. Similar to considerations for newly constructed drainage channels, the modification and/or improvements of existing drainage will be designed with a view to maintaining or improving the hydrological regime at the Site.

Maintaining or improving the hydrological regime at the Site implies achieving the objectives of the Surface Water Management Plan (SWMP) i.e., mitigating against potential adverse effects to the hydrological response to rainfall at the Site (related to flood risk), and water quality in the receiving surface water network.

9.5.1.5 Attenuation Features

There remains the risk of the proposed drainage to increase the rate of runoff from respective upgradient areas, to reduce potential runoff to respective downgradient areas, and to increase the rate of hydrological response to rainfall in the receiving surface water system (increase hydrological response will also be driven by introduction of nearly impermeable hardstand).

Mitigation measures to address surface water runoff and drainage include in-line attenuation features such as check dams and stilling ponds and buffered outfalls. Both check dams and stilling ponds (Section 5.7 Surface Water Management Plan in **Appendix 2.1**) provide mitigation against potential effects to water quality, erosion, and discharge velocity, however they also facilitate buffered and diffuse percolation of surface water runoff into the receiving environment along the permitter of the Project footprint. Attenuation features have been designed to take into consideration for a 1 in 100-year rainfall event, including an additional 20% to account for climate change, **Appendix 9.1**.

9.5.1.6 Check Dams

Check dams will be constructed along the length of constructed drainage at regular intervals in line with relevant guidance (**Section 9.2.2**). Check dams (**Appendix 9.4– Plate 3 Plate 3b,** Section 5.6 Surface Water Management Plan in **Appendix 2.1**), will be permanent (for the life of the project / drainage network), made of suitable locally sourced coarse aggregate (similar geology), and are intended to attenuate (impede) surface water runoff in the drainage channel, therefore slowing the velocity of the runoff in turn reducing the potential for erosion in the channel and allowing suspended solids to settle out if present. At low velocity, the runoff has increased opportunity to percolate through the coarse aggregate and into the surrounding peat area, effectively contributing to bog water levels at that location.

9.5.1.7 Stilling Ponds

Stilling ponds with buffered outfalls will be constructed at drainage outfalls associated with the construction runoff drainage network (**Appendix 9.4 – Plate 12, Plate 14 and Plate 16,** Section 5.7 Surface Water Management Plan in **Appendix 2.1).** Buffered outfalls will be established at intervals along the clean runoff drainage network. Multiple outfalls along the drainage routes facilitates the strategic management of runoff with a view to maintaining the baseline hydrological regime in so far as possible. Similar to check dams; stilling ponds will be permanent (for the life of the projects / drainage network), made of suitable coarse aggregate, and are intended to attenuate surface water runoff in the drainage channel, slowing the velocity of the runoff before discharging to vegetated areas (buffered outfall). Slowing the water velocity allows suspended solids to settle out if present. At low velocity the runoff has increased opportunity to percolate through the coarse aggregate and into the surrounding peat area. Through both forms of discharge (buffered outfall and percolation through aggregate) the stilling ponds will contribute to bog water levels at their locations. Stilling ponds are designed to provide attenuation to greenfield run-off rates.

A smaller version of stilling ponds, velocity reduction ponds will be included up and down stream of all culverts included in the Project design (**Appendix 9.4 – Plate 2**).

9.5.1.8 Promotion of Peatland Habitats

Excavated peat will be deposited with a view to restore infilled excavation areas associated with the Site e.g., adjacent to Turbine Hardstand areas, borrow pit and spoil storage areas. The deposition of peat, particularly in cutover peat areas, once successfully restored / revegetated will promote the recovery and development of blanket peat habitats (e.g. Wet Heath and Blanket Bog). This is considered a beneficial impact in areas of existing cutover peat and a neutral impact in areas of intact blanket peat habitats. Deposition of peat will require supporting structures to avoid any potential runoff/erosion.

Improvements to the hydrological regime as a function of the Project will promote the recovery and development of blanket peat habitats, particularly in significantly impacted areas, such as existing cutover peat areas and areas adjacent to the Project. This is worth noting in the context of the impact/s posed by the Project on blanket peat habitats i.e., range from temporarily adverse to beneficial.

The Project layout and existing drainage network, and their interaction, are assessed in detail and a detailed constructed drainage and attenuation network layout has been provided (see Surface Water Management Plan and Drawings appended to the CEMP, **Appendix 2.1**). This exercise and output will present the requirement, locations and conceptual function and objective of the drainage network and treatment train. This information has also been used to develop the SWMP and associated detailed design layout drawings have been submitted by the Developer to the planning authority for review and approval.

9.5.1.9 Constraints

The mitigation measures outlined herein will be applied to the Project design and construction methodologies with a view to avoiding and/or minimising any potential adverse effects to water quality in the receiving surface water network. Details on how such measures will be applied (objectives, design considerations, layout) are contained in the Surface Water Management Plan (contained in **Appendix 2.1**).

As part of mitigation by avoidance principles applied during the design phase of the Project, self-imposed groundwater, surface water, and drainage buffer zones were established where appropriate. Buffer zones intended to inform the design process by minimising or avoiding the risk to surface water receptors and by restricting construction disturbance to outside these zones are adopted in so far as possible. Buffer zones will in turn provide enhanced potential for filtering capacity of runoff and will protect riparian zone vegetation.

The available guidance stipulates that surface water buffer zones should be prescribed to mapped surface waterbodies or aquatic zones i.e., defined as a permanent or seasonal river, stream or lake shown on an Ordnance Survey 6-inch map, however guidance also states any drainage features leading from the Site and flowing into the receiving surface water network which may short circuit buffer zones must also be considered. The prescription of surface water and groundwater buffer zones (sometimes referred to as setback distances), is in line with relevant guidance relating to forestry, agriculture, water resources, direct discharges and wind farm development guidance documents **(Section 9.2.2).**

The available guidance stipulates varying surface water buffer widths depending on type of activity, receptor type and sensitivity, and riparian zone characteristics including topography (steepness). Recommended surface water buffer widths range from 5m to 50m depending on Site specific and activity specific characteristics. For the purposes of this assessment, the following conservative approach has been applied:

- 50m Surface Water Buffer Zone - Mapped surface water features i.e., mapped streams, rivers, lakes. Source for mapped surface water features; EPA.
- 15m Drainage Buffer Zone - Non-mapped drainage features i.e., non-mapped streams, significant natural and artificial drainage features. Source for non-mapped surface water features desk study and aerial photography assessment, Lidar topographic data and field observations.

Wind Farm and Grid Connection Route Surface Water Buffers are presented in **Figure 9.13a**. Surface Water Buffers for the works on the Turbine Delivery Route are presented in **Figure 9.13b**. A 50m buffer zone from all waterbodies will be maintained during the construction phase. The only exception to this rule will be where upgrades to pre-existing access tracks that are already located within the 50m buffer zone are required, where unavoidable stream crossings are required, and a minor portion of the hardstand associated with T1.

The significant buffer zone distance of 50m from sensitive watercourses will ensure that sensitive watercourses will not be impacted as a result of excavations or other construction works such the construction of the site access tracks. The buffer zone will also ensure adequate space is available for the proposed drainage mitigation measures to be suitably constructed up gradient of natural drainage features at the Site and spoil storage areas. This approach will allow for attenuation of surface water runoff to be diffuse and effective.

In instances where implementation of a 50m buffer zone is not possible, such as at crossings or at upgrades to pre-existing roads, or at turbine T1, silt screens / fences and/or straw bales will be used to reduce the potential for surface water run-off to sensitive watercourses. The proposed 50m buffer zone relative to the surface waters at the Site is mapped in **Figures 9.12a** and **Figure 9.12b.**

Significant drainage features have been identified and mapped in so far as practical. Some drainage features will likely not be recorded due to issues relating to access and complexity e.g., within extensive afforested areas. Such drainage features, while not mapped or prescribed buffer zones, will be treated with the same consideration as mapped drainage during the design and construction phase of the Project i.e., mitigating for the potential for drainage connection to receiving surface water network and with mitigation they are not likely to have a significant effect.

Groundwater buffer zones are dependent on the characteristics of the receptor e.g., private well, or public supply source protection zone, and the characteristics of the underlying geology and associated aquifer e.g., poor unproductive aquifer, or regionally important karstified aquifer. Recommended groundwater buffer zones range from e.g., 15m (exclusion zone karst swallow holes) to entire catchments (source protection in regionally important karstified aquifer) depending on Site specific characteristics. For the purpose of this assessment the following conservative approach has been applied:

- 100m Groundwater Buffer Zone – Groundwater abstraction points in relation to proposed access tracks and cable trenches i.e., shallow excavation. Source for mapped abstraction points: GSI. Not applicable, none within 100m of the Site. Applicable to the Grid Connection and Turbine Delivery Routes.
- 250m Groundwater Buffer Zone – Groundwater abstraction points in relation to proposed borrow pit and foundations. Source for mapped abstraction points: GSI. Not applicable, none within 250m of the Site.
  Not applicable to this Site:
- Source Protection Areas – The entire area mapped as a public or group groundwater supply protection area. Source: EPA. This is not applicable.
- Entire Catchment (Karst aquifer) – The entire catchment associated with a public or groundwater supply protection area which is underlain with a karstified aquifer. This will be assessed in detail as applicable. Not applicable.
- Karst Features – Not applicable. No karst features were identified on Site.

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Some portions of the Project footprint fall within assigned buffer areas, including:

- One new Surface Water Crossing i.e., bridge, and associated access track and infrastructure is within a surface water 50m buffer.
- Several new Surface Water Crossings i.e., culverts, and associated access track and infrastructure is within a surface water 15m buffer.
- Some sections of access track and Turbine Hardstands are within a surface water 15m buffer.

Careful consideration and special attention to planning is required for the identified locations within the surface water buffer zones. The Surface Water Management Plan **(Appendix 2.1)** details mitigation measures for works proposed within buffer zones. Each proposed construction location will possess unique characteristics and will require assessment on a case-by-case basis to ensure adequate measures are implemented. Method statements and the proposed design of any road crossings will be agreed within Inland Fisheries Ireland (IFI) in advance of any construction necessary within the buffer zones. The mitigation measures described in the following sections will also be applied.

9.5.2 Construction Phase

9.5.2.1 Increased Runoff Proposed Mitigation Measures – General / Windfarm

Management and mitigation for earthworks is covered in further detail in **Chapter 8: Soils and Geology**. Mitigation measures to reduce the potential for adverse effects arising from earthworks and management of spoil include the following:

- Management of excavated material – A Peat and Spoil Management Plan has been prepared in **Appendix 2.1**. This Plan incorporates provision on materials management with a view to establishing material balance (reuse of excavation arisings) during the proposed construction phase, thus minimising the potential for or the length of time excavated materials are exposed and vulnerable to entrainment by surface water runoff.
- Temporary stockpile locations are identified and will be used to avoid the temporary placement of any excavation arisings outside of the footprint of the Project. Temporary stockpile areas will be managed to facilitate the orderly segregation of material types, be isolated from the receiving surface water network by the use of silt screens etc., are limited in height, and are covered in plastic sheeting during extended temporary periods and ahead of storm alerts.
- Two permanent spoil storage areas will be managed in a similar manner to that described above, and will be allowed stabilise for a period during the construction

phase, following which the material will be vegetated and managed in line with other improvement works on site. Promoting the vegetating of the material will aid in binding the material and minimising erosion.

- Earthworks will be limited to seasonally dry periods and will not occur during sustained or intense rainfall events. Similar to measures outlined in relation to ground stability during excavation works (**Chapter 8: Soils and Geology**), an emergency response system has been developed for the construction phase of the project (see Environmental Response Plan and Section 5.10 **Appendix 2.1**), particularly during the early excavation phase. This involves 24-hour advance meteorological forecasting (downloadable from Met Éireann) linked to a trigger-response system. When a pre-determined rainfall trigger levels is exceeded (e.g., sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any yellow or greater rainfall warning (>25mm/hour) issued by Met Éireann, planned responses will be undertaken. These responses will include:
    - Cessation of all construction works during and until such storm events (yellow warning, Met Éireann), including storm runoff passing over;
    - Following heavy rainfall events, and before construction works recommence, the Site construction areas and infrastructure will be inspected by an Environmental Clerk of Works to confirm no additional escalation of response is required; and
    - measures will be implemented to ensure safe working conditions, for example, dewatering of standing water in open excavations and repair works to drainage features if necessary.
- Exposed soils/peat (exposed temporary stockpiles) will be covered with plastic sheeting during all heavy rainfall / storm events and during periods where works have temporarily ceased before completion at a particular area (e.g., weekends, overnight, etc.).
- Sediment fencing will be erected along proximal and paralleling areas of watercourses, channels and drains spanned by the works to reduce the potential for sediment laden run-off to reach sensitive receptors.
- No direct flow paths between stockpiles and watercourses will be permitted at the Site.
- All drainage infrastructure (as per drainage design, Sections 4 and 5 of the Surface Water Management Plan, **Appendix 2.1**) required for the management of surface water runoff or draining peat ahead of excavation works will be established before excavation works commence. Similarly, mitigation measures related to surface water quality will be implemented before excavation works commence.

- Conceptual and information graphics presented in **Appendix 9.4 – Plate No. 7, 8 and 9** present indicative layout and specification for both passive treatment trains (clean water interceptor drains), active management treatment trains (management and treatment of construction water) and emergency response and intervention.

9.5.2.2 Increased Runoff Proposed Mitigation Measures – GCR and TDR works

The Grid Connection Route Option will require excavation of cable trenches in existing roadways and on the windfarm site access track.

Mitigation measures to reduce the potential for adverse effects arising from earth works and management of spoil include the following:

- In sensitive areas, excavation of material will be conducted in a controlled manner whereby any temporary deposit of the material in buffer zones can be minimised. For example, vacuum excavation techniques or similar will be used for excavations within Surface Water Buffer zones and other sensitive areas (constraints) (**Figure 9.13a Figure 9.13b)**. Excavated soil will be removed to temporary storage areas.
- Management of excavated material will adhere to the measures related to the management of temporary stockpiles outlined in **Chapter 8: Soils and Geology**, a Peat and Spoil Management Plan has been established and forms part of the Construction & Environmental Management Plan (CEMP, **Appendix 2.1**) with a view to establishing material balance during the proposed construction phase, thus minimising the potential for, or the length of time excavated materials are exposed and vulnerable to entrainment by surface water runoff.
- All spoil from trenches in public roadways will be removed from Site as it is excavated and transported to a licenced facility this is due to the presence of bituminous material and potential hydrocarbon contaminants which will not have the opportunity to be entrained in runoff from stockpiling, but rather removed (i.e., mitigation by avoidance). All spoil from trenches in public roadways will be removed from Site as it is excavated and transported to an authorised facility for soil and stones. It is proposed to take the bitumen spoil to the licenced facility at Derrynalicka, Killrush to the east of the Site or other authorised facility, and the remainder consisting of soils and rock, to the waste management facility at Derrynalicka, Killrush to the east or to the facility at Creegh to the north of the Site or other authorised facility.
- Verge strengthening features (rock aggregate) in place during the construction phase (Drawing ref. L6132 Road Widening and Strengthening Works. Stream Crossings **6777-JOD-XX-DR-C-HR-270** P01.1 – Section: L6132 Temporary Road Widening/verge strengthening for Turbine Delivery) will provide temporary beneficial

effects whereby the features can be considered as runoff filtration, attenuation and infiltration pits.

- Earthworks will be limited to meteorologically dry periods and will not occur during sustained or intense rainfall events. Similar to measures outlined in relation ground stability during excavation works (**Chapter 8: Soils and Geology**), and as discussed in this chapter, an emergency response system has been developed for the construction phase of the project (see CEMP in **Appendix 2.1**), particularly during the early excavation phase. This, at a minimum, will involve 24 hours advance meteorological forecasting (Met Éireann download) linked to a trigger-response system. When a pre-determined rainfall trigger level is exceeded (e.g., 1 in 100-year storm event or very heavy rainfall at >25mm/hr), planned responses will be undertaken. These responses will include cessation of construction until the storm event including storm runoff surge has passed over. Following heavy rainfall events, and before construction works recommence, the site will be inspected and corrective measures implemented to ensure safe working conditions, for example dewatering of standing water in open excavations and transfer to treatment train.

Mitigation measures outlined above will ensure the effect arising from earthwork activities to the surrounding receptors are minimised to a **direct, adverse**, **neutral to slight** effect of the Project.

9.5.2.3 Construction Water Management, Dewatering, Treatment & Discharge of Trade Effluent

Mitigation measures to reduce the potential for adverse effects arising from earth works / management of spoil and associated entrainment of solids in runoff and construction water will include the following:

- Conceptual and information graphics presented in **Appendix 9.4 – Plates no. 7, 8 and 9** present indicative layout and specification for active management treatment trains (containment, management and treatment of construction water) and emergency response and intervention (recycling or diversion of poor-quality runoff to the active management portion of the treatment train). Continuous real time monitoring is also detailed.
- Management of excavations, that is areas of soil / subsoils to be excavated will be drained ahead of excavation works by sumps, in a stepped / phased approach whenever necessary, with the aim of temporarily lowering groundwater levels to allow excavation to be carried out in dry and stable conditions. For example, saturated areas of peat, thus reducing the volumes of water encountered during excavation works.

- Engineered drainage and attenuation features will be established concurrent with excavation works.
- Dewatering flow rate or pumping rate will be controlled by an inline gate valve or similar infrastructure (**Appendix 9.4- Plate 8**) This will facilitate reduction of loading on the receiving drainage and attenuation network, thus enhancing the attenuation and settlement of suspended solids. All pumped water will be discharged to constructed drainage and in line treatment train or to a vegetated surface through a silt bag (**Appendix 9.4 – Plate 12**) outside of surface water buffer zones (**Figure 9.13a,** Surface Water Management Plan, **Appendix 2.1 and Appendix 9.4 – Plates 7 and 8**). Dewatering is a dynamic process and will require continuous monitoring and modification depending on conditions encountered (**Appendix 9.4 – Plate 8**).
- In some areas of the Project constraints related to construction activities within the prescribed buffer zones, will likely limit the potential for installation of engineered attenuation features. In such instances water arising from dewatering activities will be directed or pumped to a settlement tank (**Appendix 9.4 – Plate 11**) before being discharged to the receiving drainage network or pumped to an area of the Site where the installation of attenuation features is suitable. Areas with such constraints are presented in **Figure 9.13a Figure 9.13b.**
- No extracted or pumped water will be discharged directly to the drainage or surface water network associated with the Site (This is in accordance with the Local Government (Water Pollution) Act, 1977 as amended).
- All pumps, tanks, settlement ponds, dewatering bags and check dams used in the dewatering process will be regularly inspected and maintained as necessary to ensure surface water run-off is appropriately treated.

9.5.2.3.1 Excavation Dewatering Proposed Mitigation Measures - Active Construction Water Management

In all instances where construction water, or runoff has the potential to entrain solids during excavation and other construction activities, runoff will be contained by means of temporary berms (lined geotextile of similar), bunds (lined) and sumps. This will be referred to as Dewatering. Construction water (contaminated) will be pumped to the Treatment Train (**Appendix 9.4 Plate 7-9**).

Contaminated water arising from construction works, namely, excavations, drilling and temporary stockpiling, will be contained and treated prior to release or discharge. The schematic presented here is a conceptual model of measures implemented to manage arisings and runoff (Letter headings align with **Appendix 9.4 – Plate 8):**

A. Arisings. Arisings from the launch / reception pit, or any other significant excavation (e.g., cable joint bays), will be directed the treatment train.

B. Temporary Bund. Arising control area i.e., a temporary bund. Gross solids will be temporarily deposited here. Water arising with the material will be allowed to drain to sump.

C. Sump / Pump. Sump will discharge by gravity / pumped to stilling pond.

D. Temporary Stilling Pond. This can be constructed using soils for bunding in combination with an impermeable liner.

E. Outfall. The outfall from the stilling pond will be buffered (coarse aggregate) to dissipate energy and diffuse discharging water.

F. Silt Screen. A silt screen will be in place down gradient of the Stilling Pond outfall. This is a precautionary measure to mitigate peak loads or surcharges in the system.

G. Monitoring Location/s. Discharge quality will be monitored in real time using telemetry systems. Monitoring of discharge quality will be carried out at the outfall of the stilling pond i.e., before being actually discharged to surface vegetation or surface water (licenced).

H. Sump / Pump. Discharge By-Pass. If water discharging from the stilling pond exceeds quality reference limits water will be diverted (pumped) from the stilling pond to the settlement / treatment tank.

I. Stilling Pond By-Pass. Similar to Discharge By-Pass, if conditions dictate water will be diverted directly to Settlement / Treatment Tank.

J. Settlement / Treatment Tank. A settlement tank will be provided in line and ready to use if required e.g. if., water quality at stilling pond outfall fails to meet quality reference limits. The tank will be equipped with treatment systems which will be activated as the need arises, for example, very fine particles which are very slow to settle will be treated with a flocculant agent to promote settlement of particles.

K. GAC Vessel/s. As a precautionary measure, GAC (Granulated Activated Carbon) vessel/s will be in line and ready to use if required. GAC vessels are used to filter out low concentrations of hydrocarbons. If a hydrocarbon spill does occur, normal operations will pause and the treatment train will be utilised to remediate captured contaminated runoff.

L. GAC Vessel By-Pass. If the quality of the water is acceptable in terms of hydrocarbon contamination.

M. Treated water will be discharge by gravity / pump to the stilling pond for additional clarification, monitoring and buffered discharge to vegetated area.

N. Silt Bag. A silt bag can be used as alternative to stilling ponds. However, silt bags will only be used as primary method in lower risk areas i.e., outside of buffer zones, etc. Stilling ponds will be the primary method (D, N) in circumstances where risk is elevated, however a gate vale and silt bag will be included in the treatment train and used as an emergency discharge route in the event that the stilling pond needs remediation or maintenance.

In all instances, stilling ponds (D), Silt Bags (N) and outfalls (E) will be situated outside of surface water buffer zones. At many locations, works will be within buffer zones. In these instances, waters will be pumped to the treatment train which can be positioned upgradient along the road (Grid Connection route) where discharge to vegetated areas / roadside drains can be managed.

Discharge of non-contaminated storm runoff to vegetated land within the Redline Boundary will be made in relatively low flow conditions (e.g., <2 litres per second (l/sec) typical of runoff over a relatively small site area. In the event that the expected incoming flow rate or dewatering rate is relatively high (>2 l/sec) a discharge licence will be acquired and all conditions adhered to.

The discharge points will be located outside of buffer zones and into minor or non-mapped surface water / drainage features. The main components of the treatment will be positioned outside of the 50m surface water buffer zone where possible. Suitable locations for temporary infrastructure will be identified having due regard to variables such as traffic and access management. The subject drain will be inspected to ensure connection to the mapped network (not blocked).

The quality of the water being discharged will be monitored. If discharge water quality is poor (e.g., >25mg/l) additional measures will be implemented, for example, pausing works as required and treating construction water by dosing with coagulant to enhance the settlement of finer solids – this will be done in a controlled manner by means of a suitably equipped settlement tank. Collected and treated construction water will be discharged by gravity / pump to a vegetated area of ground within the Site. Silt fences will be established at the discharge area to ensure potential residual suspended solids are attenuated and the potential for erosion is reduced. The discharge area will be outside of 50m surface water buffer areas (similar to dewatering of excavations). The quality of water discharged will comply with discharge limits in any water discharge licence and will be monitored in real time (telemetry with 15 min sampling rate).

Mitigation measures outlined above will ensure the effect arising from excavation dewatering processes to the surrounding receptors are minimised to a **direct, adverse, neutral to slight** effect of the Project.

9.5.2.3.2 Excavation Dewatering Proposed Mitigation Measures - Passive Construction Water Management

Passive management systems (**Appendix 9.4 – Plate 7**, refer also to diagrams in **Surface Water Management Plan, Appendix 2.1**) include some of the features described in active management treatment trains. These include:

- Spoil bunds and/or temporary berms. Spoil bunds and/or berms will be constructed using either crushed rock or clean soils and overlain or lined with an impermeable layer e.g., geotextile or plastic membrane. These features are intended to control the movement of construction water / runoff with a view to:
  - Containing contaminated water (e.g., drilling / excavation spoil and runoff laden with solids). Temporary bunds will be used to manage spoil arising from drilling operations or saturated spoil arising from excavations in sensitive areas e.g., within SW buffer zones.
  - To divert runoff i.e., divert clean/storm runoff during construction works or contaminated construction water away from sensitive receptors such as drains/surface waters directly adjacent to construction areas.
- Silt screens, (**Appendix 9.4 -Plate 13**). These will be utilised in a similar sense to berms whereby, silt screens will be installed between construction areas and sensitive receptors, including:
  - At the outfall of the treatment train where discharging to vegetated ground or within non-mapped drains (within redline boundary).
  - Along the perimeter of construction areas which are directly adjacent to watercourses or within surface water buffer zones. This includes all watercourse crossings along the TDR, and sections of Grid Connection route alongside adjacent watercourses.

Passive systems are intended to function with minimal supervision, however in the management of construction water on this Site or Project, in many cases the diverted water will likely require active management to ensure sensitive receptors are protected. For example, diverted stormwater, if clean can discharge to the receiving vegetated areas or existing drains, but any construction waters impacted by contaminants on the Site must be managed, and potentially active management / treatment is required.

9.5.2.4 Release and Transport of Suspended Solids - Proposed Mitigation Measures

Conceptual and information graphics associated with mitigating runoff quality are presented in **Appendix 9.4 – Plates 7 - 9**.

In order to mitigate the impact posed by release of suspended solids to the surface water environment, the following mitigation measures will be implemented. The drainage, attenuation and other surface water runoff management systems will be installed concurrent with the main construction activities to control increased runoff and associated suspended solids loads in runoff during intensive and slight construction activities e.g., excavation of Turbine Foundation and the reducing of road level by approximately 150mm to reprofile the road for abnormal vehicles. Vehicular movements will be restricted to the footprint of the Project and advancing ahead of any constructed hardstand will be minimised in so far as practical. For example, excavation ahead of established hardstands will be in line with expected phases of Turbine Hardstand and site access track construction in terms of both delivery of and installation of material and site activity periods whereby excavations will not be opened ahead of site shut down periods. This will be done with a view to minimising soils / subsoils exposure to rain and runoff. Drainage infrastructure will be installed during meteorologically dry ground conditions **(Section 9.5.2.1)**.

Diffuse surface water runoff will be managed as follows:

- With reference to Section 5, Surface Water Management Plan in **Appendix 2.1,** collector drains and/or soil berms will be established to direct/divert surface water runoff from development areas, including temporary stockpiles, and direct same into established treatment trains including stilling ponds, buffered discharge points or other surface water runoff control infrastructure as appropriate. This is particularly important for effective surface water management associated with proposed infrastructure within the varied surface water buffer zones. The drainage system will be permanent (see also **Appendix 9.4** for conceptual graphics).
- Silt fences will be established along the perimeter of source areas e.g., stockpiles, within the drainage network, and in existing natural drains and degraded peat areas which are likely to receive surface water runoff. **Appendix 9.4 – Plate 16,** Section 5.5 of the Surface Water Management Plan in **Appendix 2.1,** describes this in more detail. This will reduce the potential for surface water runoff loaded with suspended solids to rapidly infiltrate towards and be intercepted by drainage or significant surface water features. Where possible multiple silt fences will be installed at multiple locations in drains / treatment trains discharging to the surface water network. Double silt fences / screens will be deployed at outfalls within surface water buffer areas. Silt fences will be temporary features but will remain in place for a period following the completion of the construction phase until such time that Site conditions are stable.
- Small volumes of material arisings will be managed along the GCR and TDR works; temporary stockpiling is not required.

Waters arising as a product of excavation activities will be managed as follows:

- Waters arising from dewatering practices during excavation works will be significantly loaded with suspended solids. As such, constructed stilling ponds followed by buffered outfalls may be insufficient in controlling the release of suspended solids to the surface water network. Routine monitoring will prevent the possibility of clogging from significant volumes of settled or attenuated solids. Therefore, any water pumped from excavations, or any waters clearly heavily laden with suspended solids will be contained and managed and pumped through the preestablished active management treatment train **(Appendix 9.4 – Plate no. 8 and 9).** This will include continuous active monitoring of water quality by turbidity measurement on an hourly basis.

Waters (likely loaded with suspended solids) intercepted by the established drainage network will be managed as follows:

- In line Stilling Ponds will buffer the run-off discharging from the drainage system during construction, by retaining water, thus reducing the hydraulic loading to watercourses. Stilling ponds are designed to reduce flow velocity to 0.3m/s at which velocity, silt particle settlement occurs. Stilling ponds will be permanent (life of Development at minimum). The locations of stilling ponds have been specified as a part of the drainage design, refer to **Site Layout Plans 6777-JOD-BKWF-XX-DR-C-1100 to 6777-JOD-BKWF-XX-DR-C-1104** planning drawings. Flow control devices such as weirs and baffles will facilitate achieving better attenuation, particularly when considering fluctuating runoff rates.
- In line Check Dams will be constructed across drains (**Appendix 9.4 - Plates 3 – 6,** Section 5.6 of Surface Water Management Plan in **Appendix 2.1**). Check dams will reduce the velocity of run-off in turn facilitating the settlement of solids upstream of the dam. They will also reduce the potential for erosion of drains. Rock filter bunds may be used for check dams however, wood or straw/hay bales (**Appendix 9.4 – Plate 15**) will also be used, supported with rock or fitted timber to reduce potential for material being swept away by incoming water. Multiple check dams will be installed, particularly in areas immediately downgradient of construction areas. Check dams will only be constructed in drainage infrastructure and not in significant surface water features i.e., streams or rivers. Check dams (comprised of rock) established will be permanent. The following will be implemented in the design of check dams and their deployment (CIRA, 2004):
    - Permanent rock filter bunds are preferred as this will ensure that rapid surface water runoff is mitigated against for the life of the Development.

- Check dams will be installed at c. 20m intervals within the length of drainage channels. This is dependent on the slope angle and height of check dams constructed, refer to **Appendix 9.4 – Plate no. 3 and 3a.**
- Check dams will include a small pipe at the base to allow the flow of water during low flow conditions i.e., maintain hydrological regime during low flow conditions. Also, the use of coarse aggregate will facilitate some infiltration.
- Erosion protection will be established on the downstream side of the check dam i.e., cobbles or boulder (100-150mm diameter) extending at least 1.2m.
- Check dams will be constructed as part of the drain i.e., reduce the potential for bypassing between the drain wall and check dam.
- Further details and design considerations are presented in **Appendix 9.4 – Plate no. 3 to 6, refer also to Section 5.6 of Surface Water Management Plan, Appendix 2.1.**

- Surface water runoff will be discharged to land via buffered drainage outfalls (**refer to Appendix 9.4 Plates 7, 13 and 14, see also Figure 3 in Surface Water Management Plan, Appendix 2.1)**. Buffered drainage outfalls will contain hard core material of similar or identical geology to the bedrock at the Site to entrap suspended sediment. In addition, these outfalls promote sediment percolation through vegetation in the buffer zone, removing sediment loading to acceptable levels at any adjacent watercourses and avoiding direct discharge to the watercourse. A relatively high number of discharge points / buffered outfalls have been established as part of the design, thus decreasing the loading on any particular outfall. Discharging at regular intervals mimics the natural hydrology by encouraging percolation and by decreasing individual hydraulic loadings from discharge points.
- Outfalls will not be positioned in areas with extensive existing erosion and exposed soils. Buffered outfalls will be fanned and be comprised of coarse aggregate (cobbles / boulders) (**Appendix 9.4 – Plate 13**). These structures will be akin to rip raps (coastal erosion defences/ outfall erosion defences). Silt fences **(Appendix 9.4 – Plate 16 Section 5 of Surface Water Management Plan, Appendix 2.1**) will be established downstream of buffered outfalls with a view to ensuring the effectiveness of the attenuation train, particularly during elevated flow events. Buffered outfalls established will be permanent.
- Very fine solids, or colloidal particles, are very slow to settle out of waters and the finest of particles require near still water and relatively long periods of time to settle, therefore, such particles are unlikely to settle despite the aforementioned measures. To address this, as required, flocculant will be used to promote the settlement of finer solids prior to redistributing to the treatment train and discharging to surface water networks, **Appendix 9.4 – Plate 12**. Flocculant 'gel blocks' are available and can be

placed in drainage channels upstream of stilling ponds. Gel blocks are passive systems, self-dosing and self-limiting, however they still require management (by the Ecological Clerk of Works (ECoW)) as per the manufacturer's instructions. Flocculants are made from ionic polymers. Cationic polymers (positive charge) are effective flocculants; however, their positive charge make them toxic to aquatic organisms. Anionic polymers (negative charge) are also effective flocculants, and are not toxic i.e., environmentally friendly. Therefore, when flocculants are required, the material used will be made from anionic polymer. Gel blocks will be a temporary measure during the construction phase.

- Straw bales (similar to stone check dams) (**Appendix 9.4 - Plate 15)**, and silt fences (discussed under diffuse runoff) can also be used within drainage channels for the purposes of attenuating runoff and entrained suspended solids, however these measures should be considered temporary and will be used mainly in managing potential acute contamination incidents (e.g. additional features to control runoff during excavation works) or to facilitate temporary works (e.g. corrective actions, discussed in later sections). Note; the installation of straw bales or silt fences will be checked on a daily basis by the ECoW to ensure the bypassing does not occur. Coarse stone / boulders could be used in conjunction with these measures to address such issues.

The above measures, buffer zones, constructed drainage, check dams, two-stage stilling ponds design for attenuation, buffered outfalls are referred to as The Treatment Train, whereby the runoff will continuously be treated from source (construction area) to receptor (site exit, outfall of attenuation lagoon). Where necessary (>25mg/l suspended solids) the treatment train will be augmented through the use of anionic polymer gel blocks. These measures will reduce the suspended sediment and associated nutrient loading to surface water courses and mitigates potential effects to water quality and on plant and animal ecologies downstream of the Site.

Particularly sensitive areas are identified and presented in **Figure 9.12a-b and 9.13a-b.** Refer also to specific constraints relating to drainage, outfalls and stability in **EIAR Chapter 8: Soils and Geology.** Sensitive areas include identified Site constraints / buffer zones, but also particular areas with elevated soil or slope stability risk results. Drainage design will not include outfalls discharging to those particular sensitive areas without proper consideration and tailored mitigation in buffer zones and will be avoided outright in areas of elevated risk. Constraints highlighted along the proposed GCR is presented in **Figure 9.12a and 9.13a and Appendix 8.2.** Constraints highlighted along proposed Turbine Delivery Route are presented in **Figure 9.12b and 9.13b.**

The precautionary and mitigation measures listed herein will avoid, reduce or remedy all potential adverse effects on water quality and will ensure that the sensitive receptors in the catchment of the Development do not suffer any deterioration in water quality, either during construction, operation, or Decommissioning. Proposed mitigation measures will ensure that, the risk of elevated suspended solids to surface waters is **neutral to slight**. This in turn will ensure that potential risks to sensitive receptors is also **neutral to slight**. Nevertheless, should a significant discharge of suspended solids to surface waters occur, the absence of an immediate proximity to designated sites and the assimilative capacity of the localised surface waters will act as a natural hydrological buffer in terms of suspended solids loading. It should be noted that this natural mitigation measure is not to be adopted as a first principle and is not to be relied upon to prevent adverse effects on designated sites, it should be considered as a last line of defence. Where required i.e. unfavourable site conditions detected through monitoring (**Section 9.5.2.14**), escalation of mitigation including active management of construction water (**Section 9.5.2.2**) will be employed before favourable conditions permit using passive or nature based systems.

9.5.2.5 Ground stability and compaction - Proposed Mitigation Measures

Vehicular movements will be restricted to the Project footprint (**Figure 9.1**) and will be minimised in so far as practical. Confining movements to only necessary areas. Temporary stockpiling of excavated material on site will also be minimised. For example, excavation ahead of established hardstands will be in line with expected phases of Turbine Hardstand and site access track construction in terms of both delivery of and installation of material, minimising the periods of excavations. Groundwater level (pore water pressure) will be kept low at all times (excavation dewatering) to avoid ground stability risks (subsidence) associated with peat and careful attention will be given to the existing drainage and structures designed to be compatible with it (outlined in EIAR **Chapter 8, Section 8.5.2.7.**

The only exception to limiting vehicular movements to the footprint of the Project will be for forestry clear felling. Clear felling of forestry is in line with baseline conditions / Do Nothing impact, will be carried out in compliance with forestry operations best practice guidance (Forest Service, Department of the Marine and Natural Resources, 2000). Best practice will be applied during construction which will minimise double handling, again reducing the Smite traffic. Also, with the relevant mitigation measures will be employed in terms of monitoring ground stability locally and managing potential sources of contamination. The management vehicles used for tree felling will be aligned with mitigation measures set out herein, and in Appendix 2.1 CEMP (e.g. sill kits provided on-site and personnel trained to use them.) During construction down time / overnight, vehicles will be stored in designated (controlled) locations on-site (e.g. within the temporary construction compound), away from vegetated / tree felling / bare soil areas, or within sensitive areas / receptor buffers.

Where vehicular movements are necessary outside of the proposed development site, ground conditions will be maintained and reinstated, for example replacing sods, smoothing over with the excavator bucket. Where ground conditions are poor, or prolonged works, temporary access measures will be deployed, for example floating platforms / floating access track.

For the Grid Connection route, before starting construction, the area around the edge of each joint bay which will be used by heavy vehicles will be surfaced with a terram cover (if required) and stone aggregate to minimise ground damage.

For area of road widening and verge strengthening will be used by heavy vehicles. A terram layer will be put in place (if required) and rock aggregate to minimise ground damage, as well as sandbags and steel plates to protect existing culverts (i.e. WCC7-WCC9).

Implementation of the proposed mitigation measures above (avoidance, good practice and reduction) and in the following **Appendix 2.1** CEMP, **Appendix 8.1** PSRA, will minimise the adverse effects posed by vehicular movements. Any localised unforeseen impacts will trigger escalation of response ensuring locations are isolated and restored, through avoidance or 'no go areas' as well as buffer zones on potential instability areas and vehicular movements are confined within the footprint. Mitigation measures outlined above will ensure the effects arising from earthwork activities to the surrounding receptors are minimised to a **direct, adverse**, **neutral to slight** effect of the Project.

9.5.2.6 Release of Hydrocarbons - Proposed Mitigation Measures

The following mitigation measures to reduce potential effects from the environmental release of hydrocarbons and other harmful chemicals to the surface waters will be implemented:

- Refuelling of vehicles will be carried out off-Site as much as possible. This refuelling policy will mitigate the potential for effects by avoidance. Due to the remote location of the Site, occasional on-site refuelling may be necessary (e.g., bulldozers, cranes, etc.). Therefore, a designated and controlled refuelling area will be established on-site to manage and control low risk refuelling, and storage of oils/fuels during the construction phase. The designated refuelling area will contain the following attributes and mitigation measures as a minimum requirement:

- located a minimum distance of 50m from any surface waters or Site drainage features
- will be bunded to 110% volume capacity of fuels stored at the Site
- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis, including Decommissioning following construction.
- Any oil contaminated water will be disposed at a licensed waste disposal site, and disposal will comply with all relevant legal requirements; CIRIA (2006).
- Any minor spillage during this process will be cleaned up immediately using a spill kit
- Vehicles will not be left unattended during refuelling
- All machinery will be checked regularly for any leaks or signs of wear and tear
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste will be collected, stored in appropriate containers and will be reused, recycled or disposed of offsite in an authorized facility.

Notwithstanding the management of refuelling and fuel storage at the designated refuelling area, the potential risk of hydrocarbon spills from plant and equipment or other general chemical spills at other areas of the Site remains. As a precautionary measure, to mitigate against potential spills at other areas of the Site, the following mitigation measures will be implemented:

- Oil absorbent booms and spill kits will be available adjacent to all surface water features associated with the project. The controls will be positioned downstream of each construction area and at principal surface water drainage features. Oil booms deployed will have sufficient absorbency relative to the potential hazard.
- Spill kits will also be available at construction areas including : at turbine erection locations, the Temporary Construction Compound, Electrical Substation, spoil storage areas and Met Mast location.
- Spill kits will contain a minimum of oil absorbent pads, oil absorbent booms, oil absorbent granules, and heavy-duty refuse bags for collection and appropriate disposal of contaminated matter.
- Should an accidental spill occur during the construction or operational phase of the Project, such incidents will be addressed immediately under emergency protocols, this will include the cessation of works in the area of the spillage until the issue has been resolved.

- Records will be kept of all inspections and findings by the ECoW as outlined in CEMP.
- Spill kits will be kept in each vehicle at the Site and will be readily available to all operators.
- No materials, contaminated or otherwise, will be left on the Site.
- Suitable receptacles for hydrocarbon contaminated materials will also be available at the Site.
- A detailed spill response plan will be prepared as part of the Site specific CEMP.

Mitigation measures outlined above will ensure the effects arising from a potential hydrocarbon spill to the surrounding receptors are minimised to a **direct, adverse, neutral to slight** effect of the Project. Further precautionary measures and emergency response protocols have been established and are discussed in the CEMP, **Appendix 2.1** and **Section 9.5.3** of this Chapter. The above mitigation measures will ensure there will not be a significant effect on the environment from accidental spills/leaks.

9.5.2.7 Construction and Cementitious Materials - Proposed Mitigation Measures

In order to mitigate the potential impact posed by the use of concrete and the associated effects on surface water in the receiving environment, the following precautions and mitigation measures are recommended:

- The procurement, transport and use of any cement or concrete will be planned fully in advance of commencing works by the appointed Environmental Clerk of Works (EnCoW). This entails minimising quantities on Site, planning delivery routes and washout stations.
- Precast concrete will be used wherever possible. Elements of the Project where the use of precast concrete will be used include structural elements of watercourse crossings (single span / closed culverts) as well as cable joint bays. Where the use of precast concrete is not possible the following mitigation measures will apply.
    - Lean mix concrete, often used to provide protection to main foundations of infrastructure from soil biome, can alter the pH of water if introduced, which would then require the treatment of acid before being discharged to the surrounding environment. The use of lean mix concrete will be minimized, limited to the requirement of Turbine Foundations. The risk of runoff will be minimal, as concrete will be contained in an enclosed, excavated area.
    - Vehicles transporting cement or concrete to the Site will be visually inspected for signs of excess cementitious material prior to being granted access to the Site **Appendix 9.4 – Plate 19**. This will prevent the likelihood of cementitious material being accidentally deposited on the site access tracks or elsewhere at the Site or on the public road network.

  - Drivers of such vehicles will be instructed to ensure that all vehicles are washed down in a controlled environment prior to the departure of the source site, such as at concrete batching plants.

- Concrete will be poured during metrological dry periods/seasons in so far as practical and reasonably foreseeable. This will reduce the potential for surface water run off being significantly affected by freshly poured concrete. This will require limiting these works to dry meteorological conditions i.e., avoid foreseen sustained rainfall (any foreseen rainfall event longer than 4-hour duration) and/or any foreseen intense rainfall event (>3mm/hour, yellow on Met Éireann rain forecast maps), and do not proceed during any yellow (or worse) rainfall warning issued by Met Éireann. This also will avoid such conditions while concrete is curing, in so far as practical.
- Pouring of concrete into standing water within excavations will not be permitted. Excavations will be prepared before pouring of concrete by pumping standing water out of excavations to the buffered surface water discharge systems in place.
- Any required shuttering installed to contain the concrete during pouring will be fully secured around its perimeter to minimise any potential for leaks. Additional measures will be taken to ensure this, for example the use of plastic sheeting or other sealing products at joints.
- No surplus concrete will be stored or deposited anywhere on Site.
- Raw or uncured waste concrete will be disposed of by removal from the Site and returned to the source location or disposed of appropriately at a suitably licensed facility.
- Designated washout of concrete trucks shall be strictly confined to the batching facility and will not be located within the vicinity of watercourses or drainage channels. Only the chutes will be cleaned prior to departure from Site and this will take place at a designated area at the Temporary Construction Compound. The contents will be allowed to settle and the supernatant will be removed off site by licenced generator to a licenced waste water treatment plant.
- Temporary storage of cement bound sand (if required for construction of the substation building) will be on hardstand areas only where there is no direct drainage to surface waters and where the area has been bunded e.g., using sandbags and geotextile sheeting or silt fencing to contain any solids in run-off.
- Spill kits will be readily available to site personnel, and any spillages or deposits will be cleaned up as soon as possible and disposed of appropriately.

9.5.2.8 *Release of Wastewater Sanitation Contaminants*

A Temporary Construction Compound area will be constructed on-site to contain temporary facilities for the construction phase including 'port-a-cabin' structures. The Temporary Construction Compound will be constructed on a base of geo-textile matting laid at ground level. This will be stabilised with the laying of hardcore material on top. During the construction phase, foul effluent will be periodically removed for offsite disposal.

Wastewater/sewerage from the staff welfare facilities located in the Temporary Construction Compound will be collected and held in a sealed storage holding tank, fitted with a high-level alarm. The high-level alarm is a device installed in the storage tank that is capable of sounding an alarm during a filling operation when the liquid level nears the top of the tank. Chemicals are likely to be used to reduce odours, as outlined in **Appendix 2.1 CEMP** Section 5.5.4.1.2.

Mitigation measures outlined above will ensure the effect arising from a potential wastewater or sanitation contaminant spill to the surrounding receptors are minimised to a **direct, adverse, neutral to slight** effect of the Project.

9.5.2.9 *Clear Felling of Forestry*

No new effects or remediation measures are associated with forestry activities. However, good practices will be implemented when working in specific environments such as forested areas including working outside of surface water or other buffer zones, and risk assessing on a case-by-case basis in terms of drainage intercepting run off, ecological sensitivities, etc.

A felling licence will be obtained and in line with licence requirements and conditions, mitigation measures in regard to the management of forestry operations will include:

- Phased felling approach,
- Minimising erosion by use existing tracks and use of brash for off track areas,
- Follow all relevant forestry guidance and policies, including:
    - Forest Protection Guidelines (DAFM, 2000)
    - Forestry and Water Quality Guidelines (DAFM, 2000)
    - Forest Harvesting and Environmental Guidelines (DAFM, 2000)
    - Forestry and Freshwater Pearl Mussel Requirements - Site Assessment and Mitigation Measures (DAFM, 2008)
    - DRAFT Plan for Forests & Freshwater Pearl Mussel in Ireland (DAFM 2018)
    - Forest Biodiversity Guidelines (DAFM, 2000)
    - Forestry and The Landscape Guidelines (DAFM, 2000)

  - Forestry and Archaeology Guidelines (DAFM, 2000)
- The permanent felling of c.17.86ha of forestry is subject to replacement obligations.
- Harvest site plans including extraction routes, fuelling areas, stacking areas, turning areas and drain crossings etc. and HIRA will be designed and implemented during all harvesting operations.
- All drains, either mound drains, culverts, water crossings crossed during extraction, if necessary, will be cleared of any debris to ensure no drainage issues will occur for the remining trees, which can be a major attributor to windblow.
- Felling and extraction of timber are to be undertaken in dry weather conditions.
- Harvesting operations are scheduled according to the nature of the soil with sites being categorised into winter and summer sites depending on ground conditions. Also, best practice is to suspend mechanised harvesting operations during and immediately after periods of particularly heavy rainfall. Waterways are particularly vulnerable to the effects of harvesting as silt from the movement of machinery can enter streams and rivers causing blockage of gravels which affects insect and fish life. Also, nutrients released from decaying branches, particularly from large clear-felled sites, can cause enrichment of the waters which in turn causes pollution. To counteract these effects careful planning is required in carrying out harvesting operations. Some of the measures taken to avoid effects include:
  - Limiting the size of the areas to be felled which reduces the amount of nutrients and silt released.
  - Minimising the crossing of drains and streams, but where necessary installing temporary structures (log bridges, pipes etc) to avoid machines entering the water.
  - Riparian zones (25m) along mapped surface water features, streams and rivers, will be maintained to prevent erosion or destabilisation, and to enhance buffer or attenuation capacity in the vegetated riparian zone. This can include establishing buffer zones around waterways from which machines are excluded from. In some instances, this will not be possible, for example; watercourse crossings, and felling associated with turbine T1. In locations where the riparian zone cannot be maintained, particular attention will be given to ensuring active monitoring and management by suitably qualified persons (ECoW, and additional temporary measures such as straw bales and silt screens will be deployed where necessary on a case by case basis (see **Appendix 2.1 CEMP** and SWMP.)

Mitigation measures outlined above will ensure the effect arising from felling activities to the surrounding surface water receptors are minimised to a **direct, adverse**, **neutral to slight** effect of the Project.

9.5.2.10 Watercourse Crossings - Proposed Mitigation Measures

The Project includes the construction of five watercourse crossings culverts and one single span bridge within the redline boundary/ Project site to facilitate access to the proposed turbine locations and ancillary infrastructure. The proposed single span structure over the Moyasta River, and the locations of the four proposed crossings are mapped in **Figure 9.2a.** Watercourse Crossing 2 (WCC2) will be a single span structure. Single span structures span the width of the channel without the requirement for any instream support and therefore do not affect the bed of the water body. This ensures that the bank and instream habitats are maintained and the riverbed is not impacted. These crossings require detailed planning and consideration to ensure potential effects are assessed adequately and in turn mitigated against.

All watercourse crossings must be designed to facilitate peak, or storm discharge rates so as to avoid localised flooding and associated issues during storm events. Data presented in **Appendix 9.1 – GWF Flood Risk Assessment,** indicate potential surface water discharge rates during a one-hour storm event, and a 24 hour storm event with a 1 in 100 year return period along with 20% to include for climate change. Note: Upstream catchment areas are estimated and delineated by assessment of mapped catchment boundaries, topographical contours and existing infrastructure and associated drainage. The above assessment is a conservative estimation which does not consider evapotranspiration or recharge to ground, or base flow and groundwater discharge to the respective surface water features.

In relation to the design and construction of watercourse crossings risk assessment and prescription of mitigation measures have been designed in accordance with relevant guidance and reference documents **(Section 9.2.2).**

Regulation 50 of the European Communities (Assessment and Management of Flood Risks) Regulations 2010 SI 122 of 2010 requires that: "No Person, including a body corporate, shall construct any new bridge or alter, Reconstruct, or restore any existing bridge over any watercourse without the Consent of the Commissioners or otherwise than in accordance with plans previously approved of by the Commissioners."

The word "watercourse" includes rivers, streams, and other natural watercourses, and also canals, drains, and other artificial watercourses.
The word "bridge" includes a culvert or other like structure.

The OPW is responsible for the implementation of the regulations and consent to construct any bridge will be sought from the OPW via their application process. Details on the application process and guidance / requirements of the bridge design and considerations in terms of flow can be found in the OPW guide Construction, Replacement, or Alteration of Bridges and Culverts (A Guide to Applying for Consent under Section 50 of the EU (Assessment and Management of Flood Risks) Regulations as amended (SI 122 of 2010) and Section 50 of The Arterial Drainage Act, 1945 as amended). The requirements of the OPW will be incorporated into the design of the proposed watercourse crossings. Preliminary design details are included in **Figure 2.6**(**a-d**) and on drawings ref. **6777-JOD-BKWF-XX-DR-C-1205 to 6777-JOD-BKWF-XX-DR-C-1208.**

Watercourse Crossing 2 (WCC2) will be a single span structure. Single span structure are structures which span the width of the channel with no associated instream support and do not affect the bed of the river or water body. This ensures that the bank and instream habitats are maintained and the riverbed is not impacted. The use single span structures is in accordance with Engineering in the Water Environment: Good Practice Guide – River Crossings (SEPA, 2010) and Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (NRA, 2008) for river waterbodies in upland or transitional river segments and 'good practice' as defined by relevant guidance (SEPA, 2010) whereby; the course of action serves a demonstrated need, minimises the potential for ecological harm.

- The design will facilitate adequate hydraulic capacity**.** This ensures that the design will maintain the existing channel and will facilitate peak discharge events (storm events) without flow being constrained and contributing to flooding or other issues. Values presented **Appendix 9.1 – SFRA** indicate the potential discharge rate associated with each watercourse crossing during a 1 in 100 year storm event. For existing crossings, the channel width will be maintained.
- The design facilitates adequate freeboard to OPW requirements of 300mm.
- Abutments for single span structures will be set back from the river channel (**Appendix 9.4 – Plate 2a**) and banks to allow the continuation of the riparian corridor underneath the structure. This helps to minimise or prevent the need for bed and bank reinforcement, reduces the risk of creating a barrier to fish passage and allows mammal passage under the structure. The distance between the bridge abutments will be as wide as possible and will maintain the bank habitat, maximising the riparian

corridor and allowing the river some space to move. Foundations (of abutments) will be deep enough to minimise or prevent the need for bed or bank reinforcement or bridge weirs or aprons. This will maintain the natural bed material and bed levels, protecting habitat and allowing fish passage. Foundations will be buried deep enough to allow for scour during high flows. Construction will be supervised by a suitably qualified engineer who will confirm that the depth is as per the design.

There are no watercourse crossings proposed along the preferred Grid Connection Route. Also, there are no upgrades required on the watercourse crossings that the Turbine Delivery Route intersects. However, there will be temporary use of sandbags and steel plates at three (3 no.) watercourse crossings on the L6132 as outlined in **Section** Error! Reference source not found.**.**

Mitigation measures outlined above will ensure the effect arising from the construction of any new watercourse crossing is minimised to a **direct, adverse, slight** effect of the Project.

9.5.2.11 In-stream Works

There are no instream works required for the Project. Where culverts are required bottomless culverts will be installed.

9.5.2.12 Drainage Construction, Diversion or Enhancement of Drainage

Diversion of artificial drainage channels will be required at locations where the Project layout intercepts existing artificial drainage networks (**Figure 9.2a**), for example all four turbines and their associated hardstand area(s) are overlain on an existing drainage feature. Drainage works will be required/ planned to intercept run off from the TDR or GCR works

While some of the existing constructed drainage channels are observed to be dry during meteorological conditions which implies that over pumping or diverting of water flow may not be necessary. Any newly installed drain will be fully formed prior to the diversion of existing drainage (**Appendix 9.4 – Plate 1**). Erosion control will be incorporated into the design (**Appendix 9.4– Plate 2**), this requires minimising the area of exposed soil in existing and newly established channels. This will include a combination of the use of coarse aggregate / crushed rock (non-friable / non-weak), engineered solutions and/or revegetation.

A series of temporary silt fences will be installed to mitigate against the entrainment and mobilisation of solids during key events during the construction process. For example, the initial use of the new diverted channel, or the infilling of the original channel made redundant. The use of silt screens as a form of mitigation during watercourse crossing works will be used as a precautionary measure.

The proposed drainage design for the Site will mimic the existing hydrological regime and will therefore significantly reduce potential changes to flow volumes leaving these areas. Mitigation measures outlined above will ensure the effect arising from felling activities to the surrounding surface water receptors are minimised to a **direct, adverse**, **neutral to slight** effect of the Project.

9.5.2.13 Groundwater Contamination - Proposed Mitigation Measures

A combination of the underlying bedrock geology, the associated aquifer potential, low permeability soils/peat and low recharge rates has resulted in the risk posed to groundwater quality by the Project being considered as low risk. Nevertheless, mitigation measures to reduce potential risks to groundwater will be implemented as a precautionary approach.

A primary risk to the underlying groundwater quality would be through the accidental release of hydrocarbons from fuels or oils during the construction phase of the Development. In order to mitigate against potential groundwater contamination by hydrocarbons, implementation of the following mitigation measures is recommended:

- No fuel storage should occur at the Site whenever feasible and refuelling of plant and equipment should occur off Site at a controlled fuelling station.
- In instances where on Site refuelling is unavoidable, then the bunded on Site designated refuelling area must be used. The designated refuelling area must be bunded to 110% volume capacity of fuels stored at the Site.
- The bunded area will be drained by an oil interceptor that will be controlled by a pent stock valve that will be opened to discharge storm water from the bund.
- Management and maintenance of the oil interceptor and associated drainage will be carried out by a suitably licensed contractor on a regular basis.
- Any oil contaminated water will be disposed of at an appropriate oil recovery plant.
- Any minor spillage during this process will be cleaned up immediately.
- Vehicles will not be left unattended whilst refuelling.
- For large machinery such as cranes, a drip tray will be used and spill kits will be on hand.
- A site-specific CEMP will be enforced to ensure that equipment, materials and chemical storage areas are inspected and maintained as required on a regular basis.

The following mitigation measures are recommended in relation to non-hydrocarbon potential contamination of groundwater:

- All other liquid-based chemicals such as paints, thinners, primers and cleaning products etc. will be stored in locked and labelled bunded chemical storage units.
- Sanitation facilities used during the construction phase will be self-contained and supplied with water by tank trucks. These facilities will not interact with the existing hydrological environment in any way and wastewater will be removed off-site weekly, by a licensed wastewater disposal company and disposed at an appropriate licenced facility throughout the construction phase.
- The controlled attenuation of suspended solids in settlement ponds and check dams etc. will result in inorganic nutrients (if present in elevated concentrations) such as phosphorus and nitrogen being absorbed and retained by the solids in the water column. This will allow for a reduction of peak inorganic discharges in a controlled and stable run off rate. It is noted that the presence of elevated contaminants were detected during the four surface water quality monitoring rounds.
- It is considered that there is a low risk of mobilising trace metals that may naturally be present in low concentrations in the baseline environment. The potential for mobilising trace metals is most likely to result from enhanced water percolation associated with excavated bedrock substrate. To mitigate against this potential impact, water quality should be monitored for trace metal concentrations prior to, during and after the construction phase.
- The potential for livestock such as cattle and sheep which have been observed grazing in the vicinity of the Site to cause bacteriological contamination of groundwater will be controlled through the implementation of strict grazing control zones, Site perimeter fencing and exclusion zones around all open excavations.

Mitigation measures outlined above as well as Sections **9.5.2.5, 9.5.2.6 and 9.5.2.7** will ensure the effect arising from the construction phase on the groundwater underlying the Site are minimised to a **direct, adverse**, **neutral to slight** effect of the Project.

9.5.2.14 Groundwater Extraction Proposed Mitigation Measures

The extraction of groundwater from boreholes for the purpose of potable water supply will not be required for either the construction or operational phase of the project.

9.5.2.15 Water Quality Monitoring

9.5.2.15.1 *Monitoring Wind Farm*

The appropriate monitoring of peat, subsoils, and bedrock, alongside material management during the construction phase of the Project will be fundamentally important in ensuring that potential suspended solid entrainment in surface waters is minimised. With comprehensive planning, preparation, and implementation of relevant mitigation measures contained in the

CEMP, the potential for elevated suspended solids to be released to surface waters via runoff is likely to be minimal and the effects are not likely to be significant. Monitoring of surface water quality is discussed in greater detail in **Section 9.5.2** of this chapter.

To ensure effective implementation of mitigation measures, environmental auditing, and monitoring of environmental obligations of the Developer, an ECoW will be appointed to carry out monitoring of the Project during the construction phase, and for the monitoring period that is required after the wind farm is commissioned and operational. The role of the ECoW will be to actively and continuously monitor Site conditions and advise on environmental issues and monitoring compliance, but will not be responsible for implementing measures, as the due duty of implementing measures will be held by the Developer / contracted construction operator. The ECoW will have the authority to temporarily stop works in a particular area of the Site to ensure corrective measures are implemented and adverse environmental effects are minimised if not avoided (**Appendix 2.1 CEMP**). The following monitoring recommendations will be undertaken by the ECoW to mitigate against potential effects on the surface water and groundwater receiving environment:

- During the construction phase, daily inspection of silt traps, buffered outfalls and drainage channels, and daily measurement of total suspended solids, electrical conductivity, and pH at selected water monitoring locations on the Site (locations close to active working zones). Monitoring of same during times when excavations are being dewatered (likely high in solids) will be done in real time. In this regard, physiochemical properties will be monitored in real time by means of alarmed telemetry e.g., telemetric monitoring at baseline sampling locations and alarm thresholds established in line with water quality reference concentrations/limits which will be set using relevant instruments for example, Surface Water Quality Regulations, <25mg/l Total Suspended Solids (TSS).
- Telemetric continuous Monitoring will be carried out as part of Active Management of construction water management and treatment for the duration of the construction phase of the Development (**Appendix 9.4**). These monitoring systems will travel with the active construction areas / remain with the Active Management infrastructure. The purpose of this is to recycle water if quality is unfavourable and adjust the dewatering and treatment train accordingly until discharge quality is observed to be acceptable. A small degree of tolerance above reference concentrations is acceptable at this location but only if the discharge from the Active Management train discharges to another Passive Management system or to a non-sensitive vegetated area. If discharging within sensitive areas or buffer zones, the quality of discharge from the

Active Management train will be in line with prescribed reference limits (e.g., 25mg/l TSS)

- Telemetric continuous Monitoring at downstream Baseline surface water Monitoring Locations will be carried out using telemetry for the duration of the construction phase. Triggering of the threshold at these locations will trigger emergency response and escalation of measures including immediate full Site inspection to ascertain to the potential unknown source (bearing in mind that the quality of managed runoff at the Site will be known by means of live telemetry and handheld meters). Telemetric continuous monitoring at Baseline Surface Water Monitoring Locations will continue into the operational phase until such time it is confirmed the construction phase is complete and there are no further construction activities required on site, and when stable conditions are observed i.e. stable conditions in line with baseline conditions observed for two months following the completion of the construction phase.
- Post construction: inspection of silt traps, buffered outfalls and drainage channels, measurement of total suspended solids, electrical conductivity, and pH at selected water monitoring locations at the Site will be carried out at a reasonable frequency (weekly initially gradually reduced based on observed stability of conditions), and will also be scheduled following extreme metrological events (**Section 9.5.2.1**). During the operational phase of the Project, the stilling ponds and buffered outfalls will be checked on a weekly basis during maintenance visits to the Site. This will continue but will be reduced when stable conditions are observed. The frequency of monitoring will be aligned with ecological monitoring in enhancement areas, following storm events, and otherwise on a quarterly basis at minimum.
- During the construction phase of the project, the Project areas will be monitored daily for evidence of groundwater seepage, water ponding and wetting of previously dry spots, and visual monitoring of the effectiveness of the constructed drainage and attenuation system so that it does not become blocked, eroded or damaged during the construction process. This monitoring will continue at a reasonable frequency (weekly initially gradually reduced based on observed stability of conditions) during the operational phase of the Project, however it is envisaged that any potential issues in this regard will be identified and rectified during the construction phase.
- A programme of water quality monitoring outlining the selected parameters and monitoring frequency should be agreed with Inland Fisheries Ireland and Clare County Council prior to the commencement of construction. During the construction phase of the project, the Project areas and adjacent receiving drainage systems will be monitored daily for evidence of erosion and other adverse effects to natural drainage channels and existing degraded areas whereby soils/peat are exposed and prone to enhanced degradation. This monitoring will continue initially on a weekly

basis during the operational phase of the Project, and gradually reduced based on observed stability, however it is envisaged that any potential issues in this regard will be identified and rectified during the construction phase.

- During both the construction and operational phases of the project watercourse crossings will be monitored frequently (daily during construction and intermittently during operational phase i.e., weekly / monthly inspections initially) and reduced gradually in line with observed stability and confidence in longer term data obtained. The water course crossings will be monitored in terms of structural integrity and in terms of their impact on respective watercourses.
- A detailed inspection and monitoring regime, including frequency is specified in the CEMP in **Appendix 2.1.** This includes an environmental risk register e.g., constraints linked to the Project construction schedule, routine reporting on the performance and effectiveness of drainage and attenuation infrastructure, and any actions taken to rectify or enhance the system.
- Site water runoff quality at all surface water monitoring locations will be monitored on a continuous basis during the construction phase of the Project. Monitoring will continue into the operational phase until such time that the Site and water quality have stabilised (stable conditions in line with baseline conditions for e.g., 8 consecutive quarterly monitoring events). This monitoring will be carried out at the downstream surface water baseline sampling locations.
- Continuous monitoring systems will be in place, particularly in principal surface water features draining the Site. For example, remote sensing, or telemetric monitoring sensors (turbidity) will be employed in this regard.
- Continuous Monitoring Locations or Telemetric Monitoring Stations (TMS) will use probes to monitor the following parameters:
  - Electrical Conductivity
  - Turbidity (Data obtained can be equated to estimated Total Suspended Solids (TSS) through calibration)
  - pH
  - Temperature
  - Capacity for additional probes.
  - TMSs will be self-powered and will be comprised of the following components at a minimum:
  - Remote Telemetry Unit (RTU) – Modem / data hub and transmission.
  - Solar panel
  - Sensor – pH
  - Sensor – Turbidity
  - Sensor – Electrical Conductivity

- Sensor Cleaning Device (SCD)(Turbidity probe)
- Power Management Unit (PMU)
- Power Bank (PB)
- Website – presenting data trends over time.
- Metal stand / frame and protective fencing.
- The TMS will have capacity for additional parameters.

- Telemetric continuous monitoring sampling frequency is generally set at one data point per 15 minutes, however considering the intensive nature of the proposed works, particularly drilling activities, it is recommended that sampling frequency is set at 5 minutes or less with a view to escalating responses to potential discharge quality issues in good time. Data is transmitted to a project website which will display data trends over time. Access to the website can be gained and shared via a website link.
- Telemetric Monitoring Systems will be used a key part of Active Management of runoff and construction water at the Site, as presented in **Appendix 9.4 – Plates No. 7 to 9.**
- A handheld turbidity meter will be available and used to accurately measure the quality of water discharging from the Site at any particular location. The meter will be maintained and calibrated frequently (per the particular unit's calibration requirements / user manual) and will also be used to check and calibrate remote sensors if they are employed. Quality thresholds have been established for the purposes of escalating water quality issues as they arise.
- Rainfall will be monitored (1 no. rainfall gauge required). This unit will be connected with and displayed with other site water quality telemetry data via the telemetry website.
- Surface water runoff control infrastructure will be checked and maintained on an ongoing basis, and stilling ponds and check dams will be maintained (de-sludge / settle solids removed) on an ongoing basis, particularly during the construction phase of the Project. It is important to minimise the agitation of solids during these works, otherwise it will likely lead to an acute significant loading of suspended solids in the drainage network. This can be achieved by temporarily reducing or blocking inkling flow and vacuum extracting settled solids or sludge. Where the drainage feature poses relatively significant flow rates, isolating and over pumping is the best course of action.
- As part of the CEMP contained in **Appendix 2.1** regular checking and maintenance of pollution control measures are required (in line with frequencies outlined above), with an immediate plan for repair or backup if any breaches of design occur. In the event that established infrastructure and measures are failing to reduce suspended

solids to an acceptable level, construction works will cease as per the CEMP, until remediation or upgrading works are completed by the Developer.

- All details in relation to monitoring will be included in the Surface Water Management Plan **(Appendix 2.1).**

Monitoring of potential hydrological effect of the Project, particularly during the operational phase will be inherently linked to the ecological health of the blanket peat (as a functioning ecosystem) and therefore both hydrology and ecology will be considered, and monitored in tandem. For example, effects to the hydrological regime at the Site can potentially impact on the ecological health or characterisation of the Site, and vice versa. Ecological indicators can potentially provide useful data in relation to the long-term impact of changes to the hydrological regime at the Site. However, as discussed in earlier section of this report, changes to the management of runoff and in turn the hydrological regime at the Site will lead to a positive impact overall when compared to the baseline conditions associated with the Site e.g. introduction of intermittent buffered outfalls along the length of the drainage network is in contrast to baseline, this will promote a more even distribution runoff, attenuate runoff and reduce the hydrological response to rainfall, enhanced potential for recharge to ground, and in turn raising bog water levels resulting in wetting of blanket peat at the Site.

9.5.2.15.2 Active Monitoring on Site

Handheld meters (Turbidity / Total Suspended Solids (TSS)) will used by the ECoW / competent operators during construction works. This will be done with a view to managing water treatment and anticipating potential surcharges in water or TSS loading within the treatment train. Handheld meters will also be used to monitor outfall/discharge quality in the event telemetry systems fail or during system maintenance. Handheld probes will be checked and calibrated regularly.

9.5.2.15.3 Monitoring Under License

Where discharge licence is required, monitoring in line with the licence will be done in addition to the other monitoring regimes undertaken as described in sections above. Sampling will include obtaining physical samples at an agreed discharge sampling point and will be sent an accredited laboratory for analysis. Monitoring under licence conditions will not negate the requirement for the other regimes described.

9.5.2.15.4 Tailoring Monitoring Requirements

Monitoring will be tailored at each location in terms of requirements set out in trade effluent discharge licence/s where relevant.

- The baseline monitoring undertaken at the Site as part of this study will be repeated periodically before, during and after the construction phase of the Project to monitor any deviations from baseline hydrochemistry that occur at the Site. This monitoring along will help to ensure that the mitigation measures that are in place to protect water quality are working.
- A detailed inspection and monitoring regime, including frequency has been specified in the Construction and Environmental Management Plan (CEMP in **Appendix 2.1**).

9.5.2.16 *Emergency Response*

Mitigation measures outlined in the previous sections of this chapter will significantly reduce the potential for contamination of surface water or groundwater associated with the Project to insignificant. Nevertheless, as is the case with all construction projects, a risk of accidental chemical spillages, sediment overloading of control measures or leaks of contaminants from plant or equipment remains a possibility. Emergency response procedures to potential contamination incidents will be prepared as part of the site specific CEMP and will be implemented at the Site prior to the commencement of the construction phase. The following is a non-exhaustive list of potential emergency scenarios where corrective action may be required, and proposed corrective mitigation measures are included:

- Potential issue; Elevated concentrations of suspended solids in runoff during excavation activities during an unforeseen or low probability storm event, for example a 1 in 100 year event. Proposed measure; Cover exposed stockpiles in plastic sheeting and placement of straw bales and silt fences in associated drainage channels.
- Potential issue; Failure or degradation of stone check dam during a storm event with associated elevated runoff volumes. Proposed measure; Introduction of straw bales and silt fences in order to regain attenuation capacity of the drainage channel until the maintenance can be completed.
- Potential issue; Localised peat stability issue leading to deposit of peat within an active drainage channel. Proposed measure; Introduction of straw bales and silt fences directly downstream, of the area in order to attenuate gross solids isolate the area and over pump until remedial works and maintenance can be completed, divert all runoff from the area to Active Management area of the treatment train (**Appendix 9.4 – Plates no. 7 to 9**).
- Potential issue; Management of unexpected runoff patterns leading to excessive drying or wetting in a particular area, potentially leading to enhanced erosion and / or adversely impacting on the ecological health of blanket peat ecosystems. Proposed measure; This type of issue will require assessment on a case by case basis.

Solutions might include; decommission, modification, introduction or relocation of buffered outfall, or diversion of runoff volumes to or away from the area. In regard to the potential for erosion and similar physical processes, any such issues will become apparent through monitoring relatively rapidly, whereas effects to ecological sensitivities will become apparent relatively slowly in comparison. It is noted that much of the Site is impacted as part of baseline (**Section 9.3.7 and Section 9.4.4.1**) in this regard e.g., extensive existing artificial drainage networks.

Prior to commencement of construction, the ECoW will prepare a register of corrective action and emergency response sub-contractors that can be called upon in the event of an environmental incident, and/or to give training on escalating incident where useful, including e.g., specialist hydrocarbon spill response, specialist hydrological and/or water quality response.

Compliance with mitigation measures as outlined in the previous sections will mean that any effects on the environment during the construction phase of the Project are not likely to be significant, however, there remains the risk of accidental spillages and or leaks of contaminants, and excessive loading of surface water mitigation infrastructure.

Emergency responses to potential contamination incidents will be established and form part of the CEMP in **Appendix 2.1.** Potential emergencies and respective emergency responses include:

- Hydrocarbon spill or leak – Hydrocarbon contamination incidents will be dealt with immediately as they arise. Hydrocarbon spill kits will be prepared and kept in vehicles associated with the construction phase of the proposed Project. Spill kits will also be established at proposed construction areas, for example, a spill kit will be established and mobilised as part of the turbine erection materials and equipment. Suitable receptacles for hydrocarbon contaminated materials will also be at hand.
- Significant hydrocarbon spill or leak – In the event of a significant hydrocarbon spillage, emergency responses will be escalated accordingly. Escalation can include measures such as installation of temporary sumps, drains or dykes to control the flow or migration of hydrocarbons and contaminated runoff will be contained, managed and pumped to a controlled area in line with active management including treatment through a suitably equipped treatment tank and Granular Activate Carbon (GAC) vessels. This process will be managed by the ECoW in conjunction with a preidentified consultant ECoW specialist register in regard to effective remediation, treatment and removal of hydrocarbon contaminated water and soils Excavation and appropriate disposal of contaminated soils will be required in this instance.

- If a significant hydrocarbon spillage does occur, the contractor on behalf of the developer will have an approved and certified clean-up consultancy available on 24-hour notice to contain and clean-up the spill. The faster the containment or clean-up starts, the greater the success rate, the lower the damage caused and the lower the cost for the clean-up.
- Cementitious material – Cement / concrete contamination incidents will be dealt with immediately as they arise. Spill kits will also be established at proposed construction areas, for example a spill kit will be established and mobilised as part of the turbine erection materials and equipment. Suitable receptacles for cementitious materials will also be at hand.

In the event of a significant contamination or polluting incident the relevant authorities will be informed immediately.

9.5.3 Construction Phase Residual Effects

The residual impact on the surface water receiving environment resulting from the construction phase of the Project is anticipated to be a limited temporary decrease in water quality. A limited temporary decrease in water quality may arise due to a release of suspended solids and sediments to surface waters during excavations at the Site, or shallow works on the GCR and TDR. The potential for release of elevated suspended solids is likely to be exacerbated following heavy rainfall events which occur after sustained dry periods. Any localised reduction in water quality is likely to be mitigated against by the extensive control measures outlined in this chapter and also by natural dilution as distance from the point or diffuse source of contamination increases with distance from the Site.

Mitigation by avoidance and the implementation of physical control measures will ensure that contaminant concentrations, particularly elevated suspended solids entrained in run-off are reduced to below the relevant legislative screening criteria. The overall impact is anticipated to be a **direct, adverse, neutral to slight** with some **beneficial** potential.

9.5.4 Operational Phase

9.5.4.1 Increase in Hydraulic Loading Proposed Mitigation Measures

The principles of the mitigation measures described under **Section 9.5** (check dams, stilling ponds, attenuation lagoons etc.) are based on the control and management of runoff discharge rates, which ensure the regulating the speed of runoff within the drainage network, buffering the discharge from the drainage network where possible, and maintaining the natural hydrological regime. As such, the measures described with a view to controlling the release of suspended solids also mitigate against the potential for rapid runoff and rapid hydrological responses to rainfall potentially leading to flooding and erosion of the drainage network or downstream of the Project.

The same measures will be implemented with a view to mitigating against net increase surface water runoff arising from the Project. For example, the following model will be applied at a proposed Turbine Hardstand locations:

- Collector drains; allowing for 0.5m depth, 1.0m width, presume semi-circular, sectional area; c. $0.4m^2$. Presume 100m length of collector drain; up to $40m^3$ capacity per 100m, by 50% allowing for gradient equates to $20m^3$. Collector drains are not intended to store runoff, however the in-line attenuation features, such as check dams and flow regulators will serve to reduce discharge rates dramatically, effectively backing up water and regulating the rate of discharge. The actual attenuation capacity of the drainage network and treatment trains will be calculated during the detailed design phase of the Project.
- Check dams at regular intervals throughout the drainage network (existing, new clean collector and new dirty collector drains) will attenuate runoff intercepted by respective drainage channels.
- Dirty water collector drains (associated with construction areas) will direct runoff to established stilling ponds. Stilling ponds will reduce the velocity of runoff, further reducing the hydrological response to rainfall.
- Buffered outfalls to vegetated areas will utilise the infiltration capacity of the ground prior to the rejected rainfall eventually being intercepted by the receiving surface water system.
- Clean water collector drains will intercept clean runoff (upgradient of construction areas) and will direct runoff around construction areas. The runoff will be attenuated by means of check dams and intermittent buffered outfalls (**Appendix 9.4 – Plate 3a, Plate 13 and Plate 14**).

The Project will lead to an increase in impermeable surface area through the construction of hardstand areas within the Site. This in turn will lead to an increase in hydraulic loading by surface water runoff. Preliminary water balance calculations indicate that the worst-case net increase in surface water runoff volumes will be approximately $0.024m^3/sec$ or $86.4m^3/hour$ (or 0.12%) relative to the area of the Site, therefore this is considered an imperceptible, or not significant impact. The combined attenuation capacity of the proposed drainage infrastructure, checked dams, stilling ponds, etc. (**Appendix 2.1**) has been designed to attenuate net increase in water runoff during extreme storm events i.e., 1 in 100-year storm event plus a 20% allowance for global warming, as set out in **Appendix 9.1 – Ballykett Flood Risk Assessment.**

9.5.4.2 Operational Phase Residual Effects

The residual impact on the receiving surface water environment during the operational phase of the Project is anticipated to be neutral i.e., no increase in runoff and no increase in drainage discharge.

Furthermore, the drainage and attenuation network deployed will also need to consider effective passive treatment of runoff (re. suspended solids), considering this the finalised drainage and SuDS design will include attenuation capacity in excess of the values listed above. Of note is the absence of any attenuation features as part of baseline conditions. However, following the development of the Site, attenuation features will be created and reduce the level of surface water runoff.

Depending on the exact area of the Site in question, the finalised drainage design may result in some areas becoming more saturated, particularly at lower elevations, whilst other predominantly upland areas may result in a net drying effect being observed. This will require monitoring and maintenance.

This is considered a **direct, neutral to beneficial** effect of the Project, which contrasts to the baseline conditions.

9.5.5 Project Decommissioning and Restoration Phase/s

9.5.5.1 Decommissioning of Infrastructure

As discussed in **Section 9.4.6**, no new significant effect on the surface water and groundwater receiving environment are anticipated during the Decommissioning phase of the project. The Decommissioning phase of the project, as outline in the Decommissioning Plan (contained in the CEMP in **Appendix 2.1)**, would result in the removal of Site infrastructure such as wind turbine blades, towers, transformers, etc.

No excavation of peat is expected during the Decommissioning phase. The proposed the turbine foundations will remain in situ and when the turbines have been dismantled, then the hardstands will likely be covered with peat. The movement of plant, vehicles and equipment is expected to be required during the Decommissioning phase, but to a far less extent than during the construction phase. As a result, there remains a risk of elevated suspended solids being discharged in surface water run-off to the downstream receiving environmental during the decommissioning phase. Additionally, the potential risk remains for spills of fuels /hazardous chemicals which is a common risk to all developments. The mitigation measures outlined in this EIAR will be implemented during the Decommissioning phase, as well as those outlined in the Decommissioning Plan (contained as part of the CEMP in **Appendix 2.1**), to reduce the potential for such effects.

In regard to cable ducting, for the Grid Connection route, cable joint bays will be left in-situ and cabling will be left in situ as they will be an ESBN asset. In regard to internal site cable ducting, the ground above original pulling pits/joint bays will be excavated to access the cable ducts using a mechanical excavator and will be fully re-instated once the cables are removed. Excavated material will be temporarily stored adjacent to the site of excavation at a height of less than 1m and outside of any surface water buffer zone and will be removed from the site appropriately for reuse elsewhere on site, reused on another site or disposed of as a waste (through appropriate classification and assessment).

This is considered a **direct, neutral** effect of the Project, which contrasts to the baseline conditions.

9.5.5.2 Reinstatement of Redundant Access Track, Hardstand Areas, and verge strengthening.

In order to reduce the potential impact of excavating and removing the entirety of the Turbine Hardstand areas, it is proposed that the majority of the stone structure of the individual crane hardstands will be left in place, with topsoil and or peat being spread on top of the hardstand to form a vegetated surface layer. The top layer of the crane hardstand areas will have the rock/stone dug out and be left to revegetate naturally. Any reinstatement of topsoil and the restoration of vegetation will be kept consistent and compatible with surrounding vegetation and shall be agreed with Clare County Council in advance of commencement. Reinstatement of redundant site access tracks and Turbine Hardstand areas during the Decommissioning phase has the potential to result in soil creep, associated erosion and potential entrainment of elevated suspended solids in surface water run-off. This in turn has the potential to impact on the receiving surface water environment:

- A site specific Decommissioning Plan (based on the Plan contained as part of the CEMP in **Appendix 2.1**) will also be developed prior to the commencement of any Decommissioning phase activities.
- Mitigation measures described in this chapter to reduce the potential for run-off of elevated suspended solids will be implemented.
- Silt/sediment fences shall be implemented along the perimeter of all site access tracks and hardstand areas prior to decommissioning works and for the during the reinstatement works.

- Additional precautions such as the implementation of check dams, secured straw bales, sandbags, and/or settlement ponds will be implemented at areas where surface water runoff is likely to be intercepted by both natural and artificial drainage features.
- Any drains or outfalls which have the potential to draw water from reinstatement areas, or promote preferential surface water runoff flow paths through reinstatement areas will be removed, blocked or decommissioned as appropriate.
- The mitigation measures for the preparation of the hardstand area surfaces prior to material being deposited discussed in **Chapter 8: Soils and Geology** will be implemented.
- Monitoring and maintenance of the reinstated areas will be conducted regularly following the initial stages of establishment to ensure that the potential for excessive surface water runoff eroding deposited material along preferential pathways is minimised.

It is proposed that the site access tracks will be left in situ for use by the landowners during the Decommissioning stage. Any localised sections of track which will be required to be reinstated will have a covering layer of topsoil or peat (depending on adjacent vegetation) placed on top of the track surface, with vegetated sods used where available. Realignment TDR works along the L6132 will remain in-situ following the construction of the wind farm.

This is considered a **direct, neutral** effect of the Project, which contrasts to the baseline conditions.

9.5.5.3 Reinstatement Residual Effects

It is anticipated that the appropriate reinstatement of redundant hardstand areas and localised site access track will result in a net beneficial impact. This will be achieved through passive continuous improvements at the areas in question. Over time, the reinstated areas will become revegetated and will recover to become similar in appearance to the surroundings of the wider Site. The reinstatement of the Site areas will likely result in enhanced bog water levels at the Site. This will occur through the reintroduction of permeable layers at former hardstand areas which will in turn promote the filtration of potentially contaminated surface water runoff which may originate from reinstated areas. The realignment works remaining in-situ will reduce the amount of excess works in terms of soil disturbance and potential release of suspended soils. Therefore, the residual impact of reinstatement at site access tracks and former Turbine Hardstand areas is considered to be a **positive**, **localised** and **permanent** effect of the Project. Reinstatement will be required to be managed similar to the construction phase, including appropriate construction phase mitigation and monitoring **Section 9.5.2**.

9.5.5.4 Decommissioning and Restoration Phase – Physical Infrastructure

Deconstruction works during the Decommissioning phase of the Project pose similar hazards and risks associated with the construction phase but to a far lesser extent, for example, the potential for fuel spills from vehicles but there will likely be less vehicles required. The principal mitigation measures described in this EIAR chapter will be implemented by means of the Decommissioning Plan in **Appendix 2.1**.

Restoration of physical infrastructure at the Site following the Decommissioning phase has the potential to cause adverse effects on the receiving hydrological and hydrogeological environment. A high level benefit analysis was conducted to show overall positive outcomes against the removal of hardstands for example. then in line with the objectives of mitigation measures, and under the scope of relevant guidance and policy, particularly in light climate change, the restoration of the Site will result in net gains in terms of environmental services at the site, including; biodiversity, peatland health, and water quality.

The assessment of all restoration activities will require an analysis across multiple other environmental disciplines (i.e., ecology, noise and human beings etc.) with the overall synergistic effects requiring evaluation. It noted that the blanket bog and associated ecological environment surrounding the Site will also become altered over time across the operational lifetime of the Project. It is therefore recommended that the potential for restoration activities following the Decommissioning phase of the Project is evaluated in detail in line with the Decommissioning phase.

This is considered a **direct, neutral** effect of the Project, which contrasts to the baseline conditions.

9.5.6 Cumulative Effects

As outlined in **Appendix 1.2** there are 14 operational wind farms within 20km of the proposed Site. When taking into account the 'works' associated with this Project residual effects are determined to be 'Neutral' or 'Low'. This is then added with similar developments within the same sub catchment area. Namely Tullabrack (1.52km from site) and Moanmore (1.31km from site) which reside in the Wood_SC_010 catchment. Additionally Moanmore South is proposed for this subcatchment, located 3.5km from site. Ballykett Windfarm is located upstream of Moanmore and Moanmore South via the Moyasta River.

Crossmore wind Farm resides in the same subcatchment (Doonbeg_SC_010) as some of the TDR works however these effects are so slight that this will be classified as an imperceptible cumulative effect.

Given the addition of Ballykett wind farm to the two wind farms and proposed wind farm in that subcatchment, as well as their hydologocial connections via the Moyasta River, the cumulative effects on the subcatchment are considered to be moderate. It should also be noted that there is the potential for present day and future scenarios of fluvial flooding in this area.

9.5.6.1 Water Quality

The phasing/commencement of any other permitted developments in the locality could potentially result in the scenario where a number of other construction sites are in operation at the same time as the Project.

Considering the mitigation measures outlined in this report and the expected residual effect pending successful implementation of those measures i.e., neutral impact to receptors, the Project is not considered to significantly contribute to cumulative adverse effects to the associated hydrological network in terms of water quality.

In the event of accidental or temporary contamination incidents, water quality in downstream receptors can potentially be adversely impacted, particularly during the construction phase. Such incidents will demand an emergency response on site and escalation of Active Management on site (**Appendix 9.6 Plates 7 – 9**). Assuming other, similar developments, construction activities and potential adverse effects in the area, there is the potential for such incidents to have a cumulative effect on water quality to some degree if such incidents occur on multiple sites in a short period of time and within the same hydrological catchments. However, it must be noted that similar effects are part of baseline conditions at the Site, including, land reclamation, excavation of drainage and commercial forestry.

Allowing for worst case whereby a contamination incident occurs, the incident will likely be minor and temporary and therefore will unlikely contribute significantly to cumulative effects in the associated surface water network. The risk of a major landslide or mass movement to occur as a function of the Project is generally **low** (**Chapter 8**).

9.5.6.2 Hydraulic Loading

A net increase in impermeable surfaces at the project Site will likely result in a reduction in recharge to groundwater, and rapid transmission of runoff to surface water systems. These factors have the potential to significantly contribute to the cumulative / catchment of adverse effects imposed on the surface water network in the catchments associated with the Project and the hydrological response to rainfall (**Appendix 1.2** for permitted and operational wind farms within 20km of the proposed Site). However, considering the pre-existing "*Moderate*" WFD status of the surface waters surrounding the Project, and the generally moderate-quality baseline water quality results outlined in **Section 9.3.7,** (and in **Figure 9.8**) the potential for the Project to have adverse cumulative effects on hydrology is limited to the construction phase. Considering cumulative effects of pressures on the surface water network, if an accidental release of contaminants were to occur, there is a potential to temporarily impact surface waterbodies in the catchment. However, the objectives of the outlined mitigation measures in this chapter and in the Flood Risk Assessment (FRA) (**Appendix 9.1**), are to reduce any potential effect to acceptable levels. Therefore, the Project is not considered likely to significantly contribute to cumulative effects in terms of water quality nor flood risk.

With respect to hydrogeology, and the potential effects of the Project having been assessed as likely being localised due to the overlying peat, slow recharge rates, high run-off rates and poor yielding underlying groundwater aquifer except for local zones, the Project is not considered likely to potentially significantly contribute to cumulative effects.

9.6 SUMMARY OF SIGNIFICANT EFFECTS

This chapter assesses all scenarios for the proposed Project. A summary of unmitigated and mitigated impacts are presented in **Table 9.25**. During both the construction and operational phases of the Project, activities will take place at the Site and on the grid connection routes that will have the potential to significantly affect the hydrological regime and surface water quality at the Site or its vicinity.

The significant potential effects that could generally arise from the Project during the Construction, Operational and Decommissioning phases of infrastructure elements on the Wind Farm, GCR and TDR, relate to sediment input from runoff and other pollutants such as hydrocarbons and cementitious substances being released. Hydrocarbons or chemicals spills to surface waters has the most potential for effects. Examples of works which could introduce such effects include the excavation activities associated with turbine foundations, cable trenches, and works in close proximity to surface water or drainage network including watercourse crossings and culverts, Decommissioning and restoration phase effects and mitigation are similar to the construction phase, and therefore where 'Construction' is referred to in **Table 9.25**, this includes Decommissioning and restoration phase effects and mitigation.

This chapter identified the likely hydrological, and hydrogeological impacts of the Project. By summarising relevant guidance and legislation and outlining baseline information, it allowed for the assessment of the potential effects to be identified and their significance rated.

Elements of the design, construction and operation of the Development that may potentially impact on the hydrogeological and water environment receptors have been identified and their pathways for impacts have been assessed. It has been determined that without mitigation, the Project would likely cause adverse impacts ranging from moderate to significant due to the sensitivity of the Designated Sites hydrologically linked to elements of the Development.

The implementation of mitigation through avoidance principles, choice of best alternatives for location of works, pollution control measures, surface water drainage measures and other preventative measures incorporated into the project design in order to minimise potential significant adverse effects on water quality at the Site and along the grid connection route/s. A 50m stream buffer zone will be implemented at the Site to avoid sensitive hydrological features. Direct discharges to surface waters of dewatered loads will not be permitted under any circumstances. This in turn will reduce the potential for adverse significant effects on the downstream the environment including designated sites. Layout design amendments along with application of the specified mitigation during each phase of the Development will reduce the potential significance to all receptors to **'neutral' or 'positive'**. The Development will not effect any surface water or groundwater body as it will not cause a deterioration of the status of the body and/or it will not jeopardise the attainment of a WFD '*Good'* status. The project will not cause deterioration of water quality, and it will not prevent it meeting the biological and chemical characteristics for WFD 'Good' status.

It is not likely that the proposed Development will have a significant effect alone or cumulatively to the conservation status of ecological habitats and terrestrial mammals occurring in the surrounding countryside, over and above any existing effects caused by existing land use practices and existing developments.

When implemented and managed by ECoW, the drainage and Surface Water management Plan (SWMP) for the Site will be key to managing and controlling sediment runoff arising from construction activities (see **Appendix 2.1 CEMP**).

The overarching objectives of the CEMP and SWMP are to adopt and implement Nature Based Solutions including the provision of extensive Sustainable Drainage System (SuDS) features. This approach will be adopted to the extent that mitigating against likely effects such as net increase in surface water runoff and potential adverse effects to surface water quality, will overshoot net adverse losses and provide beneficial effects compared to baseline conditions.

Implementation of the control measures outlined in this EIAR will result in a robust environmental management plan which will target and mitigate likely sources and pathways of contaminant arising at the Site, and to actively manage and monitor systems on site to achieve no significant effect to the receiving surface water network. The monitoring and management will identify and deal with any potential issue arising from threatened or actual releases and ensure that appropriate actions are taken as soon as possible.

The Project as a whole, including the Turbine Delivery Route works and Grid Connection route are not likely to significantly impact groundwater quantities, quality or availability. The principal residual risk to groundwater posed by the Project is the use, storage and transfer of hydrocarbons (fuel) on site for plant equipment. In the unlikely event a spill occurs, the contaminant will be contained, managed and removed immediately.

There is a residual flood risk on Site, principally associated with the WCC2 single span bridge structure over the Moyasta River. Important design considerations are prescribed and will be incorporated into detailed assessment and design for the bridge and associated site access track within the flood zone. Implementing these measures will ensure minimal impact to hydro-morphology or the hydrological regime. Flood Risk Assessments conclude that the likelihood of exacerbating flood risk or behaviours at the Site, on the GCR and the section of L6132 where the TDR works take place is **very low,** and the potential to exacerbate effects on local receptors including dwellings is **very low.**

Table 9.25: Summary of Potential Effects on the Receiving Environment from the Proposed Project in the Absence of, and with the implementation of appropriate Mitigation Measures.

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Earthworks	Construction	Direct and Indirect *	Adverse	Large	Moderate to Significant	Project Footprint, Localised	Conforms to baseline e.g. forestry operations)	Unavoidable	Temporary	Yes; **Section 9.5.2.1**	Adverse	Neutral to Slight
Clear Fell of Afforested Areas	Construction	Direct and Indirect *	Adverse	Small	Moderate	Project Footprint,	Conforms to baseline	Unavoidable	Permanent but Reversible	Yes; **Section 9.5.2.9**	Adverse	Neutral to Slight, Potentially Beneficial
Release of Suspended Solids	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Significant	Localised (Potentially Regional)	Conforms to baseline e.g. forestry operations)	Unavoidable	Temporary	Yes; **Section 9.5.2.5**	Adverse	Neutral to Slight
Ground Stability and Compaction	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Significant	Localised (Potentially Regional)	Conforms to baseline e.g. forestry operations)	Unavoidable	Temporary	Yes; **Section 9.5.2.6**	Adverse	Neutral to Slight
Release of Hydrocarbons (SW)	Construction	Direct and Indirect *	Adverse	Small	Moderate to Significant	Localised (Potentially Regional)	Contrast to Baseline	Likely	Permanent but Reversible	Yes; **Section 9.5.2.7**	Adverse	Neutral to Slight

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Release of Hydrocarbons and Storage (GW)	Construction	Indirect	Adverse	Small	Moderate to Significant	Localised (Potentially Regional)	Contrast to Baseline	Likely	Permanent but Reversible	Yes; **Section 9.5.2.7**	Adverse	Neutral to Slight
Release of Wastewater Sanitation Contaminants (SW)	Construction	Direct and Indirect *	Adverse	Small	Moderate to Significant	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary to Long Term Reversible	Yes; **Section 9.5.2.9**	Adverse	Neutral to Slight
Release of Wastewater Sanitation Contaminants (GW)	Construction	Indirect	Adverse	Small	Moderate to Profound	Localised (Potentially Regional)	Contrast to Baseline	Likely	Permanent but Reversible	Yes; **Section 9.5.2.9**	Adverse	Neutral to Slight
Release of Construction or Cementitious Materials (SW)	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Significant	Localised (Potentially Regional)	Contrast to Baseline	Likely	Temporary to Medium Term	Yes; **Section 9.5.2.8**	Adverse	Neutral to Slight
Release of Construction or Cementitious Materials (GW)	Construction	Indirect	Adverse	Small	Moderate to Profound	Localised (Potentially Regional)	Contrast to Baseline	Likely	Permanent but Reversible	Yes; **Section 9.5.2.8**	Adverse	Neutral to Slight

		Qualifying Criteria Pre-Mitigation								Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Hydrologically Connected Designated Sites	Construction	Indirect	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to baseline e.g. cumulative upstream impacts	Likely	Temporary to Long-term	Yes; Covered in all above Sections	Adverse	Neutral to Slight
Local Groundwater Supplies (Wells)	Construction / Operational	Direct and Indirect *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g. other shallow excavations.	Unlikely	Temporary	Yes; Section 9.5.2.12	Neutral	Neutral
Groundwater or Bog Water Associated with Wind Farm	Construction	Direct and Indirect *	Neutral to Adverse	Small to Moderate	Slight to Moderate	Localised	Conforms to Baseline e.g. forestry drains.	Likely	Permanent / Reversible	Yes; Section 9.5.1	Slight Adverse / Small Beneficial	Slight / Neutral / Beneficial
Groundwater and Surface Water Associated with Wind Farm Cable Works	Construction	Direct and Indirect *	Adverse	Small to Moderate	Slight	Localised	Conforms to Baseline e.g. public roads and services.	Likely	Permanent but Reversible	Yes; **Section 9.5.2.12**	Adverse	Neutral to Slight
Groundwater and Surface Water Associated with Grid Connection Cable Works	Construction	Direct and Indirect *	Adverse	Small	Slight	Localised	Conforms to Baseline e.g. public roads and services.	Likely	Temporary	Yes; **Section 9.5.2.12**	Adverse	Neutral to Slight

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Reinstatement of Redundant Access Track, Hardstand Areas and Borrow Pit	Construction	Direct and Indirect *	Adverse	Small	Slight	Project Footprint, Localised	Contrast to Baseline.	Likely	Permanent	Yes; **Section 9.5.6.2**	Adverse	Neutral to Beneficial
Excavation Dewatering & Construction Water	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Contrast to Baseline.	Likely	Temporary to Permanent	Yes; **Section 9.5.2.2**	Adverse	Neutral to Slight
Diversion and Enhancement of Drainage	Construction	Direct and Indirect *	Adverse	Small	Moderate	Localised (Potentially Regional)	Conforms to Baseline e.g. forestry drains.	Likely	Permanent	Yes; **Sections 9.5.2.10, 9.5.2.11**	Adverse	Neutral to Slight
Watercourse Crossings - Mapped Rivers	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to Baseline e.g. existing bridges and roads in area.	Unavoidable	Permanent	Yes; **Section 9.5.2.9 and Section 9.5.2.10**	Adverse	Slight
Watercourse Crossings - Drainage Features	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to Baseline e.g. agri / peat drains / forestry drains.	Unavoidable	Permanent	Yes; **Section 9.5.2.9 and Section 9.5.2.10.**	Adverse	Slight

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Increased Hydraulic Loading & Flood Risk	Operational	Direct and Indirect *	Adverse	Small	Slight	Localised (Potentially Regional)	Conforms to Baseline e.g. existing forestry tracks.	Unavoidable	Permanent	Yes; **Section 9.5.4.1**	Neutral to Beneficial	Neutral to Beneficial

Note:
***** Includes Indirect / Secondary impacts to receptors downstream of the Project. For example: Contaminants intercepted by surface water features or groundwater bodies can have a potential effect on downstream sensitive receptors or regional groundwater aquifers depending on the environmental circumstances.

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10 NOISE

10.1 INTRODUCTION

This chapter of the EIAR assesses the effects of the Project from noise impacts. This assessment was undertaken by Brendan O'Reilly of Noise & Vibration Consultants Limited and Shane Carr of Irwin Carr Ltd.

The assessment considers the potential effects during the following phases of the Development:

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

The Project refers to all elements of the application for the construction of Ballykett Wind Farm (**Chapter 2: Project Description**).

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

- **Appendix 10.1**: Photos of noise monitors in-situ
- **Appendix 10.2**: Wind speed calculations for Hub Height
- **Appendix 10.3**: Calibration certificates of noise instruments
- **Appendix 10.4**: Candidate turbine manufacturer's noise emission data

10.1.1 Statement of Authority

This chapter has been prepared by Mr. Brendan O'Reilly of Noise and Vibration Consultants Limited. Brendan has a Master's degree in noise and vibration from Liverpool University and has over 40 years' experience in noise and vibration control (and many years' experience in preparation of noise impact statements) and has been a member of a number of professional organisations. Brendan was a co-author and project partner (as a senior noise consultant) in 'Environmental Quality Objectives Noise in Quiet Areas' administered by the Environmental Protection Agency. Brendan has considerable experience in the assessment of noise impact and have compiled studies for in excess of 100 wind farm developments throughout Ireland, north and south.

Irwin Carr Consulting is based in Northern Ireland. The company has a proven track record in noise impact assessments throughout the UK and Ireland, with extensive knowledge of the issues in relation to noise from wind energy developments. Mr. Shane Carr carried out the noise modelling in this assessment and contributed to the report. Shane is a Director in Irwin Carr Consulting, primarily responsible for environmental noise and noise modelling. He has over 22 years' experience working in both the public and private sectors having previously obtained a BSc (Hons) Degree in Environmental Health and a Post-Graduate Diploma in Acoustics. Shane has been responsible for undertaking and reviewing noise impact assessments on numerous large scale wind farms throughout the UK and Ireland.

10.1.2 Acoustic Terminology

Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB), and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound, it does not accumulate in the environment, is transitory, fluctuates, and is normally localised. Environmental noise is normally assessed in terms of A-weighted decibels, dB (A), when the 'A weighted' filter in the measuring device elicits a response which provides a good correlation with the human ear. The criteria for environmental noise control are of annoyance or nuisance rather than damage. In general, a noise level is liable to provoke a complaint whenever its level exceeds by a certain margin, the pre-existing noise level or when it attains an absolute level. A change in noise level of 3 dB (A) is 'barely perceptible', while an increase in noise level of 10 dB (A) is perceived as a twofold increase in loudness. A noise level in excess of 85 dB (A) gives a significant risk of hearing damage. Construction and industrial noise sources are normally assessed and expressed using equivalent continuous levels, LAeq[1]. Wind turbine source noise is generally expressed in Leq dBA and in sound power levels (LWA dB). Sound power level is a measure of the noise source while sound pressure level is a measurement taken at a distance from the noise source carried out with a noise meter.

Operational wind turbine noise is assessed using the LA90[2] descriptor, which allows reliable measurements to be made without corruption from relatively loud transitory noise events from other sources. The LA90 should be used for assessing both the wind energy development noise and background noise as stated in the Wind Energy Development Guidelines (WEDG06)3

As discussed in ETSU-R-97[4] the LA90 is 1.5-2.5dBA less than the LAeq measured over the same period. In this assessment, the difference between LAeq and LA90 is given as 2dBA which is best practice and the value most commonly applied in wind farm assessments in

[1] L_{Aeq} is defined as being the A-weighted equivalent continuous steady sound level that has the same sound energy as the real fluctuating sound during the sample period and effectively represents a type of average value.
[2] LA90, or L90dBA is defined as the noise level equaled or exceeded for 90% of the measurement interval and with wind farm noise the interval used is 10 minutes.
[3] Department of Environment, Heritage and Local Government: Wind Energy Development Guidelines, Guidelines for Planning Authorities 2006 Energy
[4] ETSU-R-97, The Assessment & Rating of Noise from Wind Farms, June 1996

Ireland. Wind turbine noise levels are given as sound power levels (LWA) dB at integer wind speeds up to maximum LWA levels.

Table 10.1: Comparison of sound pressure level in our Environment[5]

Source/Activity	Indicative noise level dBA
Threshold of hearing	0
Rural night-time background	20-50
Quiet bedroom	35
Windfarm at 350m	35-45
Busy road at 5 km	35-45
Car at 65km/hr at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/hr at 100m	65
Inside a typical shopping centre	70-75
Inside a modern car at around 90km/hr	75-80
Passenger cabin of jet aircraft	85
City Traffic	90
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

10.1.3 Assessment Structure

This assessment contains the following sections:

- Assessment Methodology and Significance Criteria – a description of the methods used in baseline surveys and in the assessment of the significance of effects;
- Baseline description - a description of the baseline noise of the area surrounding the Development based on the results of surveys, desk information and consultations, and a summary of any information required for the assessment that could not be obtained;
- Assessment of potential effects - identifying the ways in which noise receptors could be affected by the Development, including a summary of the measures taken during design of the Development to minimise noise effects;
- Mitigation Measures and Residual Effects - a description of measures recommended to off-set potential negative effects and a summary of the significance of the effects of the Development after mitigation measures have been implemented;
- Cumulative Effects – identifying the potential for effects of the Development to combine with those from other wind farm developments;
- Summary of Effects; and
- Statement of Significance.

[5] Fact sheet published by the Australian Government (Greenhouse Office) and the Australian Wind Energy Association

10.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

10.2.1 Assessment Methodology

This assessment has involved the following elements, further details of which are provided in the following sections:

- Legislation and guidance review
- Desk study, including review of available maps and published information
- Site walkover
- Evaluation of potential effects
- Evaluation of the significance of these effects
- Identification of measures to avoid and mitigate potential effects

10.2.2 Description of Effects

The significance of effects of the proposed development is described in accordance with the EPA guidance document '*Guidelines on the information to be contained in the Environmental Impact Assessment Reports (EIAR), EPA May 2022'*. The details of the methodology for describing the significance of effects are provided in Table 3.4: Section 3.7.3 of the aforementioned EPA 2022 document.

10.2.3 Relevant Legislation and Guidance

The noise assessment is carried out in accordance with the guidance contained in the following documents:

- Wind Energy Development Guidelines (WEDG06) (the 2006 Guidelines)
- Recent An Bord Pleanála Decisions on Noise Limits
- WHO 2018 Environmental Noise Guidelines for European Region (WHO 2018)
- Draft Revised Wind Energy Development Guidelines December 2019 (DRWEDG 2019).
- A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise including Supplementary Guidance Note 4: Wind Shear'[6] (the IOA Good Practice Guide)
- ISO 1996[7] Acoustics-Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures (ISO 1996)
- ETSU-R-97[8]: The Assessment & Rating of Noise from Wind Farms (ETSU-R-97)

[6] Institute of Acoustics (2013) A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise
[7] ISO 1996/1- Acoustics-Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures
[8] ETSU-R-97: Acoustics-The Assessment & Rating of Noise from Wind Farms: ETSU for the DTI, UK, 1996

10.2.3.1 Wind Energy Development Guidelines 2006 (WEDG06)

The following are a number of key extracts from the 2006 Guidelines in relation to noise impact:

General Noise Impact

"*Noise impact should be assessed by reference to the nature and character of noise sensitive locations*."

"*Separate noise limits should apply for day-time and for night-time*"

"Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed."

Measurement Units

"The descriptor [LA90 10min] which allows reliable measurements to be made without corruption from relatively loud transitory noise events from other sources, should be used for assessing both wind energy development noise and background noise."

Specific Noise Limits

"Noise limits should be applied to external locations and should reflect the variation in both turbine source noise and background noise with wind speed."

"In general, a lower fixed limit of 45 dB(A) or a maximum increase of 5 dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours.

However, in very quiet areas, the use of the margin of 5 dB(A) above the background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments. Instead in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of LA90,10min of the wind energy development noise should be limited to an absolute level within the range 35-40 dB(A)".

"During the night the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43 dB(A) L90,10min which will protect sleep inside properties during the night"

The WEDG06 do not specify daytime or night-time hours. However, it is considered good practice to follow the framework given in ETSU-R-97 and IOA Good Practice Guide where daytime and night-time hours are specified. The limits are based on the prevailing background noise level for 'quiet daytime' periods, defined in ETSU-R-97 as:

- Quiet waking hours or quiet day-time periods are defined as:
- All evenings from 18:00 to 23:00 hrs

- Saturday afternoon from 13:00 to 18.00 hrs and all-day Sunday 07:00 to 18:00 hrs
- Night-time is defined as 23:00 to 07:00 hrs

10.2.3.1 An Bord Pleanála

<u>2020 An Bord Pleanála Decisions</u>

Recent decisions by ABP gave limits (ABP-304807 and ABP-303592-19, dated 2020) in accordance with the 2006 Guidelines were as follows:

(a) between the hours of 0700 and 2300: the greater of 5 dB(A) L90,10min above background noise levels, or 43 dB(A) L90, 10min, and

(b) 43 dB(A) L90,10min at all other times where wind speeds are measured at 10 metres above ground level.

10.2.3.2 World Health Guidelines (WHO) 2018

The most recent WHO 2018 Guidelines: 'Environmental Noise Guidelines for the European Region' gives a recommendation limit of 45 dB Lden which is based on low quality evidence. This is an annual average noise level, based on wind speed and direction in the vicinity of the site with no specific limits for night.

10.2.3.3 Draft Revised Wind Energy Development Guidelines 2019 (DRWEDG 2019)

There have been a number of draft guidelines over the years with the latest one being in December 2019. The DRWEDG 2019 guidelines, currently in draft format are subject to significant public and stakeholder consultation and liable to change. A tender to review the DRWEDG19 has been issued. In respect of the noise assessment in this chapter and in line with best practice the assessment is based on the WEDG06 as outlined in Section 10.2.3.1.

10.2.4 Desk Study

The location for noise monitoring were selected by inspection of site maps and by identifying the nearest receptors surrounding the wind turbines. The noise Study Area has been defined such that the predicted results have been included for all residential receptors within 2.7km of the wind farm. This covers all residential properties where the predicted noise level from the proposed site is in excess of 33dB LA90. Which is 10dB lower than the WEDG06 noise limit of 43dB LA90. Where the noise level from the site is more than 10dB lower than the limit it is not deemed to be significant.

The noise monitoring location is considered representative of the local noise environment.

10.2.5 Acquisition and Analysis of Background Noise Data

The WEDG06, ETSU-R-97 and the IOA Good Practice Guide recommend the measurement and use of wind speed data, against which background noise measurements are correlated. The IOA Good Practice Guide Supplementary Guidance Note 4[9].(**Appendix 10.2**) gives the methodology to account for wind shear, calculation to hub height and to standardise 10m height wind speed.

A Lidar measurement was located within the Site during the noise survey was used for wind data measurements at the proposed hub height with wind shear derived and used to calculate to the proposed turbine hub height wind speed of 104m.

The 104m hub height wind speed was then standardised to 10m height wind speed with the wind speed plotted against the 10-minute background noise data to derive a best fit polynomial curve.

10.2.6 Prediction of Wind Turbine Noise Levels

The predicted noise levels are based on the methodology given in the IOA Good Practice Guide. Noise level calculations are based on ISO 9613-2[10] which provides a prediction of noise levels likely to occur under worst-case down-wind conditions.

There are numerous models for predicting noise from a point source and some of these models are specifically used for the prediction of noise from wind farms. SoundPLAN software package was used to calculate the noise level at the receptors. The propagation model calculates the predicted sound pressure levels by taking the source sound power level for each turbine in their respective octave bands and subtracting a number of attenuation factors according to the following formula:

$$\text{Predicted Octave Band Noise level} = LW + D - (A_{geo} + A_{atm} + A_{gr} + A_{br} + A_{mis})j$$

The predicted octaves from each of the turbines are summed to give the predicted noise level expressed as dBA.

No allowance has been made for the character of noise emitted by the turbines, however in general the emissions from wind turbines are broadband in nature. In the unlikely event of a turbine exhibiting clearly tonal components at any receptor, the turbine would be turned

[9] IOA, A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise- Supplementary Guidance Note 4: Wind Shear

[10] ISO 9613-2 Acoustics -Attenuation of sound during propagation outdoors, Part 2: General Method of Calculation

down or stopped until such tonality is ameliorated. A guarantee will be required in the procurements of the turbine to be used onsite, stating that there should be no clearly tonal or impulsive components audible at any noise sensitive receptor location.

A_{geo} –Geometric Spreading

Geometric (spherical) spreading from a simple free-field point source results in attenuation over distance according to:

Lp = Lw – (20 log R + 11)

Where:

Lp = sound pressure level

Lw = sound power level

R = distance from the turbine to receiver

D – Directivity Factor

The directivity factor allows for adjustment where the sound radiated in the direction of the receptor is higher than that for which the sound power level is specified. In this case, the sound power levels are predicted as worst-case propagation conditions, i.e., all receptors are assumed to be in downwind conditions.

A_{gr} - Ground Effects

Ground effect is the result of sound reflected by the ground interfering with the sound propagating directly from the turbine to receiver. The prediction of ground effects is complex and depends on the source height, receiver height, propagation height between the source and receiver and the intervening ground conditions.

Ground conditions are described according to a variable defined as G, which varies between 0 for hard ground and 1 for soft ground. Although in reality the ground is predominately porous, it has been modelled as mixed 50% hard and 50% porous corresponding to a ground absorption coefficient of 0.5. Our predictions have been carried out using a source height corresponding to the proposed height of the turbine nacelle, a receiver height of 4m and an assumed ground factor of G=0.5 as recommended in the IOA Good Practice Guide.

A_{bar}- Barrier Attenuation

The effect of a barrier (including a natural barrier) between a noise source and receptor is that noise will be reduced according to the path difference (difference between the direct distance between source to receptor and distance between source and receptor over the barrier). The reduction is relative to the frequency spectrum of the sound and may be predicted according to the method given in ISO 9613. In practice, barriers can become less effective in downwind conditions. A barrier can be very effective when it lies within a few metres of the receptor. In the prediction model, zero attenuation is given for barrier effects, which is a worst-case scenario setting.

A_{atm} - Atmospheric Absorption

Sound emergency through the atmosphere is attenuated by conversion of sound energy to heat. This energy is dependent on the temperature and relative humidity of the air, but only weakly on ambient pressure through which the sound is travelling and is frequency dependent with increasing attenuation towards higher frequencies. The attenuation by atmospheric absorption A_{atm} in decibels during propagation through distance in metres is given by:

$A_{atm} = d \times \alpha$,

α = atmospheric absorption coefficient in dBm^{-1}

d = distance from turbine

Values of α from ISO 9613 Part 1, corresponding to a temperature of $10^{0}C$ and a relative humidity of 70% has been used for these predictions and are given in **Table 10.2** below. These values are recommended in the IOA Good Practice Guide.

Table 10.2: Frequency dependent atmospheric attenuation coefficients (dB/m)

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Atmospheric Absorption Coefficient (dB/m)	0.0001	0.0004	0.001	0.0019	0.0037	0.0097	0.0328	0.117

A_{misc} – Miscellaneous Other Effects

ISO 9613 includes effects of propagation through foliage, industrial plants and housing as additional attenuation effects. These have not been included here and any such effects are unlikely to significantly reduce noise levels below those predicted.

The ISO 9613-2 standard calculates under downwind propagation conditions and therefore predicts the average downwind sound pressure level at each dwelling. The model assumes that the wind is directly downwind from each turbine to each dwelling. The prediction model is calculated as a worst-case scenario.

The predicted noise levels $L_{Aeq\ 10min}$ are converted to the required $L_{A90,10min}$ by subtracting 2 dBA.

10.2.7 Aerodynamic Modulation or Aerodynamic Noise

Aerodynamic noise originates from the flow of air over, under and around the blades and is generally broadband in character. It is directly linked to the movement of the rotors through the air and will occur to varying degrees whenever the turbine blades move. Aerodynamic noise is generally both broadband i.e., it does not contain a distinguishable note or tone, and of random character, although the level is not constant and fluctuates in time with the movement of the blades. The dominant character of such aerodynamic noise is therefore normally a 'swish' type of sound, which is familiar to most people who have stood near to a large wind turbine.

The sound level of aerodynamic noise from wind turbine blades is not completely steady but is modulated (fluctuates) in a cycle of increased and then reduced level, sometimes called "*blade swish*", typically occurring in step with the angle of rotation of the blades and so being periodic at the rotor's rotational speed – for typical commercial turbines, this is at a rate of around once or twice per second. This phenomenon is known as Amplitude Modulation of Aerodynamic Noise or more succinctly by the acronym AM. In some situations, however, the modulation characteristics can change in character to the point where it can potentially give rise to increased annoyance.

In early wind turbine designs, where the rotor was positioned downwind of the tower, a pronounced 'beat' was audible as each blade passed through the turbulent wake shed from the tower. However, this effect does not exist for the upwind rotor designs found on the majority of modern wind farms where the air flow to the blades is not interrupted by the tower structure. Instead, it seems that aerodynamic modulation is due to fluctuation of the primary mechanisms of aerodynamic noise generation.

The Temple Group[11] undertook a review of Renewable UK's Research into Amplitude Modulation and concluded the following:
The distinction between normal Amplitude Modulation i.e., blade swish (NAM) and other Amplitude Modulation (OAM) is important as they are caused by different mechanisms and have separate impacts. Normal AM (NAM) is a commonly occurring typical characteristic of

[11] Report for Renewable UK by Temple Group (Dani Fliumicelli). *Summary of Research into Amplitude Modulation of Aerodynamic Noise from Wind Turbines*, Wind Turbine Amplitude Modulation: *Research to Improve Understanding as to the cause and Effec*t, Dec'2013.

wind turbine noise that occurs persistently for long periods. NAM or "swish" usually disappears at around 3 to 4 rotor lengths from the turbines, except in crosswind conditions.

Based on the evidence available, it was recognised that even at those wind farm sites where OAM has been reported to be an issue, its occurrence may be relatively infrequent.

The study reports that the occurrence and intensity of OAM is dependent on a number of interacting factors that are specific to a location, and it is not feasible to reliably predict the occurrence of OAM at another location simply by cross checking whether similar conditions that arise at a location where OAM has occurred might arise at the new location.

NAM is a fundamental component of wind turbine noise and can be heard in proximity to virtually all wind turbine installations. The 2007[12] Salford University Report found instances of "enhanced" AM which occurred at larger distances, but relatively infrequently and at only a small minority of sites. These characteristics are consistent with and can be explained by OAM.

As described previously, many risk factors have been considered for OAM. However, no single item or specific combination of items have been found to be the controlling factors whereby the occurrence, duration and intensity of OAM at a particular location can be reliably predicted in advance of a wind turbine or wind farm being installed.

Salford University in 2007, found that out of 133 operational wind farms investigated, 27 were associated with noise complaints, but OAM was considered to be a factor in noise complaints at only four sites and a possible factor in a further eight locations.

10.2.8 Infrasound and Low Frequency Noise and Vibration

There is always low frequency (or infrasound) noise present in the ambient quiet background. It is generated by natural sources such as road traffic, wind effects thru air and vegetation, wave motion, water flow in streams and rivers. There are also low frequency emissions from many sources found in modern life, such as household appliances (e.g., washing machines, air conditioners, fridges, heating systems, boilers, burners, heat pumps, extraction systems, electric or battery clocks, sky box, etc.), Other sources include water flowing through pipes within your home and in water flow from municipal water supply. Vibration of elements of structures (low frequency, less than 20Hz)) can be generated by local activity in one's home by way of normal routine activity, like climbing stairs, walking on the floor, closing doors etc.

[12] Research into Aerodynamic Modulation of Wind Turbine Noise. Report by University of Salford

When sitting in a moving vehicle very high levels of low frequency vibration/sound is experienced.

The frequency range of audible noise is in the range of 20 to 20,000Hz and low frequency noise is generally from about 2 to 200Hz with infrasound typically of frequencies below 20Hz. There appears to be little or no agreement about the biological effects of low frequency noise on human health and there is evidence to suggest that there are no serious consequences to people's health from infrasound exposure.

A study of low frequency noise (infrasound) and vibration around a modern wind farm was carried out for ETSU and reported in ETSU W/13/00392/REP – '*Low Frequency Noise and Vibration Measurements at a Modern Wind Farm*'[13]. The results showed levels of infrasound to be below accepted thresholds of perception even on the Site. Furthermore, a document prepared for the World Health Organisation, states that *"there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects".*

Significant research carried out on low frequency noise (and not alluded to by Leventhall) has been in the area of blasting (air overpressure) which falls into a very low frequency range (2-20Hz), although with a considerably higher magnitude. Interestingly most microphones recording air-overpressure (low frequency sound) is linear down to 2 Hz with a range that does not go below a level of 88dB, as below that value trigger can occur from relatively low wind speeds (a gust of wind at 9m/s equates to an air overpressure of 133dB).

The level of ground vibration from the operation of the wind farms is below human threshold of 0.2mm/s[14] at the base of a turbine.

<u>South Australian Environment Protection Authority (EPA) Infrasound Study</u>

A report released in January 2013 by the South Australian EPA[15] found that the level of infrasound from wind turbines is insignificant and no different to any other sources of noise, and that the worst contributors to household infrasound are air-conditioners, traffic and noise generated by people. The study included several houses in rural and urban areas, houses both adjacent to a wind farm and away from turbines and measured the levels of infrasound with the wind farms operating and also switched off. There were no noticeable differences in the level of infrasound under all these different conditions. In fact, the lowest levels of infrasound were recorded at one of the houses closest to a wind farm, whereas the highest

[13] ETSU W/13/00392/REP – '*Low Frequency Noise and Vibration Measurements at a Modern Wind Farm'.*
[14] Wiss, J. F., and Parmelee, R. A.. (1974) Human Perception of Transient Vibrations, "*Journal of Structural Division"*, ASCE, Vol 100, No. S74, PP. 773-787
[15] http://www.epa.sa.gov.au/environmental_info/noise/wind_farms

levels were found in an urban office building. The South Australian study found: '*the contribution of wind turbines to the measured infrasound levels is insignificant in comparison with the background level of infrasound in the environment'*.

Massachusetts Institute of Technology (MIT)

A report by an independent expert panel prepared for Massachusetts Department of Health (2012)[16] which consisted of a panel that included seven individuals with backgrounds in public health, epidemiology, toxicology, neurology and sleep medicine, neuroscience, and mechanical engineering, all considered independent experts from academic institutions. The report found that *"there is insufficient evidence that the noise from wind turbines is directly (i.e., independent from an effect on annoyance or sleep) causing health problems or disease'* and '*available evidence shows that infrasound levels near wind turbines cannot impact the vestibular system"*.

Technical Research Centre of Finland

A long-term study into so-called "wind turbine syndrome"[17] health problems supposedly caused by low-frequency sound from spinning blades has concluded that this "infrasound" has absolutely no physical impact on the human body.

The study conducted by the Technical Research Centre of Finland (VTT) and others, commissioned by the Finnish government, found that infrasound sound waves with frequencies below the range of human hearing cause no measurable changes in the human body, and cannot in any way be detected by the human ear.

Infrasound measurements were taken inside and outside local dwellings near two Finnish wind farms, as well as inside the facilities and beyond them, for 308 days.

Measurements showed that the infrasound levels in rural areas with wind farms were about the same as levels in a regular urban environment.

"Infrasound samples representing the worst-case scenarios were picked out from the measurement data and used in the listening tests," said VTT.

"The participants in the listening tests were divided into two groups based on how they reported wind turbine infrasound related symptoms: people who suffered from those and people who never had symptoms."

[16] Infrasound Does Not Explain Symptoms Related to Wind Turbines, Finnish Government, June 2020, https://www.vttresearch.com/en/news-and-ideas/vtt-studied-health-effects-infrasound-wind-turbine-noise-multidisciplinary

[17] Report by Leigh Collins, 21st April 2020 on a study commissioned by the Finnish Government into infrasound and wind turbine syndrome

"The participants were unable to make out infrasonic frequencies in wind turbine noise, and the presence of infrasound made no difference to how annoying the participants perceived the noise, and their autonomous nervous system did not respond to it. There were no differences between the results of the two groups."

10.2.9 Field Work

Baseline noise monitoring was undertaken between 28th June and 28th July 2022 (see **Appendix 10.1**). The continuous monitoring period coincided with the wind speed monitoring over the same period and at the same 10-minute intervals. Noise data was recorded for a representative range of wind speeds during the monitoring period.

The monitoring location was chosen so that the distance was sufficient to ensure no noise contribution from any of the other two operating wind farms. This location away from busy roads also contributes to a low background noise, thereby allowing it to be used as a reference for all locations surrounding the proposal.

10.2.10 Consultation

A desk top study was carried out to identify noise monitoring locations representative of the site. Consultation was carried out with landowners who were familiar with the site in order to gain access to conduct the baseline monitoring. Access to the nearest dwellings was carried out with permission from the householders / landowners.

10.2.10.1 Noise Assessment Methodology

In summary, the assessment process comprised:

- Identification of potential receptors, i.e., houses and other potentially noise-sensitive locations;
- Measurement of existing background noise levels at representative locations close to the Site;
- Prediction of the likely noise levels of wind turbines received at each receptor; and
- Comparison of the predicted levels with noise limits.

Potential receptors in the area around the Development were initially identified from Ordnance Survey maps, google maps, EPA maps and Site visits. Background measurements were carried out at the locations shown in **Appendix 10.1**.

The method of measuring background noise is described in ISO 1996 and ETSU-R-97. In practice, it means carrying out continuous monitoring of background noise levels at

receptors for a period that includes a range of wind speeds which correspond to the maximum sound power of the candidate turbines being proposed which is usually 3 to 4 weeks duration. The candidate turbine assessed reaches maximum sound power level at a mean wind speed of 7m/s at 10m height and generates the highest noise level for that turbine specification.
The method of predicting noise levels of wind turbines at receptors is discussed in **Section 10.2.3.2**. This method was applied to the calculations for both contour plots and individual receptor predictions.

It is standard practice to predict noise levels for a reference wind speed and to adjust these for other wind speeds, according to the variation in sound power level with wind speed.

For EIA purposes, a candidate turbine, the Vestas V136-4.5 megawatts (MW) operating in unrestricted Mode P04 with serrated trailing edge (STE) as standard has been selected with a hub height of 82m for the EIA technical assessment. The tip of the blades with STE lowers noise emissions without reducing energy output. The selected turbine will have STE as standard.

A copy of the manufacturers noise specification for the turbine used in the assessment are given in the **Appendix 10.3**.

The prediction modelling is based on the turbines operating at full power and all turbines fitted with STE which reduces noise emissions of each turbine. The IOA Good Practice Guide recommends that an uncertainty value is required to be added to the turbine emission data prior to modelling. Depending on the type of manufacturer's data, the uncertainty value will range from 0 to 2dBA. However, as no uncertainty is given, then an uncertainty value of 2dBA is given in both tables. **Table 10.3** gives the noise emission data of the V136 turbine up to maximum sound power output at varying wind speed at hub height. **Table 10.4** gives the maximum sound power output at varying wind speed (presented at standardised 10m height) for the V136-4.5MW with a hub height of 82m. An uncertainty value of 2dBA is subtracted to account for conversion from LAeq to LA90 which is best practise.

Table 10.3: Noise Emission Data, Vestas V136-4.5MW, STE at Maximum Sound Power (LWA dB) at Hub Height at varying wind speed

Hub Height Wind Speed, ms^{-1}	4	5	6	7	8	9	10	11	12
Sound Power Level, dB LWA at Varying Wind Speeds	91.1	92.8	95.9	99.5	102.8	103.9	103.9	103.9	103.9
Uncertainty added and conversion of LAeq to LA90	0	0	0	0	0	0	0	0	0

Table 10.4: Noise Emission Data, Vestas V136-4.5MW, STE at Maximum Sound Power (LWA dB) at Standardised 10m Height wind Speed

Standardised 10m Height Wind Speed ms^{-1}	4	5	6	7	8	9	10	11	12
Sound Power Level dB LWA derived from 104m hub height	94.9	99.6	102.8	104.2	104.2	103.8	103.6	104	104
Uncertainty added and Conversion of LAeq to LAeq	0	0	0	0	0	0	0	0	0

The octave band values are given in **Table 10.5** with uncertainty values and conversion for LAeq to LA90 added as input to the prediction model. It is important to note that the maximum sound power level of a specific turbine does not change with variation in hub height, however minor variation occurs at the lower wind speeds with change in hub height. The proposed turbine for this Development has no variation in hub height.

Table 10.5: Octave Band Spectrum of Vestas V136-4.5MW, STE at Maximum Sound Power (LWA dB) at 7m/s wind speed

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level, dB LWA at 11 ms^{-1}	85.2	92.6	97.6	99.4	98.3	94.2	87.3	77.3
Uncertainty added to octaves and conversion of LAeq to LA90	0	0	0	0	0	0	0	0

10.2.10.2 Cumulative Assessment

Cumulative effects from any existing, consented or application-stage wind farms within 3km of the wind farm have been taken into consideration as the potential for cumulative effects beyond this distance is considered negligible as the predicted noise level would be more than 10dB lower than the limit level of 43dB LA90. On this basis, the cumulative effect of the operational Tullabrack Wind Farm located approximately 2,000m northwest, and Ballykett Wind Farm located approximately 1,800m west-northwest of the Development was assessed. The operational Tullabrack Wind Farm comprises six no. Enercon E82 each rated at 2.3MW, and the operational Ballykett Wind Farm comprises seven no. Enercon E70 each rated at 2.3MW. The maximum noise emission data at varying wind speeds (at standardised 10m height) is presented for both the Enercon E82, 2.3MW wind turbines of 78m hub height, and Enercon E70, 2.3MW wind turbines of 85m hub height is given in **Table 10.6** and **Table 10.7**.

Table 10.6: Noise Emission Levels of Enercon E82, 2.3MW w/1dB uncertainty

Standardised 10m Height Wind Speed ms^{-1}	4	5	6	7	8	9	10	11	12
Sound Power Level dB LWA derived from 104m hub height	96.1	96.1	99.5	101.3	102	102	102	102	102
Uncertainty added and Conversion of LAeq to LAeq	-1	-1	-1	-1	-1	-1	-1	-1	-1

Table 10.7: Noise Emission Levels of Enercon E70, 2.3MW w/1dB uncertainty

Standardised 10m Height Wind Speed ms^{-1}	4	5	6	7	8	9	10	11	12
Sound Power Level dB LWA derived from 104m hub height	94.1	94.1	99.7	101.1	102.5	103	103	103	103
Uncertainty added and Conversion of LAeq to LAeq	-1	-1	-1	-1	-1	-1	-1	-1	-1

The octave band values at maximum sound power output are given in **Table 10.8** and **Table 10.9** with uncertainty values and conversion for LAeq to LA90 added as input to the prediction model.

Table 10.8: Octave Band Spectrum of Enercon E82, 2.3MW

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level, dB LWA at 11 ms^{-1}	84.4	93	93.4	97	97.3	91	78.2	72.2
Uncertainty added to octaves and conversion of LAeq to LA90	-1	-1	-1	-1	-1	-1	-1	-1

Table 10.9: Octave Band Spectrum of Enercon E70, 2.3MW

Octave Band Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Power Level, dB LWA at 11 ms^{-1}	86.1	94.6	98.3	97.1	92.2	87.7	82.8	76.8
Uncertainty added to octaves and conversion of LAeq to LA90	-1	-1	-1	-1	-1	-1	-1	-1

10.2.10.3 Noise Limits

The method of deriving operational noise limits is described in Section 10.2.3.1 based on the WEDG06 and taking into account the cumulative effects and noise limits given for the Ballykett and Tullabrack Wind Farms. The noise limits for the Ballykett Wind Farm is:

'Wind turbine noise arising from the proposed development, by itself or in combination with other existing or permitted wind energy development in the vicinity, shall not exceed the greater of:

- *5 dB(A) above the background noise levels. Or*
- *43 dB(A)'*

A noise limit of 43dBA for day and night to include cumulative effects is proposed for the Development.

10.2.11 Construction Assessment Methodology

10.2.11.1 Relevant Guidance

There is no published national guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. However, National Roads Authority (NRA) give limit values which are acceptable (the NRA Guidelines)[18]. Guidance to predict and control noise is also given in BS 5228:2009-1+A12014, *Code of Practice for Noise and Vibration Control on Construction and Open Sites* (two parts) where Part 1 deal with Noise[19].

10.2.11.1.1 NRA Guidelines for the Treatment of Noise and Vibration in National Road Schemes

The NRA Guidelines provide noise limits which are acceptable and states that where it is deemed necessary to predict noise levels associated with construction noise that this should be done in accordance with BS 5228.

10.2.11.1.2 BS 5228: 2009-1A; 2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites

Part 1 of BS5228 deals with noise prediction and control. It recommends procedures for noise control in respect of construction operations. The standard stresses the importance of community relations, and states that early establishment and maintenance of the relations throughout the carrying out of site operations will go some way towards allaying

[18] National Roads Authority, *Guidelines for Noise and Vibration in National Road Schemes, October 2004.*
[19] BS 5228-1: 2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites: *Code of Practice for Basic Information and Procedures for Noise Control*.

people's concerns. Some of the more relevant factors that are likely to affect the acceptability of construction noise are:

- The attitude of local receptors to the Development
- Site location relevant to noise sensitive receptors
- Duration of Site operations
- Hours of work
- The characteristics of the noise produced.

Recommendations are made regarding the supervision, planning, preparation and execution of works, emphasising the need to consider noise at every stage of the activity. Measures to control noise are described including:

Control of noise at source by, e.g.,

- Substitution of plant or activities by less noisy ones
- Modification of plant or equipment by less noisy ones
- Using noise control enclosures
- Siting of equipment and its method of use
- Maintenance of equipment
- Controlling the spread of noise by increasing distance between plant and receptors, or by the provision of acoustic screening

Example criteria for the assessment of the significance of noise effects are also given, although these are not mandatory.

Methods of calculating the levels of noise resulting from construction activities are provided, as are updated source levels for various plant, equipment and construction activities.

10.2.11.2 Construction and Decommissioning Noise Assessment Methodology

The NRA guidelines for construction noise which are considered acceptable are given in **Table 10.10**.

Table 10.10: Noise levels that are considered acceptable based on the NRA guidelines

Day / Times	Guideline Limits
Monday to Friday 07:00 – 19:00hrs	70dB LAeq, (1h) and LAmax 80dB

19:00 – 22:00hrs	*60dB LAeq, (1h) and LAmax 65dB*
Saturday 08:00 – 16:30hrs	65dB LAeq,1h and LAmax75dB
Sunday and Bank Holidays 08:00 – 16:00hrs	*60dB LAeq,1h and LAmax 65dB*

*Construction at these times, other than required by an emergency works, will normally require explicit permission from the relevant local authority, in this case Clare County Council.

Construction Times for The Development

The proposed construction times for this Development are:
Monday to Friday: 07.00 to 19.00hrs, Saturday 08.00 to 16.30hrs with no work on Sunday, or Bank Holidays.

It is likely that delivery of turbine components will need to take place outside of these times and will be in agreement with the relevant local authority.

Part 1 of BS 5228 provides several example criteria for the assessment of the significance of noise effects from construction activities. Noise levels generated by construction activities are considered significant if:

- The LAeq, period level of construction noise exceeds lower threshold values of 65dB during daytime, 55dB during evenings and weekends or 45dB at night.
- The total noise level (pre-construction ambient noise plus construction noise) exceeds the pre-construction noise level by 5dB or more for a period of one month or more.

Construction noise from wind farm Development, or Decommissioning is not considered an intensive activity. The main noise sources will be associated with the construction of the Turbine Foundations and Turbine Hardstands. Lesser noise source activity will be construction of site access tracks, temporary construction compound and turbine erection. The Grid Connection from the Electrical Substation will be an entirely underground line along public roads to the national grid at Tullabrack 110KV Substation located to the northwest (construction of the Electrical Substation will generate no more noise than construction of a small bungalow).

Decommissioning will likely involve the remediation of Turbine Hardstand areas and Turbine Foundations, where they will be covered in topsoil/peat and allowed to revegetate. site access tracks will likely be left in-situ for use by the landowners. Underground Internal Wind Farm Cabling will be removed, and the ducting left in-situ. Therefore, the Decommissioning phase is likely to be shorter and less intrusive than the construction phase with the resultant effects being less.

All workers associated with the Development will be subject to the Health and Safety Authority Guidance[20] which states that for noise exposure noise levels likely to exceed 80 dBA (expressed as Lep,d 8 hour dBA) that there is the potential of risk of damage to hearing. All workers on site will be given guidance on how to comply with the 'First Action Level'.

10.2.12 Evaluation of Potential Effects

The potential effects of construction are evaluated by comparing the predicted noise levels against the guideline limits given in **Table 10.10:** Noise levels that are acceptable based on the NRA guidelines**,** and sample criteria in Part 1 of BS 5228 in **Section 10.2.8.2**.

The potential operational impacts are evaluated by comparing the predicted noise levels against the day and night-time noise limits given in **Section 10.3.5**. The predicted noise levels are carried out according to the IOA Good Practice Guide as detailed in **Section 10.2.2.5** and potential impacts are assessed against the noise limits at the nearest receptors.

10.2.12.1 Sensitivity

The sensitivity of the Development during construction is based on the guideline values in **Table 10.10:** Noise levels that are acceptable based on the NRA guidelines**,** and sample criteria in Part 1 of BS 5228. The sensitivity of the Development during operation is based on the values in **Section 10.4.2** and **Section 10.4.4.3**.

10.2.12.2 Magnitude

The magnitude of potential impacts of construction is based on the values in **Table 10.14.** The magnitude of the Development during operation is based on the values in **Table 10.10**.

10.2.12.3 Significance Criteria

The significance of construction is based on the potential impacts based on the predicted values and compliance with the guideline limits in **Table 10.10** and sample criteria of in Part 1 of BS 5228.

The significance of the potential impacts of the Development have been assessed by taking into account the noise limits at receptors and the degree to which compliance has been met.

[20] Noise - Frequently Asked Questions - Health and Safety Authority (hsa.ie)

10.3 BASELINE DESCRIPTION

10.3.1 Identification of Potential Receptors

A number of predictions were prepared for the layout of the wind farm. Based on the initial layout, potential noise-sensitive receptors including occupied and un-occupied dwellings were identified from maps, a survey of the area and reference to the planning permission register of the Local Authority. Receptor locations were verified through visits to the area surrounding the Development.

There are 146 houses within 2km of the proposed turbines. All houses located within 2km of the proposed turbines are shown in Figure 1.3. The closest inhabited dwelling not connected with the Development is (H4) located 608m from the nearest turbine. There are three properties (H1, H2 and H5) located less than 600m from proposed turbines. H2 is an old cottage that has been converted to a workshop and is not considered a sensitive receptor in this EIAR. H1 is an abandoned house which still has an intact roof so it has been included in the EIAR. H5 is an inhabited dwelling that is financially involved with the Project and it has also been included in this EIAR.

10.3.2 Selection of Baseline Noise Survey Locations

Four baseline noise survey locations were selected on the basis of their locations relative to the turbine layout. In order to be conservative, the monitoring location with the lowest background noise level (H3) was relied upon as the background noise level.

10.3.3 Baseline Noise Survey

Baseline noise measurements were carried out continuously between 28th June and 28th July 2022 at the receptor location given in **Table 10.11** (Photos of monitor in-situ in Appendix 10.1) are where the lowest measured levels were obtained.

Table 10.11: Baseline Noise Survey

Location	ING Reference	ITM Reference	Description of Location
H3	102546, 158229	502517.63, 658272.73	At 20m from western façade of house in garden away from trees facing towards turbine location

The survey was carried out in accordance with ISO 1996, ETSU-R-97 and the IOA Good Practice Guide with the following implemented:

- Measurement of background noise levels at 10-minute intervals was undertaken using Type 1 instruments.

- Concurrent measurements of noise and mean wind speeds were made at 10-minute intervals with the mean wind speed recorded from a LIDAR on Site. The methodology is given in **Section 10.2.3.1**.
- The background noise measurement recorded continuously included 10-minute intervals, as LA90, 10min along with a series of other parameters including LAeq,10min.
- Noise measurements were recorded at a height of 1.2-1.5m above ground level and more than 5m from any reflective surface other than the porous ground.
- An electronic rain gauge was installed onsite at H3 to monitor rainfall at 10-minute intervals over the duration of the noise survey. Rain data which impacted on noise levels were removed from the noise data set prior to analysis.
- The standardised 10m wind speed was plotted against the time synchronised background noise levels using a best-fit polynomial line.

10.3.3.1 Instrumentation Used

The following instrumentation was used in the baseline survey measurements:

- Larson Davis Precision Integrating Sound Level Analyser/Data logger with 1/2" Condenser Microphones. Microphone was fitted with double skin windscreens based on that specified in W/31/00386/REP 'Noise Measurements in Windy Conditions[21]'.
- Calibration Type: Larson Davis Precision Acoustic Calibrator.
- Rain Gauge Type: TR-525met tipping bucket rain gauge, 0.2mm pulse with LOGBOX datalogger.

All acoustic instrumentation was calibrated before and after the survey and the drift of calibration was less than 0.3dB within accepted guidelines. Survey measurement data and calibration certificates of the acoustic instruments are included in **Appendix 10.3**.

10.3.4 Prevailing Background Noise Levels

Table 10.12 gives the background noise levels obtained from quiet daytime and night-time measurement periods at the baseline measurement location. The main noise sources are dominant low road traffic on the N68. The area could may be defined as a low noise environment as the background is below 30dB LA90 from 4m/s to 5m/s, and above 30dB from 6m/s to 12m/s.

[21] W/31/00386/REP 'Noise Measurements in Windy Conditions'.

Table 10.12: Prevailing Background Noise Levels

Monitoring Location	Prevailing Background (B/G) noise levels LA90dB, 10min Standardised Mean 10 m Height Wind Speed, (m/s)						
		4	5	6	7	8	9
H3	Day	28.4	30	31.6	33.5	35.8	38.5
	B/G+5	33.4	35	36.6	38.5	40.8	43.5
H3	Night	20.4	22.1	24.3	26.9	30	33.3
	B/G+5	25.4	27.1	29.3	31.9	35	38.3

10.3.5 Noise Assessment Locations

The monitoring location was chosen so that the distance was sufficient to ensure no noise contribution from any of the other two operating wind farms. This location away from busy roads also contributes to a low background noise, thereby allowing it to be used as a reference for all locations surrounding the proposal.

Should the predicted operational noise levels from the Development comply with the requirements of the WEDG06 at the closest receptors, it may be assumed that the predicted noise levels at receptors further away from the Development will also comply, due to the attenuation of turbine noise levels with distance. The location is given in **Table 10.11.**

10.3.6 Noise Limits

The noise limits for the Development are based on the limits contained within the Wind Energy Development Guidelines 2006 and on the background levels obtained in **Table 10.12**. The baseline daytime noise levels are shown to be above 30dB, therefore the area is not a low noise environment. A lower fixed limit of 45dBA for daytime could be applied, however a more stringent limit is applied with the lowest background noise levels obtained at location H3 used as the basis for the assessment at all receptors with a limit of 43dBA being applied for day and night at all wind speeds at 5m/s and above, with a limit of 40dBA applied for wind speeds of less than 5m/s.

Table 10.13: Derived Background Day and Night Noise Levels used in Assessment

Monitoring Location	Prevailing Background (B/G) noise levels LA90dB, 10min Standardised Mean 10 m Height Wind Speed, (m/s)						
		4	5	6	7	8	9
H3	Day	28.4	30	31.6	33.5	35.8	38.5
	B/G+5	33.4	35	36.6	38.5	40.8	43.5
Noise Limit		43	43	43	43	43	43.5
H3	Night	20.4	22.1	24.3	26.9	30	33.3
	B/G+5	25.4	27.1	29.3	31.9	35	38.3
Noise Limit		43	43	43	43	43	43

10.3.7 Development Design Mitigation

The preferred turbine model, the V136 will be fitted with STE as standard which is best practice. A serrated extension of the trailing edge to the rotor blades mitigates noise emissions by effectively breaking up the turbulence on the tooth flanks into smaller eddies. The intensity of the pressure fluctuations is reduced which mitigates the noise emissions. Since the intensity of the noise emissions is largely dependent on the flow speed, STE are only installed on the outer rotor blade area where the rotary speed is the highest. Typically, STE reduces the noise levels by 2 to 3dBA depending on specific turbine used.

10.4 ASSESSMENT OF POTENTIAL EFFECTS

10.4.1 Construction Noise

10.4.1.1 Typical Construction and Decommissioning Noise Levels

As has been previously stated, the construction process associated with wind farms is not considered intensive and is temporary works, most of which is carried out at considerable distances from receptors (the nearest turbine is more than 500m from any receptors). The main noise sources will be associated with the construction of the Turbine Foundations, Turbine Hardstands, Grid Connection, processing in the borrow pit location, with lesser sources being site access tracks and construction of an Electrical Substation. Decommissioning noise levels are based on similar activities to the construction process, generating noise levels in the same order as construction levels but of shorter duration.

The material for the Development will be imported from local quarries (and via the on-site borrow pit) via the local road network with the main road traffic noise being generated for a short period with delivery of concrete for the Turbine Foundations to take 4 days. Delivery of the turbines to the Development will generate very low noise levels as the vehicles transporting will travel at low speed.

It is not possible to specify the precise noise levels of emissions from the construction plant and equipment until such time as a contractor is chosen and construction plant has been selected. However, **Table 10.14** indicates typical construction related noise levels for this type of Development activity. Predictions are made for the nearest receptor to the Development and receptors at varying distances from the Grid Connection.

Table10.14: Typical Noise Levels from Construction Works

Activity	L_{Aeq} at 10m
General Construction (pile driving, ready-mix trucks pouring concrete)	70-84dBA
Tracked excavator removing topsoil, subsoil for foundation	80- 87dBA
Rock breaker, mobile crusher, vibratory rollers, trucks loading and tipping material	82-89dBA
Grid Connection: Trenching Tracked excavator 14t, pneumatic breaker, vibratory roller 71t, tractor Horizontal directional drilling: Drill Rig (diesel), mud pump, diesel generator /tractor	70-74dBA 69-71dBA*
Spreading spoil, Tracked excavator and tractors	69-74
Road widening, Excavator and tractor trailer	70-74

*Recent measurements (2022) taken by author of HDD

The difference in noise levels between two locations can be calculated as:

$$\mathbf{L}_{p2} - \mathbf{L}_{p1} = 10 \log (R_2 / R_1)^2 - (A_{atm} + A_{gr} + A_{br} + A_{mis})$$

$$= 20 \log (R_2 / R_1) - (A_{atm} + A_{gr} + A_{br} + A_{mis})$$

where:

L_{p1} = sound pressure level at location 1

L_{p2} = sound pressure level at location 2

R_1 = distance from source to location 1

R_2 = distance from source to location 2

and where:

A_{atm} = Attenuation due to air absorption

A_{gr} = Attenuation due to ground absorption

A_{br} = Attenuation provided by a barrier

A_{mis} = Attenuation provided by miscellaneous other effects

In the calculations attenuation by A_{atm}, A_{gr} and A_{mis} is taken as 3dBA where distances are more than 200m from a source and as zero within 200m -amelioration by barriers is not accounted for.

Table 10.15 gives the noise levels predicted from construction activity at varying distances. The main noise sources are assumed to be the construction of the Turbine Foundations, Turbine Hardstands, Grid Connection. The construction of the site access tracks, the new Electrical Substation, however the noise levels associated with this activity will be lower and of shorter duration than other works. The main road traffic noise will be associated with the delivery of ready-mix concrete for Turbine Foundations.

Road traffic is dealt with under a sub-heading within this section.

The maximum construction noise levels associated with the Development and Grid Connection are listed in **Table 10.15.** At receptor locations further away, noise levels will be less than that predicted. Works associated with Decommissioning will be no more than the levels predicted in **Table 10.15**.

Table 10.15: Predicted Construction Noise Levels

Receptor	Activity taken as 100% per hour	Distance of Activity (m)	LAeq dB 1hr range
H2 - nearest house to a turbine*	Foundation works: trucks pouring concrete, large tracked excavator moving topsoil/subsoil	532	49-58
H2 - nearest house to a turbine	Rock breaking, vibratory roller, trucks loading/tipping	532	51-58
H2 - nearest house to a turbine	Spreading spoil, Tracked excavator and tractors	532	38-43
Grid Connection: Trenching Receptors at varying distances	Tracked excavator 14t, pneumatic breaker, vibratory roller 71t, tractor	20 40 80	64-68 58-62 52-56

*H2 is a workshop and not considered therefore to be noise sensitive.

Construction Traffic

The delivery of turbines to the Site will generate low level traffic noise as the vehicles carrying the turbines will move slowly along the local roads where impact is expected to be greatest. The main construction noise generated by traffic to and from the Site will be due to HGVs delivering rock to Site and ready-mix trucks delivering concrete. The concrete pour for each individual turbine will be required to be completed in a short a period as possible (usually within 10 hours).

Each turbine will require approximately 600m^3 of concrete while each ready-mix truck has a capacity of 8m^3. This results in 75 loads of concrete and 150 truck movements for each turbine. For delivery of concrete the timeframe envisaged for each turbine concrete pour is taken as 10 hrs. This equates to an average of 15 movements per hour.

The general expression for predicting the 1 hr LAeq alongside a haul road used by single engine items of mobile plant is:

$L_{Aeq} = L_{WA} - 33 + 10\log_{10}Q - 10\log_{10}V - 10\log_{10}d$ where:

L_{WA} is the sound power level of the truck, in decibels (dB);

Q is 15 the number of vehicles per hour;

V is 60, the average vehicle speed, in kilometres per hour (km/h);

d is the distance of receiving position from the centre of haul road, in metres (m).

LAeq = 105-33 +10log 16 – 10log60 – 10log20 = 53 LAeq 1hr.

At 10m from the roadside, the noise levels equate to 56 LAeq 1hr. The trucking for the concrete pour will extend for a total of 4 days (1 day for each turbine). In practice the levels generated by truck movement should be lower than predicted due to the smooth surface on the local roads.

Grid Connection-Cable laying along road by trenching

Cable laying and trenching will move along the grid route from the Electrical Substation to the national grid at Tullabrack 110KV Substation which means maximum levels will pertain no more than one day equivalent (8 hours) at any single receptor. The Grid Connection extends up to 1.7km. Spoil material from the Grid Connection is predicted to generate 220 truck loads which is to be disposed at a licenced facility. This activity is planned to be completed in approximately 5 months. Truck movements predicted over a 40hr/week would result in less than 3 movements/hr. In terms of trenching and trucking the noise generated by this temporary activity is insignificant.

Construction noise levels are based on continuous operation. In practice, most plant will operate at a maximum level for short intervals. If required, an acoustic barrier can be provided which can be placed close to the source giving maximum attenuation (refer to BS 5228 for guidance on screening / barrier effects). When a noise source is completely obscured from a receptor by an acoustic barrier a minimum 10dBA reduction is obtained.

10.4.1.2 Assessment of Construction Noise

The highest predicted noise levels predicted are from the Grid Connection and delivery of concrete for Turbine Foundations. These maximum noise levels are expected to persist for no more than 3 days at any receptor. All predicted noise levels are well within NRA guidelines given as acceptable and are considered slight. Construction noise is a temporary activity.

All other identified activities will have lower noise levels.

Ground vibration from rock breaking will be below the threshold of sensitivity to humans of 0.2mm/s peak particle velocity at all receptors[22]. The effects of noise and vibration from onsite construction activities are therefore considered not significant.

10.4.1.3 Description of Effects

The criteria for description of effects for all construction noise activity and the potential worst-case effects, at the nearest receptors is given below.

Quality	Significance	Duration
Negative	Not Significant	Temporary

10.4.1.4 Decommissioning

Noise effects during the Decommissioning phase of the Development are likely to be of a similar nature to that during construction but of shorter duration. It is likely that site access tracks and Turbine Foundations (excluding plinths) will be left in place and covered over with topsoil/peat unless there are environmental reasons to remove. It is likely that the duration of the Decommissioning phase will be of shorter duration than that during construction. Any legislation, guidance, or best practice relevant at the time of Decommissioning will be complied with.

The criteria for description of effects for all decommissioning noise activity and the potential worst-case effects, at the nearest receptors is given below.

Quality	Significance	Duration
Negative	Not Significant	Temporary

10.4.2 Predicted Operational Noise Levels

Table 10.16 gives the predicted noise levels at the nearest receptors to the Development at varying wind speeds for each receptor location. A noise contour map of the 4-no. turbine

[22] Wiss, J. F., and Parmelee, R. A. (1974) Human Perception of Transient Vibrations, "*Journal of Structural Division*", ASCE, Vol 100, No. S74, PP. 773-787

Development at maximum sound power output at a wind speed of 7ms-1 at 10m height is presented in **Figure 10.1**. The contour map in **Figure 10.1** assumes that all turbines are simultaneously downwind to each location all of the time (continuously) which results is an overprediction of the noise levels.

Table 10.16: Predicted Noise Levels as LA90 at Varying Wind Speeds from the Development

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
T1	501526	658497	-	-	-	-	-	-	-	-	-
T2	501504	658098	-	-	-	-	-	-	-	-	-
T3	501928	657973	-	-	-	-	-	-	-	-	-
T4	501913	658375	-	-	-	-	-	-	-	-	-
H1*	502460	658250	32.3	37	40.2	41.6	41.6	41.2	41	41.4	41.4
H2**	502400	657728	31.5	36.2	39.4	40.8	40.8	40.4	40.2	40.6	40.6
H3	502538	658258	31.2	35.9	39.1	40.5	40.5	40.1	39.9	40.3	40.3
H4	501974	658980	31.7	36.4	39.6	41	41	40.6	40.4	40.8	40.8
H5	501368	657536	31.5	36.2	39.4	40.8	40.8	40.4	40.2	40.6	40.6
H6	501004	658951	29.2	33.9	37.1	38.5	38.5	38.1	37.9	38.3	38.3
H7	500980	658864	29.6	34.3	37.5	38.9	38.9	38.5	38.3	38.7	38.7
H8	502597	658352	30.3	35	38.2	39.6	39.6	39.2	39	39.4	39.4
H9	502520	657769	30.3	35	38.2	39.6	39.6	39.2	39	39.4	39.4
H10	502068	659061	30.2	34.9	38.1	39.5	39.5	39.1	38.9	39.3	39.3
H11	500911	657734	29.4	34.1	37.3	38.7	38.7	38.3	38.1	38.5	38.5
H12	502536	657735	29.9	34.6	37.8	39.2	39.2	38.8	38.6	39	39
H13	502234	659009	29.8	34.5	37.7	39.1	39.1	38.7	38.5	38.9	38.9
H14	502524	657817	30.5	35.2	38.4	39.8	39.8	39.4	39.2	39.6	39.6
H15	500917	658974	28.3	33	36.2	37.6	37.6	37.2	37	37.4	37.4
H16	501999	659116	29.9	34.6	37.8	39.2	39.2	38.8	38.6	39	39
H17	500972	658979	28.7	33.4	36.6	38	38	37.6	37.4	37.8	37.8
H18	501009	659016	28.7	33.4	36.6	38	38	37.6	37.4	37.8	37.8
H19	502647	658743	28.3	33	36.2	37.6	37.6	37.2	37	37.4	37.4

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H20	502355	659039	28.7	33.4	36.6	38	38	37.6	37.4	37.8	37.8
H21	502330	659060	28.7	33.4	36.6	38	38	37.6	37.4	37.8	37.8
H22	502266	659125	28.5	33.2	36.4	37.8	37.8	37.4	37.2	37.6	37.6
H23	502626	658821	28.1	32.8	36	37.4	37.4	37	36.8	37.2	37.2
H24	502215	659189	28.2	32.9	36.1	37.5	37.5	37.1	36.9	37.3	37.3
H25	500599	658323	27.6	32.3	35.5	36.9	36.9	36.5	36.3	36.7	36.7
H26	500829	659102	26.7	31.4	34.6	36	36	35.6	35.4	35.8	35.8
H27	500569	658254	27.3	32	35.2	36.6	36.6	36.2	36	36.4	36.4
H28	502558	657360	27.1	31.8	35	36.4	36.4	36	35.8	36.2	36.2
H29	501807	659352	27.8	32.5	35.7	37.1	37.1	36.7	36.5	36.9	36.9
H30	502796	658774	26.8	31.5	34.7	36.1	36.1	35.7	35.5	35.9	35.9
H31	500539	658210	27	31.7	34.9	36.3	36.3	35.9	35.7	36.1	36.1
H32	500527	658182	26.9	31.6	34.8	36.2	36.2	35.8	35.6	36	36
H33	500513	658146	26.7	31.4	34.6	36	36	35.6	35.4	35.8	35.8
H34	501249	659412	26.5	31.2	34.4	35.8	35.8	35.4	35.2	35.6	35.6
H35	502269	659318	26.8	31.5	34.7	36.1	36.1	35.7	35.5	35.9	35.9
H36	500683	657529	26.3	31	34.2	35.6	35.6	35.2	35	35.4	35.4
H37	500488	658211	26.5	31.2	34.4	35.8	35.8	35.4	35.2	35.6	35.6
H38	502923	658648	26.2	30.9	34.1	35.5	35.5	35.1	34.9	35.3	35.3
H39	500700	657460	26	30.7	33.9	35.3	35.3	34.9	34.7	35.1	35.1
H40	500437	658130	26	30.7	33.9	35.3	35.3	34.9	34.7	35.1	35.1
H41	500761	657365	25.9	30.6	33.8	35.2	35.2	34.8	34.6	35	35
H42	502437	659304	26.1	30.8	34	35.4	35.4	35	34.8	35.2	35.2
H43	502205	656909	25.2	29.9	33.1	34.5	34.5	34.1	33.9	34.3	34.3
H44	502997	658597	25.7	30.4	33.6	35	35	34.6	34.4	34.8	34.8
H45	500855	657246	25.7	30.4	33.6	35	35	34.6	34.4	34.8	34.8
H46	500477	657678	25.3	30	33.2	34.6	34.6	34.2	34	34.4	34.4
H47	500461	657717	25.3	30	33.2	34.6	34.6	34.2	34	34.4	34.4
H48	500450	657743	25.3	30	33.2	34.6	34.6	34.2	34	34.4	34.4

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H49	500505	657596	25.2	29.9	33.1	34.5	34.5	34.1	33.9	34.3	34.3
H50	502404	656964	25	29.7	32.9	34.3	34.3	33.9	33.7	34.1	34.1
H51	501340	659545	25.6	30.3	33.5	34.9	34.9	34.5	34.3	34.7	34.7
H52	502042	656845	25	29.7	32.9	34.3	34.3	33.9	33.7	34.1	34.1
H53	501906	656820	25	29.7	32.9	34.3	34.3	33.9	33.7	34.1	34.1
H54	501855	656799	24.8	29.5	32.7	34.1	34.1	33.7	33.5	33.9	33.9
H55	501358	659584	25.4	30.1	33.3	34.7	34.7	34.3	34.1	34.5	34.5
H56	500379	657834	25	29.7	32.9	34.3	34.3	33.9	33.7	34.1	34.1
H57	501828	656771	24.6	29.3	32.5	33.9	33.9	33.5	33.3	33.7	33.7
H58	500368	657798	24.8	29.5	32.7	34.1	34.1	33.7	33.5	33.9	33.9
H59	501532	659631	25.2	29.9	33.1	34.5	34.5	34.1	33.9	34.3	34.3
H60	501710	656737	24.3	29	32.2	33.6	33.6	33.2	33	33.4	33.4
H61	502518	656978	24.6	29.3	32.5	33.9	33.9	33.5	33.3	33.7	33.7
H62	501744	656751	24.5	29.2	32.4	33.8	33.8	33.4	33.2	33.6	33.6
H63	501154	656963	25.1	29.8	33	34.4	34.4	34	33.8	34.2	34.2
H64	501080	656967	24.8	29.5	32.7	34.1	34.1	33.7	33.5	33.9	33.9
H65	500217	658015	24.1	28.8	32	33.4	33.4	33	32.8	33.2	33.2
H66	500341	657710	24.4	29.1	32.3	33.7	33.7	33.3	33.1	33.5	33.5
H67	501677	656728	24.3	29	32.2	33.6	33.6	33.2	33	33.4	33.4
H68	500908	657072	24.8	29.5	32.7	34.1	34.1	33.7	33.5	33.9	33.9
H69	502814	657237	24.7	29.4	32.6	34	34	33.6	33.4	33.8	33.8
H70	502557	656913	24	28.7	31.9	33.3	33.3	32.9	32.7	33.1	33.1
H71	501768	656721	24.2	28.9	32.1	33.5	33.5	33.1	32.9	33.3	33.3
H72	503144	658544	24.6	29.3	32.5	33.9	33.9	33.5	33.3	33.7	33.7
H73	500307	657573	23.7	28.4	31.6	33	33	32.6	32.4	32.8	32.8
H74	502770	657040	23.8	28.5	31.7	33.1	33.1	32.7	32.5	32.9	32.9
H75	501470	656658	23.5	28.2	31.4	32.8	32.8	32.4	32.2	32.6	32.6
H76	500489	659366	23.1	27.8	31	32.4	32.4	32	31.8	32.2	32.2
H77	500969	659682	23.5	28.2	31.4	32.8	32.8	32.4	32.2	32.6	32.6

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H78	500204	657814	23.6	28.3	31.5	32.9	32.9	32.5	32.3	32.7	32.7
H79	500153	658099	23.7	28.4	31.6	33	33	32.6	32.4	32.8	32.8
H80	501005	656860	23.8	28.5	31.7	33.1	33.1	32.7	32.5	32.9	32.9
H81	502780	659409	23.7	28.4	31.6	33	33	32.6	32.4	32.8	32.8
H82	501199	656728	23.5	28.2	31.4	32.8	32.8	32.4	32.2	32.6	32.6
H83	502860	659401	23.3	28	31.2	32.6	32.6	32.2	32	32.4	32.4
H84	500534	659465	22.9	27.6	30.8	32.2	32.2	31.8	31.6	32	32
H85	500251	657459	23	27.7	30.9	32.3	32.3	31.9	31.7	32.1	32.1
H86	501272	656641	23.1	27.8	31	32.4	32.4	32	31.8	32.2	32.2
H87	500512	659542	22.4	27.1	30.3	31.7	31.7	31.3	31.1	31.5	31.5
H88	500186	657430	22.5	27.2	30.4	31.8	31.8	31.4	31.2	31.6	31.6
H89	500468	659601	21.9	26.6	29.8	31.2	31.2	30.8	30.6	31	31
H90	503117	657153	22.5	27.2	30.4	31.8	31.8	31.4	31.2	31.6	31.6
H91	502990	659465	22.3	27	30.2	31.6	31.6	31.2	31	31.4	31.4
H92	501847	659972	22.6	27.3	30.5	31.9	31.9	31.5	31.3	31.7	31.7
H93	503044	659503	21.9	26.6	29.8	31.2	31.2	30.8	30.6	31	31
H94	501302	656436	21.8	26.5	29.7	31.1	31.1	30.7	30.5	30.9	30.9
H95	500483	659655	21.7	26.4	29.6	31	31	30.6	30.4	30.8	30.8
H96	500030	657504	21.8	26.5	29.7	31.1	31.1	30.7	30.5	30.9	30.9
H97	500116	659240	21.6	26.3	29.5	30.9	30.9	30.5	30.3	30.7	30.7
H98	503135	657004	21.8	26.5	29.7	31.1	31.1	30.7	30.5	30.9	30.9
H99	501267	656415	21.6	26.3	29.5	30.9	30.9	30.5	30.3	30.7	30.7
H100	501382	656380	21.6	26.3	29.5	30.9	30.9	30.5	30.3	30.7	30.7
H101	501742	660048	22.1	26.8	30	31.4	31.4	31	30.8	31.2	31.2
H102	499840	658115	21.5	26.2	29.4	30.8	30.8	30.4	30.2	30.6	30.6
H103	499839	658169	21.5	26.2	29.4	30.8	30.8	30.4	30.2	30.6	30.6
H104	501323	656382	21.5	26.2	29.4	30.8	30.8	30.4	30.2	30.6	30.6
H105	501241	656389	21.4	26.1	29.3	30.7	30.7	30.3	30.1	30.5	30.5
H106	501761	660081	21.9	26.6	29.8	31.2	31.2	30.8	30.6	31	31

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H107	503520	657758	21.8	26.5	29.7	31.1	31.1	30.7	30.5	30.9	30.9
H108	501213	656356	21.1	25.8	29	30.4	30.4	30	29.8	30.2	30.2
H109	501779	660109	21.7	26.4	29.6	31	31	30.6	30.4	30.8	30.8
H110	499792	658063	21.2	25.9	29.1	30.5	30.5	30.1	29.9	30.3	30.3
H111	502338	660030	21.5	26.2	29.4	30.8	30.8	30.4	30.2	30.6	30.6
H112	500173	657026	21	25.7	28.9	30.3	30.3	29.9	29.7	30.1	30.1
H113	503418	657226	21.1	25.8	29	30.4	30.4	30	29.8	30.2	30.2
H114	501621	660209	21.1	25.8	29	30.4	30.4	30	29.8	30.2	30.2
H115	501421	656246	20.8	25.5	28.7	30.1	30.1	29.7	29.5	29.9	29.9
H116	500086	657100	20.8	25.5	28.7	30.1	30.1	29.7	29.5	29.9	29.9
H117	500432	659864	20.5	25.2	28.4	29.8	29.8	29.4	29.2	29.6	29.6
H118	502158	660135	21.2	25.9	29.1	30.5	30.5	30.1	29.9	30.3	30.3
H119	501134	656278	20.6	25.3	28.5	29.9	29.9	29.5	29.3	29.7	29.7
H120	501920	660219	21	25.7	28.9	30.3	30.3	29.9	29.7	30.1	30.1
H121	500695	656437	20.4	25.1	28.3	29.7	29.7	29.3	29.1	29.5	29.5
H122	503475	659361	20.3	25	28.2	29.6	29.6	29.2	29	29.4	29.4
H123	501100	656250	20.3	25	28.2	29.6	29.6	29.2	29	29.4	29.4
H124	500601	656510	20.4	25.1	28.3	29.7	29.7	29.3	29.1	29.5	29.5
H125	500994	656249	20.1	24.8	28	29.4	29.4	29	28.8	29.2	29.2
H126	501472	656103	20	24.7	27.9	29.3	29.3	28.9	28.7	29.1	29.1
H127	503549	659345	20	24.7	27.9	29.3	29.3	28.9	28.7	29.1	29.1
H128	499985	657478	21.4	26.1	29.3	30.7	30.7	30.3	30.1	30.5	30.5
H129	501177	660305	20.1	24.8	28	29.4	29.4	29	28.8	29.2	29.2
H130	499752	657399	20	24.7	27.9	29.3	29.3	28.9	28.7	29.1	29.1
H131	499595	658007	20	24.7	27.9	29.3	29.3	28.9	28.7	29.1	29.1
H132	501016	656203	19.9	24.6	27.8	29.2	29.2	28.8	28.6	29	29
H133	501555	660347	20.2	24.9	28.1	29.5	29.5	29.1	28.9	29.3	29.3
H134	503662	657388	20.2	24.9	28.1	29.5	29.5	29.1	28.9	29.3	29.3
H135	501513	656022	19.5	24.2	27.4	28.8	28.8	28.4	28.2	28.6	28.6

House ID	ING Easting	ING Northing	4m/s dBA	5m/s dBA	6m/s dBA	7m/s dBA	8m/s dBA	9m/s dBA	10m/s dBA	11m/s dBA	12m/s dBA
H136	501915	656014	19.5	24.2	27.4	28.8	28.8	28.4	28.2	28.6	28.6
H137	503692	657399	20.1	24.8	28	29.4	29.4	29	28.8	29.2	29.2
H138	500976	656185	19.7	24.4	27.6	29	29	28.6	28.4	28.8	28.8
H139	503724	657423	20	24.7	27.9	29.3	29.3	28.9	28.7	29.1	29.1
H140	501607	660418	19.9	24.6	27.8	29.2	29.2	28.8	28.6	29	29
H141	501978	655955	19.2	23.9	27.1	28.5	28.5	28.1	27.9	28.3	28.3
H142	499544	657840	19.6	24.3	27.5	28.9	28.9	28.5	28.3	28.7	28.7
H143	503779	657431	19.7	24.4	27.6	29	29	28.6	28.4	28.8	28.8
H144	500810	656224	19.6	24.3	27.5	28.9	28.9	28.5	28.3	28.7	28.7
H145	499828	657009	19.3	24	27.2	28.6	28.6	28.2	28	28.4	28.4
H146	502025	660073	21.8	26.5	29.7	31.1	31.1	30.7	30.5	30.9	30.9

*H1 is an abandoned house which still has an intact roof so has been included in the assessment.

**H2 is a workshop and not considered therefore to be noise sensitive.

10.4.3 Operational Noise Assessment

The assessment was made of the predicted operational noise levels from the Development based on the applicable limits (as compared to the baseline noise levels) described in **Section 10.2.2.1** in the WEDG06 and taking into consideration recent An Bord Pleanála decisions.

As can be seen from **Table 10.17** the predicted noise levels at all receptors are lower than the noise limits in all cases, at all wind speeds, and are therefore compliant with the noise limits and are not significant in terms of EIA.

The predicted noise levels assume all receptors are downwind of turbines to simulate maximum impact.

Table 10.17: Margin between Predicted Noise Levels and Noise Limit of 43dBA

House ID	ING Easting	ING Northing	4m/s dBA	5m/s dBA	6m/s dBA	7m/s dBA	8m/s dBA	9m/s dBA	10m/s dBA	11m/s dBA	12m/s dBA
H1*	502460	658250	-10.7	-6	-2.8	-1.4	-1.4	-1.8	-2	-1.6	-1.6
H2**	502400	657728	-11.5	-6.8	-3.6	-2.2	-2.2	-2.6	-2.8	-2.4	-2.4

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H3	502538	658258	-11.8	-7.1	-3.9	-2.5	-2.5	-2.9	-3.1	-2.7	-2.7
H4	501974	658980	-11.3	-6.6	-3.4	-2	-2	-2.4	-2.6	-2.2	-2.2
H5	501368	657536	-11.5	-6.8	-3.6	-2.2	-2.2	-2.6	-2.8	-2.4	-2.4
H6	501004	658951	-13.8	-9.1	-5.9	-4.5	-4.5	-4.9	-5.1	-4.7	-4.7
H7	500980	658864	-13.4	-8.7	-5.5	-4.1	-4.1	-4.5	-4.7	-4.3	-4.3
H8	502597	658352	-12.7	-8	-4.8	-3.4	-3.4	-3.8	-4	-3.6	-3.6
H9	502520	657769	-12.7	-8	-4.8	-3.4	-3.4	-3.8	-4	-3.6	-3.6
H10	502068	659061	-12.8	-8.1	-4.9	-3.5	-3.5	-3.9	-4.1	-3.7	-3.7
H11	500911	657734	-13.6	-8.9	-5.7	-4.3	-4.3	-4.7	-4.9	-4.5	-4.5
H12	502536	657735	-13.1	-8.4	-5.2	-3.8	-3.8	-4.2	-4.4	-4	-4
H13	502234	659009	-13.2	-8.5	-5.3	-3.9	-3.9	-4.3	-4.5	-4.1	-4.1
H14	502524	657817	-12.5	-7.8	-4.6	-3.2	-3.2	-3.6	-3.8	-3.4	-3.4
H15	500917	658974	-14.7	-10	-6.8	-5.4	-5.4	-5.8	-6	-5.6	-5.6
H16	501999	659116	-13.1	-8.4	-5.2	-3.8	-3.8	-4.2	-4.4	-4	-4
H17	500972	658979	-14.3	-9.6	-6.4	-5	-5	-5.4	-5.6	-5.2	-5.2
H18	501009	659016	-14.3	-9.6	-6.4	-5	-5	-5.4	-5.6	-5.2	-5.2
H19	502647	658743	-14.7	-10	-6.8	-5.4	-5.4	-5.8	-6	-5.6	-5.6
H20	502355	659039	-14.3	-9.6	-6.4	-5	-5	-5.4	-5.6	-5.2	-5.2
H21	502330	659060	-14.3	-9.6	-6.4	-5	-5	-5.4	-5.6	-5.2	-5.2
H22	502266	659125	-14.5	-9.8	-6.6	-5.2	-5.2	-5.6	-5.8	-5.4	-5.4
H23	502626	658821	-14.9	-10.2	-7	-5.6	-5.6	-6	-6.2	-5.8	-5.8
H24	502215	659189	-14.8	-10.1	-6.9	-5.5	-5.5	-5.9	-6.1	-5.7	-5.7
H25	500599	658323	-15.4	-10.7	-7.5	-6.1	-6.1	-6.5	-6.7	-6.3	-6.3
H26	500829	659102	-16.3	-11.6	-8.4	-7	-7	-7.4	-7.6	-7.2	-7.2
H27	500569	658254	-15.7	-11	-7.8	-6.4	-6.4	-6.8	-7	-6.6	-6.6
H28	502558	657360	-15.9	-11.2	-8	-6.6	-6.6	-7	-7.2	-6.8	-6.8
H29	501807	659352	-15.2	-10.5	-7.3	-5.9	-5.9	-6.3	-6.5	-6.1	-6.1
H30	502796	658774	-16.2	-11.5	-8.3	-6.9	-6.9	-7.3	-7.5	-7.1	-7.1
H31	500539	658210	-16	-11.3	-8.1	-6.7	-6.7	-7.1	-7.3	-6.9	-6.9

House ID	ING Easting	ING Northing	4m/s dBA	5m/s dBA	6m/s dBA	7m/s dBA	8m/s dBA	9m/s dBA	10m/s dBA	11m/s dBA	12m/s dBA
H32	500527	658182	-16.1	-11.4	-8.2	-6.8	-6.8	-7.2	-7.4	-7	-7
H33	500513	658146	-16.3	-11.6	-8.4	-7	-7	-7.4	-7.6	-7.2	-7.2
H34	501249	659412	-16.5	-11.8	-8.6	-7.2	-7.2	-7.6	-7.8	-7.4	-7.4
H35	502269	659318	-16.2	-11.5	-8.3	-6.9	-6.9	-7.3	-7.5	-7.1	-7.1
H36	500683	657529	-16.7	-12	-8.8	-7.4	-7.4	-7.8	-8	-7.6	-7.6
H37	500488	658211	-16.5	-11.8	-8.6	-7.2	-7.2	-7.6	-7.8	-7.4	-7.4
H38	502923	658648	-16.8	-12.1	-8.9	-7.5	-7.5	-7.9	-8.1	-7.7	-7.7
H39	500700	657460	-17	-12.3	-9.1	-7.7	-7.7	-8.1	-8.3	-7.9	-7.9
H40	500437	658130	-17	-12.3	-9.1	-7.7	-7.7	-8.1	-8.3	-7.9	-7.9
H41	500761	657365	-17.1	-12.4	-9.2	-7.8	-7.8	-8.2	-8.4	-8	-8
H42	502437	659304	-16.9	-12.2	-9	-7.6	-7.6	-8	-8.2	-7.8	-7.8
H43	502205	656909	-17.8	-13.1	-9.9	-8.5	-8.5	-8.9	-9.1	-8.7	-8.7
H44	502997	658597	-17.3	-12.6	-9.4	-8	-8	-8.4	-8.6	-8.2	-8.2
H45	500855	657246	-17.3	-12.6	-9.4	-8	-8	-8.4	-8.6	-8.2	-8.2
H46	500477	657678	-17.7	-13	-9.8	-8.4	-8.4	-8.8	-9	-8.6	-8.6
H47	500461	657717	-17.7	-13	-9.8	-8.4	-8.4	-8.8	-9	-8.6	-8.6
H48	500450	657743	-17.7	-13	-9.8	-8.4	-8.4	-8.8	-9	-8.6	-8.6
H49	500505	657596	-17.8	-13.1	-9.9	-8.5	-8.5	-8.9	-9.1	-8.7	-8.7
H50	502404	656964	-18	-13.3	-10.1	-8.7	-8.7	-9.1	-9.3	-8.9	-8.9
H51	501340	659545	-17.4	-12.7	-9.5	-8.1	-8.1	-8.5	-8.7	-8.3	-8.3
H52	502042	656845	-18	-13.3	-10.1	-8.7	-8.7	-9.1	-9.3	-8.9	-8.9
H53	501906	656820	-18	-13.3	-10.1	-8.7	-8.7	-9.1	-9.3	-8.9	-8.9
H54	501855	656799	-18.2	-13.5	-10.3	-8.9	-8.9	-9.3	-9.5	-9.1	-9.1
H55	501358	659584	-17.6	-12.9	-9.7	-8.3	-8.3	-8.7	-8.9	-8.5	-8.5
H56	500379	657834	-18	-13.3	-10.1	-8.7	-8.7	-9.1	-9.3	-8.9	-8.9
H57	501828	656771	-18.4	-13.7	-10.5	-9.1	-9.1	-9.5	-9.7	-9.3	-9.3
H58	500368	657798	-18.2	-13.5	-10.3	-8.9	-8.9	-9.3	-9.5	-9.1	-9.1
H59	501532	659631	-17.8	-13.1	-9.9	-8.5	-8.5	-8.9	-9.1	-8.7	-8.7
H60	501710	656737	-18.7	-14	-10.8	-9.4	-9.4	-9.8	-10	-9.6	-9.6

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H61	502518	656978	-18.4	-13.7	-10.5	-9.1	-9.1	-9.5	-9.7	-9.3	-9.3
H62	501744	656751	-18.5	-13.8	-10.6	-9.2	-9.2	-9.6	-9.8	-9.4	-9.4
H63	501154	656963	-17.9	-13.2	-10	-8.6	-8.6	-9	-9.2	-8.8	-8.8
H64	501080	656967	-18.2	-13.5	-10.3	-8.9	-8.9	-9.3	-9.5	-9.1	-9.1
H65	500217	658015	-18.9	-14.2	-11	-9.6	-9.6	-10	-10.2	-9.8	-9.8
H66	500341	657710	-18.6	-13.9	-10.7	-9.3	-9.3	-9.7	-9.9	-9.5	-9.5
H67	501677	656728	-18.7	-14	-10.8	-9.4	-9.4	-9.8	-10	-9.6	-9.6
H68	500908	657072	-18.2	-13.5	-10.3	-8.9	-8.9	-9.3	-9.5	-9.1	-9.1
H69	502814	657237	-18.3	-13.6	-10.4	-9	-9	-9.4	-9.6	-9.2	-9.2
H70	502557	656913	-19	-14.3	-11.1	-9.7	-9.7	-10.1	-10.3	-9.9	-9.9
H71	501768	656721	-18.8	-14.1	-10.9	-9.5	-9.5	-9.9	-10.1	-9.7	-9.7
H72	503144	658544	-18.4	-13.7	-10.5	-9.1	-9.1	-9.5	-9.7	-9.3	-9.3
H73	500307	657573	-19.3	-14.6	-11.4	-10	-10	-10.4	-10.6	-10.2	-10.2
H74	502770	657040	-19.2	-14.5	-11.3	-9.9	-9.9	-10.3	-10.5	-10.1	-10.1
H75	501470	656658	-19.5	-14.8	-11.6	-10.2	-10.2	-10.6	-10.8	-10.4	-10.4
H76	500489	659366	-19.9	-15.2	-12	-10.6	-10.6	-11	-11.2	-10.8	-10.8
H77	500969	659682	-19.5	-14.8	-11.6	-10.2	-10.2	-10.6	-10.8	-10.4	-10.4
H78	500204	657814	-19.4	-14.7	-11.5	-10.1	-10.1	-10.5	-10.7	-10.3	-10.3
H79	500153	658099	-19.3	-14.6	-11.4	-10	-10	-10.4	-10.6	-10.2	-10.2
H80	501005	656860	-19.2	-14.5	-11.3	-9.9	-9.9	-10.3	-10.5	-10.1	-10.1
H81	502780	659409	-19.3	-14.6	-11.4	-10	-10	-10.4	-10.6	-10.2	-10.2
H82	501199	656728	-19.5	-14.8	-11.6	-10.2	-10.2	-10.6	-10.8	-10.4	-10.4
H83	502860	659401	-19.7	-15	-11.8	-10.4	-10.4	-10.8	-11	-10.6	-10.6
H84	500534	659465	-20.1	-15.4	-12.2	-10.8	-10.8	-11.2	-11.4	-11	-11
H85	500251	657459	-20	-15.3	-12.1	-10.7	-10.7	-11.1	-11.3	-10.9	-10.9
H86	501272	656641	-19.9	-15.2	-12	-10.6	-10.6	-11	-11.2	-10.8	-10.8
H87	500512	659542	-20.6	-15.9	-12.7	-11.3	-11.3	-11.7	-11.9	-11.5	-11.5
H88	500186	657430	-20.5	-15.8	-12.6	-11.2	-11.2	-11.6	-11.8	-11.4	-11.4
H89	500468	659601	-21.1	-16.4	-13.2	-11.8	-11.8	-12.2	-12.4	-12	-12

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H90	503117	657153	-20.5	-15.8	-12.6	-11.2	-11.2	-11.6	-11.8	-11.4	-11.4
H91	502990	659465	-20.7	-16	-12.8	-11.4	-11.4	-11.8	-12	-11.6	-11.6
H92	501847	659972	-20.4	-15.7	-12.5	-11.1	-11.1	-11.5	-11.7	-11.3	-11.3
H93	503044	659503	-21.1	-16.4	-13.2	-11.8	-11.8	-12.2	-12.4	-12	-12
H94	501302	656436	-21.2	-16.5	-13.3	-11.9	-11.9	-12.3	-12.5	-12.1	-12.1
H95	500483	659655	-21.3	-16.6	-13.4	-12	-12	-12.4	-12.6	-12.2	-12.2
H96	500030	657504	-21.2	-16.5	-13.3	-11.9	-11.9	-12.3	-12.5	-12.1	-12.1
H97	500116	659240	-21.4	-16.7	-13.5	-12.1	-12.1	-12.5	-12.7	-12.3	-12.3
H98	503135	657004	-21.2	-16.5	-13.3	-11.9	-11.9	-12.3	-12.5	-12.1	-12.1
H99	501267	656415	-21.4	-16.7	-13.5	-12.1	-12.1	-12.5	-12.7	-12.3	-12.3
H100	501382	656380	-21.4	-16.7	-13.5	-12.1	-12.1	-12.5	-12.7	-12.3	-12.3
H101	501742	660048	-20.9	-16.2	-13	-11.6	-11.6	-12	-12.2	-11.8	-11.8
H102	499840	658115	-21.5	-16.8	-13.6	-12.2	-12.2	-12.6	-12.8	-12.4	-12.4
H103	499839	658169	-21.5	-16.8	-13.6	-12.2	-12.2	-12.6	-12.8	-12.4	-12.4
H104	501323	656382	-21.5	-16.8	-13.6	-12.2	-12.2	-12.6	-12.8	-12.4	-12.4
H105	501241	656389	-21.6	-16.9	-13.7	-12.3	-12.3	-12.7	-12.9	-12.5	-12.5
H106	501761	660081	-21.1	-16.4	-13.2	-11.8	-11.8	-12.2	-12.4	-12	-12
H107	503520	657758	-21.2	-16.5	-13.3	-11.9	-11.9	-12.3	-12.5	-12.1	-12.1
H108	501213	656356	-21.9	-17.2	-14	-12.6	-12.6	-13	-13.2	-12.8	-12.8
H109	501779	660109	-21.3	-16.6	-13.4	-12	-12	-12.4	-12.6	-12.2	-12.2
H110	499792	658063	-21.8	-17.1	-13.9	-12.5	-12.5	-12.9	-13.1	-12.7	-12.7
H111	502338	660030	-21.5	-16.8	-13.6	-12.2	-12.2	-12.6	-12.8	-12.4	-12.4
H112	500173	657026	-22	-17.3	-14.1	-12.7	-12.7	-13.1	-13.3	-12.9	-12.9
H113	503418	657226	-21.9	-17.2	-14	-12.6	-12.6	-13	-13.2	-12.8	-12.8
H114	501621	660209	-21.9	-17.2	-14	-12.6	-12.6	-13	-13.2	-12.8	-12.8
H115	501421	656246	-22.2	-17.5	-14.3	-12.9	-12.9	-13.3	-13.5	-13.1	-13.1
H116	500086	657100	-22.2	-17.5	-14.3	-12.9	-12.9	-13.3	-13.5	-13.1	-13.1
H117	500432	659864	-22.5	-17.8	-14.6	-13.2	-13.2	-13.6	-13.8	-13.4	-13.4
H118	502158	660135	-21.8	-17.1	-13.9	-12.5	-12.5	-12.9	-13.1	-12.7	-12.7

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H119	501134	656278	-22.4	-17.7	-14.5	-13.1	-13.1	-13.5	-13.7	-13.3	-13.3
H120	501920	660219	-22	-17.3	-14.1	-12.7	-12.7	-13.1	-13.3	-12.9	-12.9
H121	500695	656437	-22.6	-17.9	-14.7	-13.3	-13.3	-13.7	-13.9	-13.5	-13.5
H122	503475	659361	-22.7	-18	-14.8	-13.4	-13.4	-13.8	-14	-13.6	-13.6
H123	501100	656250	-22.7	-18	-14.8	-13.4	-13.4	-13.8	-14	-13.6	-13.6
H124	500601	656510	-22.6	-17.9	-14.7	-13.3	-13.3	-13.7	-13.9	-13.5	-13.5
H125	500994	656249	-22.9	-18.2	-15	-13.6	-13.6	-14	-14.2	-13.8	-13.8
H126	501472	656103	-23	-18.3	-15.1	-13.7	-13.7	-14.1	-14.3	-13.9	-13.9
H127	503549	659345	-23	-18.3	-15.1	-13.7	-13.7	-14.1	-14.3	-13.9	-13.9
H128	499985	657478	-21.6	-16.9	-13.7	-12.3	-12.3	-12.7	-12.9	-12.5	-12.5
H129	501177	660305	-22.9	-18.2	-15	-13.6	-13.6	-14	-14.2	-13.8	-13.8
H130	499752	657399	-23	-18.3	-15.1	-13.7	-13.7	-14.1	-14.3	-13.9	-13.9
H131	499595	658007	-23	-18.3	-15.1	-13.7	-13.7	-14.1	-14.3	-13.9	-13.9
H132	501016	656203	-23.1	-18.4	-15.2	-13.8	-13.8	-14.2	-14.4	-14	-14
H133	501555	660347	-22.8	-18.1	-14.9	-13.5	-13.5	-13.9	-14.1	-13.7	-13.7
H134	503662	657388	-22.8	-18.1	-14.9	-13.5	-13.5	-13.9	-14.1	-13.7	-13.7
H135	501513	656022	-23.5	-18.8	-15.6	-14.2	-14.2	-14.6	-14.8	-14.4	-14.4
H136	501915	656014	-23.5	-18.8	-15.6	-14.2	-14.2	-14.6	-14.8	-14.4	-14.4
H137	503692	657399	-22.9	-18.2	-15	-13.6	-13.6	-14	-14.2	-13.8	-13.8
H138	500976	656185	-23.3	-18.6	-15.4	-14	-14	-14.4	-14.6	-14.2	-14.2
H139	503724	657423	-23	-18.3	-15.1	-13.7	-13.7	-14.1	-14.3	-13.9	-13.9
H140	501607	660418	-23.1	-18.4	-15.2	-13.8	-13.8	-14.2	-14.4	-14	-14
H141	501978	655955	-23.8	-19.1	-15.9	-14.5	-14.5	-14.9	-15.1	-14.7	-14.7
H142	499544	657840	-23.4	-18.7	-15.5	-14.1	-14.1	-14.5	-14.7	-14.3	-14.3
H143	503779	657431	-23.3	-18.6	-15.4	-14	-14	-14.4	-14.6	-14.2	-14.2
H144	500810	656224	-23.4	-18.7	-15.5	-14.1	-14.1	-14.5	-14.7	-14.3	-14.3
H145	499828	657009	-23.7	-19	-15.8	-14.4	-14.4	-14.8	-15	-14.6	-14.6
H146	502025	660073	-21.2	-16.5	-13.3	-11.9	-11.9	-12.3	-12.5	-12.1	-12.1

*H1 is an abandoned house which still has an intact roof so has been included in the assessment.

**H2 is a workshop and not considered therefore to be noise sensitive.

A noise contour map of the cumulative effects of all four turbines is presented in **Figure 10.2** with a maximum sound power output at a wind speed of 7ms^{-1} at 10m height. The contour map in **Figure 10.2** assumes that all turbines are simultaneously downwind at the same time to each location which results in an overprediction of the noise levels.

Charts 10.1 and **10.2** of this section plots the derived background noise levels, background plus 5 trendline with the predicted noise levels against a noise limit of 43dB(A).

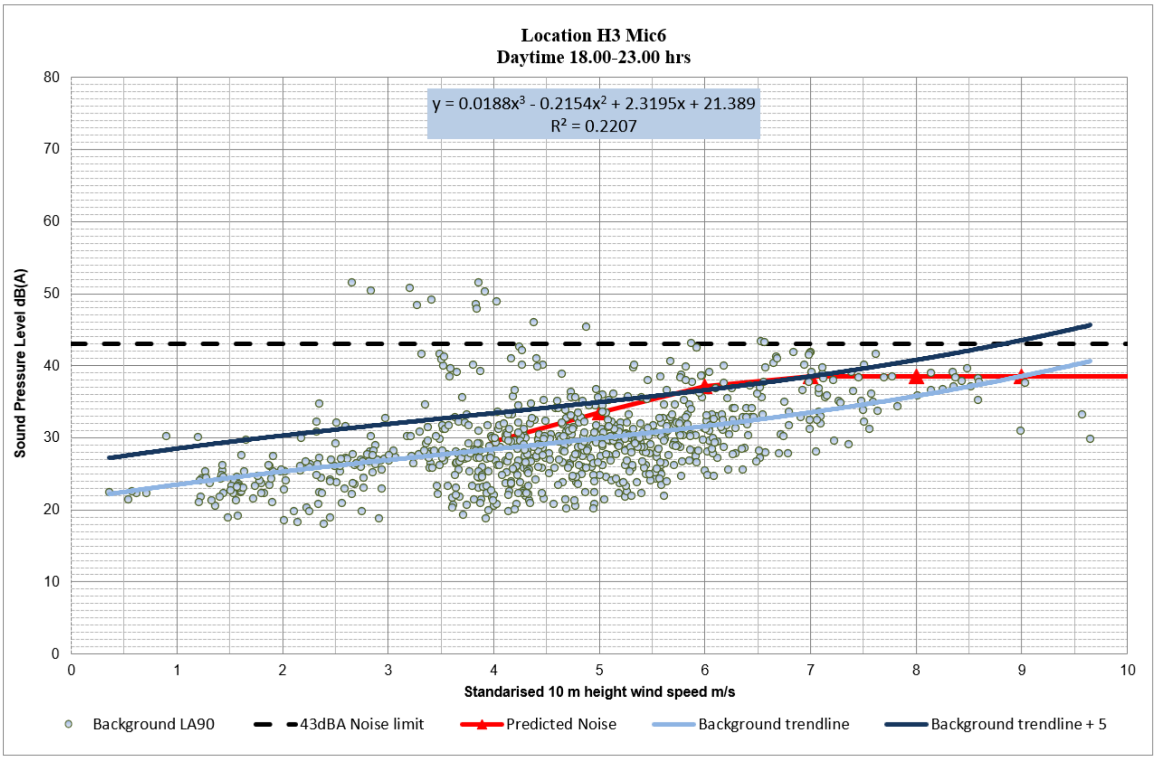

Chart 10.1: H3 for daytime, background noise level, predicted level and assessment limit

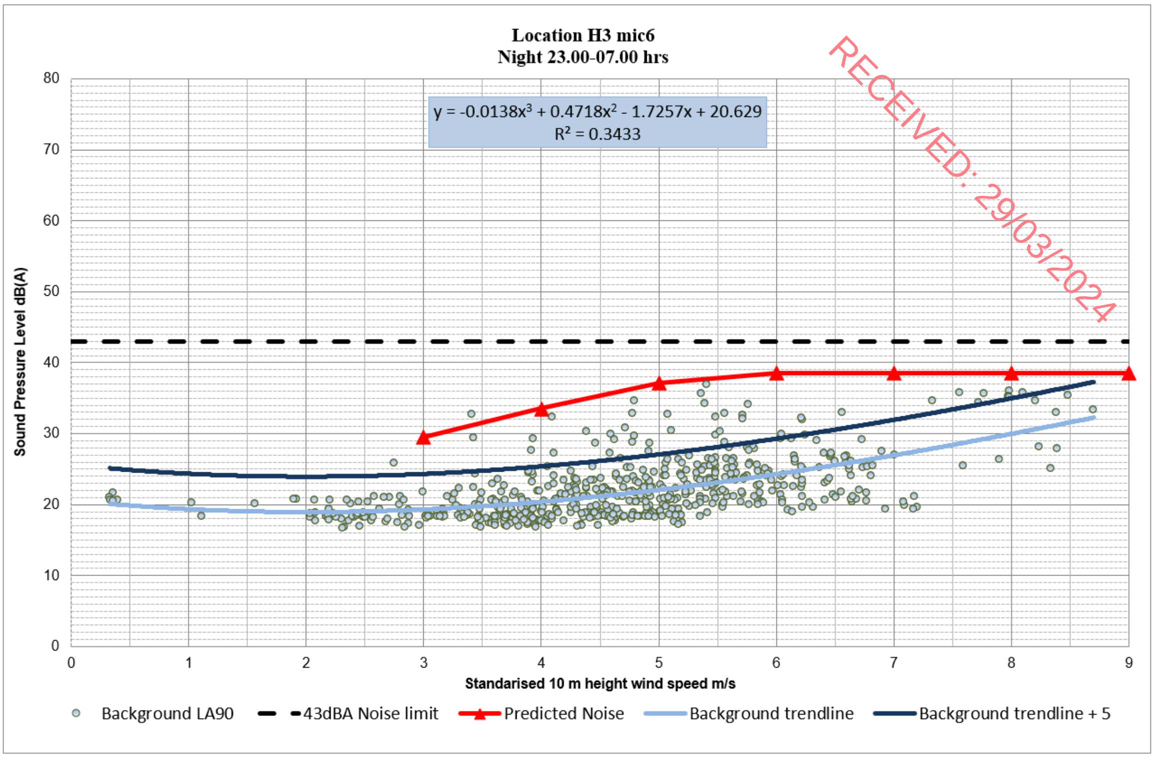

Chart 10.2: H3 for night-time, background noise level, predicted level and assessment limit

10.4.3.1 Cumulative Effects Assessment

An assessment of the cumulative effects of noise from the Development together with both the nearby six turbine operational Tullabrack Wind Farm, and seven turbine operational Ballykett Wind Farm, located west-northwest of the Development has been undertaken.

10.4.3.2 Cumulative assessment locations

The same receptor locations used for the Development are also used in the cumulative assessment. The assessment is a worst-case scenario with the assumption made that the predicted noise levels to receptors are downwind from both wind farms and individual turbines are at the same time, a scenario that cannot occur in practice.

10.4.3.3 Noise Limits

The noise limits are the same as that used in **Table 10.13**, a limit of LA90 43dB for day and night.

10.4.3.4 Cumulative Noise Levels

Table 10.18 gives details of the predicted cumulative noise levels for the nearest receptors to the development.

Table 10.18: Predicted Cumulative Noise Levels for each Receptor

House ID	ING Easting	ING Northing	4m/s dBA	5m/s dBA	6m/s dBA	7m/s dBA	8m/s dBA	9m/s dBA	10m/s dBA	11m/s dBA	12m/s dBA
H1*	502460	658250	32.5	37.1	40.3	41.7	41.7	41.4	41.2	41.6	41.6
H2**	502400	657728	31.7	36.3	39.5	40.9	41.0	40.6	40.4	40.8	40.8
H3	502538	658258	31.5	36.0	39.2	40.6	40.7	40.3	40.1	40.5	40.5
H4	501974	658980	32.1	36.6	39.8	41.2	41.3	40.9	40.7	41.1	41.1
H5	501368	657536	31.9	36.3	39.6	41.0	41.1	40.7	40.5	40.9	40.9
H6	501004	658951	31.0	34.6	38.1	39.5	39.7	39.5	39.4	39.7	39.7
H7	500980	658864	31.3	35.0	38.4	39.9	40.1	39.9	39.8	40.1	40.1
H8	502597	658352	30.6	35.1	38.4	39.8	39.8	39.4	39.3	39.6	39.6
H9	502520	657769	30.6	35.1	38.3	39.7	39.8	39.4	39.2	39.6	39.6
H10	502068	659061	30.8	35.1	38.4	39.8	39.9	39.5	39.3	39.7	39.7
H11	500911	657734	30.4	34.4	37.8	39.2	39.4	39.1	38.9	39.3	39.3
H12	502536	657735	30.2	34.7	38.0	39.4	39.4	39.0	38.9	39.2	39.2
H13	502234	659009	30.3	34.7	37.9	39.3	39.4	39.1	38.9	39.3	39.3
H14	502524	657817	30.8	35.3	38.5	39.9	40.0	39.6	39.4	39.8	39.8
H15	500917	658974	30.7	34.0	37.5	38.9	39.3	39.1	39.0	39.3	39.3
H16	501999	659116	30.6	34.8	38.1	39.5	39.6	39.3	39.1	39.5	39.5
H17	500972	658979	30.8	34.2	37.7	39.2	39.5	39.3	39.2	39.4	39.4
H18	501009	659016	30.8	34.2	37.7	39.1	39.4	39.3	39.1	39.4	39.4
H19	502647	658743	28.8	33.2	36.5	37.9	37.9	37.6	37.4	37.8	37.8
H20	502355	659039	29.3	33.6	36.9	38.3	38.4	38.1	37.9	38.3	38.3
H21	502330	659060	29.3	33.6	36.9	38.3	38.4	38.1	37.9	38.3	38.3
H22	502266	659125	29.2	33.4	36.7	38.2	38.3	37.9	37.8	38.1	38.1
H23	502626	658821	28.7	33.0	36.3	37.7	37.8	37.4	37.3	37.6	37.6
H24	502215	659189	29.0	33.2	36.5	37.9	38.0	37.7	37.5	37.9	37.9
H25	500599	658323	30.3	33.4	37.1	38.6	39.0	38.9	38.8	39.1	39.1
H26	500829	659102	30.2	32.9	36.6	38.1	38.6	38.5	38.4	38.6	38.6
H27	500569	658254	30.1	33.2	36.9	38.3	38.7	38.7	38.6	38.8	38.8
H28	502558	657360	27.6	32.0	35.2	36.7	36.7	36.4	36.2	36.6	36.6

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H29	501807	659352	29.0	33.0	36.3	37.7	37.9	37.6	37.5	37.8	37.8
H30	502796	658774	27.5	31.7	35.0	36.4	36.5	36.2	36.0	36.4	36.4
H31	500539	658210	29.9	32.9	36.7	38.1	38.6	38.5	38.4	38.6	38.6
H32	500527	658182	29.8	32.8	36.6	38.0	38.5	38.4	38.3	38.6	38.6
H33	500513	658146	29.6	32.6	36.4	37.8	38.3	38.2	38.1	38.4	38.4
H34	501249	659412	29.2	32.3	35.8	37.3	37.6	37.5	37.4	37.6	37.6
H35	502269	659318	27.8	31.9	35.2	36.6	36.8	36.5	36.3	36.6	36.6
H36	500683	657529	28.1	31.7	35.2	36.6	36.9	36.8	36.6	36.9	36.9
H37	500488	658211	29.8	32.6	36.5	37.9	38.4	38.4	38.3	38.5	38.5
H38	502923	658648	26.9	31.1	34.4	35.8	35.9	35.6	35.4	35.8	35.8
H39	500700	657460	27.7	31.4	34.9	36.3	36.6	36.4	36.3	36.6	36.6
H40	500437	658130	29.5	32.2	36.1	37.5	38.0	38.1	38.0	38.2	38.2
H41	500761	657365	27.5	31.2	34.7	36.1	36.4	36.2	36.1	36.4	36.4
H42	502437	659304	27.2	31.2	34.5	36.0	36.1	35.8	35.6	36.0	36.0
H43	502205	656909	25.7	30.1	33.4	34.8	34.9	34.5	34.4	34.7	34.7
H44	502997	658597	26.4	30.7	34.0	35.4	35.5	35.2	35.0	35.3	35.3
H45	500855	657246	27.2	31.0	34.4	35.9	36.1	35.9	35.7	36.0	36.0
H46	500477	657678	28.0	31.1	34.8	36.2	36.7	36.6	36.5	36.7	36.7
H47	500461	657717	28.1	31.2	34.9	36.3	36.8	36.7	36.6	36.8	36.8
H48	500450	657743	28.1	31.2	34.9	36.3	36.8	36.8	36.6	36.9	36.9
H49	500505	657596	27.8	31.0	34.6	36.1	36.5	36.4	36.3	36.5	36.5
H50	502404	656964	25.7	29.9	33.3	34.7	34.8	34.5	34.3	34.6	34.6
H51	501340	659545	28.5	31.5	35.1	36.5	36.9	36.8	36.6	36.9	36.9
H52	502042	656845	25.8	30.0	33.3	34.7	34.8	34.5	34.4	34.7	34.7
H53	501906	656820	25.8	30.0	33.3	34.7	34.9	34.6	34.4	34.7	34.7
H54	501855	656799	25.7	29.8	33.2	34.6	34.7	34.4	34.2	34.6	34.6
H55	501358	659584	28.4	31.3	34.9	36.4	36.7	36.6	36.5	36.7	36.7
H56	500379	657834	28.4	31.1	35.0	36.4	37.0	37.0	36.9	37.1	37.1
H57	501828	656771	25.5	29.6	33.0	34.4	34.5	34.3	34.1	34.4	34.4

House ID	ING Easting	ING Northing	4m/s dBA	5m/s dBA	6m/s dBA	7m/s dBA	8m/s dBA	9m/s dBA	10m/s dBA	11m/s dBA	12m/s dBA
H58	500368	657798	28.2	31.0	34.8	36.3	36.8	36.8	36.7	36.9	36.9
H59	501532	659631	27.9	31.0	34.5	36.0	36.3	36.1	36.0	36.3	36.3
H60	501710	656737	25.3	29.4	32.7	34.1	34.3	34.0	33.9	34.2	34.2
H61	502518	656978	25.3	29.5	32.9	34.3	34.4	34.1	33.9	34.3	34.3
H62	501744	656751	25.4	29.5	32.9	34.3	34.5	34.2	34.0	34.3	34.3
H63	501154	656963	26.3	30.3	33.7	35.1	35.3	35.0	34.9	35.2	35.2
H64	501080	656967	26.1	30.0	33.4	34.8	35.1	34.8	34.7	35.0	35.0
H65	500217	658015	28.9	31.1	35.2	36.7	37.4	37.5	37.4	37.6	37.6
H66	500341	657710	27.9	30.6	34.5	35.9	36.4	36.5	36.4	36.6	36.6
H67	501677	656728	25.3	29.4	32.7	34.1	34.3	34.0	33.9	34.2	34.2
H68	500908	657072	26.3	30.1	33.6	35.0	35.2	35.0	34.9	35.2	35.2
H69	502814	657237	25.3	29.6	32.9	34.3	34.4	34.1	33.9	34.3	34.3
H70	502557	656913	24.8	29.0	32.3	33.7	33.8	33.5	33.4	33.7	33.7
H71	501768	656721	25.2	29.3	32.6	34.0	34.2	33.9	33.7	34.1	34.1
H72	503144	658544	25.4	29.6	32.9	34.3	34.4	34.1	34.0	34.3	34.3
H73	500307	657573	27.2	29.9	33.8	35.2	35.8	35.8	35.7	35.9	35.9
H74	502770	657040	24.5	28.8	32.1	33.5	33.6	33.3	33.1	33.5	33.5
H75	501470	656658	24.7	28.7	32.1	33.5	33.7	33.4	33.3	33.6	33.6
H76	500489	659366	31.5	32.5	36.7	38.2	39.1	39.2	39.2	39.3	39.3
H77	500969	659682	29.2	31.0	34.8	36.3	36.9	36.9	36.8	37.0	37.0
H78	500204	657814	28.1	30.4	34.4	35.9	36.5	36.6	36.6	36.7	36.7
H79	500153	658099	29.3	31.1	35.4	36.8	37.6	37.8	37.7	37.9	37.9
H80	501005	656860	25.4	29.1	32.6	34.0	34.2	34.0	33.9	34.2	34.2
H81	502780	659409	25.0	28.9	32.3	33.7	33.9	33.6	33.5	33.8	33.8
H82	501199	656728	24.9	28.7	32.2	33.6	33.8	33.6	33.5	33.8	33.8
H83	502860	659401	24.7	28.5	31.9	33.3	33.5	33.3	33.1	33.4	33.4
H84	500534	659465	31.4	32.4	36.4	38.0	38.8	38.9	38.9	39.0	39.0
H85	500251	657459	26.7	29.3	33.2	34.7	35.2	35.3	35.2	35.4	35.4
H86	501272	656641	24.5	28.3	31.8	33.2	33.4	33.2	33.1	33.4	33.4

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H87	500512	659542	31.7	32.6	36.6	38.2	39.0	39.1	39.1	39.1	39.1
H88	500186	657430	26.4	29.0	32.9	34.3	34.9	35.0	34.9	35.1	35.1
H89	500468	659601	31.8	32.6	36.6	38.2	39.0	39.1	39.1	39.2	39.2
H90	503117	657153	23.2	27.5	30.8	32.2	32.3	32.0	31.8	32.2	32.2
H91	502990	659465	23.9	27.6	31.0	32.4	32.6	32.4	32.3	32.6	32.6
H92	501847	659972	25.8	28.7	32.2	33.7	34.1	33.9	33.8	34.1	34.1
H93	503044	659503	23.5	27.2	30.6	32.1	32.3	32.1	31.9	32.2	32.2
H94	501302	656436	23.5	27.1	30.6	32.0	32.3	32.1	32.0	32.3	32.3
H95	500483	659655	32.2	32.9	36.9	38.5	39.3	39.4	39.4	39.4	39.4
H96	500030	657504	26.6	28.7	32.8	34.3	35.0	35.1	35.0	35.2	35.2
H97	500116	659240	34.3	34.7	39.3	40.8	41.9	42.2	42.2	42.2	42.2
H98	503135	657004	22.5	26.8	30.1	31.5	31.6	31.3	31.1	31.5	31.5
H99	501267	656415	23.3	27.0	30.5	31.9	32.2	32.0	31.8	32.1	32.1
H100	501382	656380	23.2	26.9	30.4	31.8	32.1	31.9	31.7	32.0	32.0
H101	501742	660048	25.8	28.4	32.0	33.5	33.9	33.8	33.7	33.9	33.9
H102	499840	658115	30.0	31.0	35.7	37.2	38.2	38.5	38.5	38.6	38.6
H103	499839	658169	30.5	31.5	36.3	37.7	38.8	39.1	39.1	39.1	39.1
H104	501323	656382	23.2	26.8	30.3	31.8	32.0	31.8	31.7	32.0	32.0
H105	501241	656389	23.2	26.8	30.3	31.7	32.0	31.8	31.7	32.0	32.0
H106	501761	660081	25.6	28.3	31.9	33.3	33.8	33.7	33.6	33.8	33.8
H107	503520	657758	22.6	26.8	30.1	31.5	31.7	31.4	31.2	31.5	31.5
H108	501213	656356	23.0	26.5	30.1	31.5	31.8	31.6	31.5	31.7	31.7
H109	501779	660109	25.5	28.1	31.7	33.2	33.6	33.5	33.4	33.6	33.6
H110	499792	658063	30.0	31.0	35.8	37.2	38.3	38.6	38.6	38.7	38.7
H111	502338	660030	24.2	27.3	30.8	32.3	32.6	32.4	32.3	32.6	32.6
H112	500173	657026	24.7	27.3	31.2	32.7	33.2	33.3	33.2	33.4	33.4
H113	503418	657226	21.8	26.1	29.4	30.8	30.9	30.6	30.4	30.8	30.8
H114	501621	660209	25.9	28.1	31.7	33.2	33.8	33.7	33.6	33.8	33.8
H115	501421	656246	22.5	26.1	29.6	31.1	31.3	31.1	31.0	31.3	31.3

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H116	500086	657100	24.9	27.4	31.3	32.8	33.4	33.4	33.3	33.5	33.5
H117	500432	659864	32.9	33.4	37.2	38.9	39.7	39.8	39.8	39.8	39.8
H118	502158	660135	24.4	27.3	30.8	32.3	32.7	32.6	32.4	32.7	32.7
H119	501134	656278	22.6	26.1	29.6	31.1	31.4	31.2	31.1	31.4	31.4
H120	501920	660219	24.9	27.4	31.0	32.5	33.0	32.9	32.8	33.0	33.0
H121	500695	656437	23.0	26.2	29.8	31.2	31.7	31.6	31.4	31.7	31.7
H122	503475	659361	22.0	25.7	29.1	30.5	30.8	30.6	30.4	30.7	30.7
H123	501100	656250	22.4	25.8	29.4	30.8	31.2	31.0	30.9	31.2	31.2
H124	500601	656510	23.1	26.2	29.9	31.3	31.7	31.6	31.5	31.8	31.8
H125	500994	656249	22.3	25.7	29.3	30.7	31.1	30.9	30.8	31.1	31.1
H126	501472	656103	21.7	25.4	28.9	30.3	30.6	30.4	30.3	30.6	30.6
H127	503549	659345	21.8	25.4	28.8	30.3	30.5	30.3	30.1	30.4	30.4
H128	499985	657478	26.5	28.5	32.7	34.1	34.9	35.0	34.9	35.1	35.1
H129	501177	660305	27.4	28.7	32.5	34.1	34.7	34.8	34.7	34.8	34.8
H130	499752	657399	26.3	27.9	32.3	33.7	34.6	34.8	34.7	34.8	34.8
H131	499595	658007	29.9	30.7	35.6	37.0	38.1	38.5	38.5	38.5	38.5
H132	501016	656203	22.2	25.5	29.1	30.5	30.9	30.8	30.6	30.9	30.9
H133	501555	660347	25.6	27.5	31.3	32.8	33.3	33.3	33.2	33.4	33.4
H134	503662	657388	21.0	25.2	28.5	29.9	30.1	29.8	29.6	29.9	29.9
H135	501513	656022	21.3	24.9	28.4	29.8	30.1	30.0	29.8	30.1	30.1
H136	501915	656014	20.9	24.7	28.2	29.6	29.9	29.7	29.5	29.8	29.8
H137	503692	657399	20.9	25.1	28.4	29.8	30.0	29.7	29.5	29.8	29.8
H138	500976	656185	22.1	25.3	29.0	30.4	30.8	30.6	30.5	30.8	30.8
H139	503724	657423	20.8	25.0	28.3	29.7	29.9	29.6	29.4	29.8	29.8
H140	501607	660418	25.4	27.3	31.0	32.5	33.1	33.1	33.0	33.2	33.2
H141	501978	655955	20.7	24.5	27.9	29.3	29.6	29.4	29.2	29.5	29.5
H142	499544	657840	28.5	29.5	34.2	35.7	36.8	37.1	37.1	37.1	37.1
H143	503779	657431	20.5	24.7	28.0	29.4	29.5	29.2	29.1	29.4	29.4
H144	500810	656224	22.1	25.3	29.0	30.4	30.8	30.7	30.6	30.8	30.8

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H145	499828	657009	24.2	26.3	30.4	31.9	32.6	32.7	32.6	32.8	32.8
H146	502025	660073	29.6	30.8	35.5	36.9	37.9	38.2	38.2	38.3	38.3

*H1 is an abandoned house which still has an intact roof and has been included in the assessment.

**H2 is a workshop and not considered therefore to be noise sensitive.

A noise contour map of the cumulative effects of all turbines is presented in **Figure 10.2** with a maximum sound power output at a wind speed of 8m/s at 10m height. The contour map assumes that all turbines are simultaneously downwind at the same time to each location which results in an overprediction of the noise levels.

10.4.3.5 Cumulative Noise assessment

The assessment was made with predicted operational noise levels from the Development against noise limits in the WEDG06. All predicted noise levels are within the noise limits. **Table 10.19** gives the difference between the predicted cumulative noise levels in Table **10.18** and noise limits for each receptor. A negative margin indicates that the predicted noise levels are within the lower fixed 43dBA limit, which means the levels are within the day and night limits.

Table 10.19: Margin between Predicted Cumulative Noise Levels and Lower Fixed Limit of 43dBA

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H1*	502460	658250	-10.5	-5.9	-2.7	-1.3	-1.3	-1.6	-1.8	-1.4	-1.4
H2**	502400	657728	-11.3	-6.7	-3.5	-2.1	-2.0	-2.4	-2.6	-2.2	-2.2
H3	502538	658258	-11.5	-7.0	-3.8	-2.4	-2.3	-2.7	-2.9	-2.5	-2.5
H4	501974	658980	-10.9	-6.4	-3.2	-1.8	-1.7	-2.1	-2.3	-1.9	-1.9
H5	501368	657536	-11.1	-6.7	-3.4	-2.0	-1.9	-2.3	-2.5	-2.1	-2.1
H6	501004	658951	-12.0	-8.4	-4.9	-3.5	-3.3	-3.5	-3.6	-3.3	-3.3
H7	500980	658864	-11.7	-8.0	-4.6	-3.1	-2.9	-3.1	-3.2	-2.9	-2.9
H8	502597	658352	-12.4	-7.9	-4.6	-3.2	-3.2	-3.6	-3.7	-3.4	-3.4
H9	502520	657769	-12.4	-7.9	-4.7	-3.3	-3.2	-3.6	-3.8	-3.4	-3.4
H10	502068	659061	-12.2	-7.9	-4.6	-3.2	-3.1	-3.5	-3.7	-3.3	-3.3
H11	500911	657734	-12.6	-8.6	-5.2	-3.8	-3.6	-3.9	-4.1	-3.7	-3.7

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H12	502536	657735	-12.8	-8.3	-5.0	-3.6	-3.6	-4.0	-4.1	-3.8	-3.8
H13	502234	659009	-12.7	-8.3	-5.1	-3.7	-3.6	-3.9	-4.1	-3.7	-3.7
H14	502524	657817	-12.2	-7.7	-4.5	-3.1	-3.0	-3.4	-3.6	-3.2	-3.2
H15	500917	658974	-12.3	-9.0	-5.5	-4.1	-3.7	-3.9	-4.0	-3.7	-3.7
H16	501999	659116	-12.4	-8.2	-4.9	-3.5	-3.4	-3.7	-3.9	-3.5	-3.5
H17	500972	658979	-12.2	-8.8	-5.3	-3.8	-3.5	-3.7	-3.8	-3.6	-3.6
H18	501009	659016	-12.2	-8.8	-5.3	-3.9	-3.6	-3.7	-3.9	-3.6	-3.6
H19	502647	658743	-14.2	-9.8	-6.5	-5.1	-5.1	-5.4	-5.6	-5.2	-5.2
H20	502355	659039	-13.7	-9.4	-6.1	-4.7	-4.6	-4.9	-5.1	-4.7	-4.7
H21	502330	659060	-13.7	-9.4	-6.1	-4.7	-4.6	-4.9	-5.1	-4.7	-4.7
H22	502266	659125	-13.8	-9.6	-6.3	-4.8	-4.7	-5.1	-5.2	-4.9	-4.9
H23	502626	658821	-14.3	-10.0	-6.7	-5.3	-5.2	-5.6	-5.7	-5.4	-5.4
H24	502215	659189	-14.0	-9.8	-6.5	-5.1	-5.0	-5.3	-5.5	-5.1	-5.1
H25	500599	658323	-12.7	-9.6	-5.9	-4.4	-4.0	-4.1	-4.2	-3.9	-3.9
H26	500829	659102	-12.8	-10.1	-6.4	-4.9	-4.4	-4.5	-4.6	-4.4	-4.4
H27	500569	658254	-12.9	-9.8	-6.1	-4.7	-4.3	-4.3	-4.4	-4.2	-4.2
H28	502558	657360	-15.4	-11.0	-7.8	-6.3	-6.3	-6.6	-6.8	-6.4	-6.4
H29	501807	659352	-14.0	-10.0	-6.7	-5.3	-5.1	-5.4	-5.5	-5.2	-5.2
H30	502796	658774	-15.5	-11.3	-8.0	-6.6	-6.5	-6.8	-7.0	-6.6	-6.6
H31	500539	658210	-13.1	-10.1	-6.3	-4.9	-4.4	-4.5	-4.6	-4.4	-4.4
H32	500527	658182	-13.2	-10.2	-6.4	-5.0	-4.5	-4.6	-4.7	-4.4	-4.4
H33	500513	658146	-13.4	-10.4	-6.6	-5.2	-4.7	-4.8	-4.9	-4.6	-4.6
H34	501249	659412	-13.8	-10.7	-7.2	-5.7	-5.4	-5.5	-5.6	-5.4	-5.4
H35	502269	659318	-15.2	-11.1	-7.8	-6.4	-6.2	-6.5	-6.7	-6.4	-6.4
H36	500683	657529	-14.9	-11.3	-7.8	-6.4	-6.1	-6.2	-6.4	-6.1	-6.1
H37	500488	658211	-13.2	-10.4	-6.5	-5.1	-4.6	-4.6	-4.7	-4.5	-4.5
H38	502923	658648	-16.1	-11.9	-8.6	-7.2	-7.1	-7.4	-7.6	-7.2	-7.2
H39	500700	657460	-15.3	-11.6	-8.1	-6.7	-6.4	-6.6	-6.7	-6.4	-6.4
H40	500437	658130	-13.5	-10.8	-6.9	-5.5	-5.0	-4.9	-5.0	-4.8	-4.8

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H41	500761	657365	-15.5	-11.8	-8.3	-6.9	-6.6	-6.8	-6.9	-6.6	-6.6
H42	502437	659304	-15.8	-11.8	-8.5	-7.0	-6.9	-7.2	-7.4	-7.0	-7.0
H43	502205	656909	-17.3	-12.9	-9.6	-8.2	-8.1	-8.5	-8.6	-8.3	-8.3
H44	502997	658597	-16.6	-12.3	-9.0	-7.6	-7.5	-7.8	-8.0	-7.7	-7.7
H45	500855	657246	-15.8	-12.0	-8.6	-7.1	-6.9	-7.1	-7.3	-7.0	-7.0
H46	500477	657678	-15.0	-11.9	-8.2	-6.8	-6.3	-6.4	-6.5	-6.3	-6.3
H47	500461	657717	-14.9	-11.8	-8.1	-6.7	-6.2	-6.3	-6.4	-6.2	-6.2
H48	500450	657743	-14.9	-11.8	-8.1	-6.7	-6.2	-6.2	-6.4	-6.1	-6.1
H49	500505	657596	-15.2	-12.0	-8.4	-6.9	-6.5	-6.6	-6.7	-6.5	-6.5
H50	502404	656964	-17.3	-13.1	-9.7	-8.3	-8.2	-8.5	-8.7	-8.4	-8.4
H51	501340	659545	-14.5	-11.5	-7.9	-6.5	-6.1	-6.2	-6.4	-6.1	-6.1
H52	502042	656845	-17.2	-13.0	-9.7	-8.3	-8.2	-8.5	-8.6	-8.3	-8.3
H53	501906	656820	-17.2	-13.0	-9.7	-8.3	-8.1	-8.4	-8.6	-8.3	-8.3
H54	501855	656799	-17.3	-13.2	-9.8	-8.4	-8.3	-8.6	-8.8	-8.4	-8.4
H55	501358	659584	-14.6	-11.7	-8.1	-6.6	-6.3	-6.4	-6.5	-6.3	-6.3
H56	500379	657834	-14.6	-11.9	-8.0	-6.6	-6.0	-6.0	-6.1	-5.9	-5.9
H57	501828	656771	-17.5	-13.4	-10.0	-8.6	-8.5	-8.7	-8.9	-8.6	-8.6
H58	500368	657798	-14.8	-12.0	-8.2	-6.7	-6.2	-6.2	-6.3	-6.1	-6.1
H59	501532	659631	-15.1	-12.0	-8.5	-7.0	-6.7	-6.9	-7.0	-6.7	-6.7
H60	501710	656737	-17.7	-13.6	-10.3	-8.9	-8.7	-9.0	-9.1	-8.8	-8.8
H61	502518	656978	-17.7	-13.5	-10.1	-8.7	-8.6	-8.9	-9.1	-8.7	-8.7
H62	501744	656751	-17.6	-13.5	-10.1	-8.7	-8.5	-8.8	-9.0	-8.7	-8.7
H63	501154	656963	-16.7	-12.7	-9.3	-7.9	-7.7	-8.0	-8.1	-7.8	-7.8
H64	501080	656967	-16.9	-13.0	-9.6	-8.2	-7.9	-8.2	-8.3	-8.0	-8.0
H65	500217	658015	-14.1	-11.9	-7.8	-6.3	-5.6	-5.5	-5.6	-5.4	-5.4
H66	500341	657710	-15.1	-12.4	-8.5	-7.1	-6.6	-6.5	-6.6	-6.4	-6.4
H67	501677	656728	-17.7	-13.6	-10.3	-8.9	-8.7	-9.0	-9.1	-8.8	-8.8
H68	500908	657072	-16.7	-12.9	-9.4	-8.0	-7.8	-8.0	-8.1	-7.8	-7.8
H69	502814	657237	-17.7	-13.4	-10.1	-8.7	-8.6	-8.9	-9.1	-8.7	-8.7

House ID	ING Easting	ING Northing	4m/s dBA	5m/s dBA	6m/s dBA	7m/s dBA	8m/s dBA	9m/s dBA	10m/s dBA	11m/s dBA	12m/s dBA
H70	502557	656913	-18.2	-14.0	-10.7	-9.3	-9.2	-9.5	-9.6	-9.3	-9.3
H71	501768	656721	-17.8	-13.7	-10.4	-9.0	-8.8	-9.1	-9.3	-8.9	-8.9
H72	503144	658544	-17.6	-13.4	-10.1	-8.7	-8.6	-8.9	-9.0	-8.7	-8.7
H73	500307	657573	-15.8	-13.1	-9.2	-7.8	-7.2	-7.2	-7.3	-7.1	-7.1
H74	502770	657040	-18.5	-14.2	-10.9	-9.5	-9.4	-9.7	-9.9	-9.5	-9.5
H75	501470	656658	-18.3	-14.3	-10.9	-9.5	-9.3	-9.6	-9.7	-9.4	-9.4
H76	500489	659366	-11.5	-10.5	-6.3	-4.8	-3.9	-3.8	-3.8	-3.7	-3.7
H77	500969	659682	-13.8	-12.0	-8.2	-6.7	-6.1	-6.1	-6.2	-6.0	-6.0
H78	500204	657814	-14.9	-12.6	-8.6	-7.1	-6.5	-6.4	-6.4	-6.3	-6.3
H79	500153	658099	-13.7	-11.9	-7.6	-6.2	-5.4	-5.2	-5.3	-5.1	-5.1
H80	501005	656860	-17.6	-13.9	-10.4	-9.0	-8.8	-9.0	-9.1	-8.8	-8.8
H81	502780	659409	-18.0	-14.1	-10.7	-9.3	-9.1	-9.4	-9.5	-9.2	-9.2
H82	501199	656728	-18.1	-14.3	-10.8	-9.4	-9.2	-9.4	-9.5	-9.2	-9.2
H83	502860	659401	-18.3	-14.5	-11.1	-9.7	-9.5	-9.7	-9.9	-9.6	-9.6
H84	500534	659465	-11.6	-10.6	-6.6	-5.0	-4.2	-4.1	-4.1	-4.0	-4.0
H85	500251	657459	-16.3	-13.7	-9.8	-8.3	-7.8	-7.7	-7.8	-7.6	-7.6
H86	501272	656641	-18.5	-14.7	-11.2	-9.8	-9.6	-9.8	-9.9	-9.6	-9.6
H87	500512	659542	-11.3	-10.4	-6.4	-4.8	-4.0	-3.9	-3.9	-3.9	-3.9
H88	500186	657430	-16.6	-14.0	-10.1	-8.7	-8.1	-8.0	-8.1	-7.9	-7.9
H89	500468	659601	-11.2	-10.4	-6.4	-4.8	-4.0	-3.9	-3.9	-3.8	-3.8
H90	503117	657153	-19.8	-15.5	-12.2	-10.8	-10.7	-11.0	-11.2	-10.8	-10.8
H91	502990	659465	-19.1	-15.4	-12.0	-10.6	-10.4	-10.6	-10.7	-10.4	-10.4
H92	501847	659972	-17.2	-14.3	-10.8	-9.3	-8.9	-9.1	-9.2	-8.9	-8.9
H93	503044	659503	-19.5	-15.8	-12.4	-10.9	-10.7	-10.9	-11.1	-10.8	-10.8
H94	501302	656436	-19.5	-15.9	-12.4	-11.0	-10.7	-10.9	-11.0	-10.7	-10.7
H95	500483	659655	-10.8	-10.1	-6.1	-4.5	-3.7	-3.6	-3.6	-3.6	-3.6
H96	500030	657504	-16.4	-14.3	-10.2	-8.7	-8.0	-7.9	-8.0	-7.8	-7.8
H97	500116	659240	-8.7	-8.3	-3.7	-2.2	-1.1	-0.8	-0.8	-0.8	-0.8
H98	503135	657004	-20.5	-16.2	-12.9	-11.5	-11.4	-11.7	-11.9	-11.5	-11.5

	ING	ING	4m/s	5m/s	6m/s	7m/s	8m/s	9m/s	10m/s	11m/s	12m/s
House ID	Easting	Northing	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA	dBA
H99	501267	656415	-19.7	-16.0	-12.5	-11.1	-10.8	-11.0	-11.2	-10.9	-10.9
H100	501382	656380	-19.8	-16.1	-12.6	-11.2	-10.9	-11.1	-11.3	-11.0	-11.0
H101	501742	660048	-17.2	-14.6	-11.0	-9.5	-9.1	-9.2	-9.3	-9.1	-9.1
H102	499840	658115	-13.0	-12.0	-7.3	-5.8	-4.8	-4.5	-4.5	-4.4	-4.4
H103	499839	658169	-12.5	-11.5	-6.7	-5.3	-4.2	-3.9	-3.9	-3.9	-3.9
H104	501323	656382	-19.8	-16.2	-12.7	-11.2	-11.0	-11.2	-11.3	-11.0	-11.0
H105	501241	656389	-19.8	-16.2	-12.7	-11.3	-11.0	-11.2	-11.3	-11.0	-11.0
H106	501761	660081	-17.4	-14.7	-11.1	-9.7	-9.2	-9.3	-9.4	-9.2	-9.2
H107	503520	657758	-20.4	-16.2	-12.9	-11.5	-11.3	-11.6	-11.8	-11.5	-11.5
H108	501213	656356	-20.0	-16.5	-12.9	-11.5	-11.2	-11.4	-11.5	-11.3	-11.3
H109	501779	660109	-17.5	-14.9	-11.3	-9.8	-9.4	-9.5	-9.6	-9.4	-9.4
H110	499792	658063	-13.0	-12.0	-7.2	-5.8	-4.7	-4.4	-4.4	-4.3	-4.3
H111	502338	660030	-18.8	-15.7	-12.2	-10.7	-10.4	-10.6	-10.7	-10.4	-10.4
H112	500173	657026	-18.3	-15.7	-11.8	-10.3	-9.8	-9.7	-9.8	-9.6	-9.6
H113	503418	657226	-21.2	-16.9	-13.6	-12.2	-12.1	-12.4	-12.6	-12.2	-12.2
H114	501621	660209	-17.1	-14.9	-11.3	-9.8	-9.2	-9.3	-9.4	-9.2	-9.2
H115	501421	656246	-20.5	-16.9	-13.4	-11.9	-11.7	-11.9	-12.0	-11.7	-11.7
H116	500086	657100	-18.1	-15.6	-11.7	-10.2	-9.6	-9.6	-9.7	-9.5	-9.5
H117	500432	659864	-10.1	-9.6	-5.8	-4.1	-3.3	-3.2	-3.2	-3.2	-3.2
H118	502158	660135	-18.6	-15.7	-12.2	-10.7	-10.3	-10.4	-10.6	-10.3	-10.3
H119	501134	656278	-20.4	-16.9	-13.4	-11.9	-11.6	-11.8	-11.9	-11.6	-11.6
H120	501920	660219	-18.1	-15.6	-12.0	-10.5	-10.0	-10.1	-10.2	-10.0	-10.0
H121	500695	656437	-20.0	-16.8	-13.2	-11.8	-11.3	-11.4	-11.6	-11.3	-11.3
H122	503475	659361	-21.0	-17.3	-13.9	-12.5	-12.2	-12.4	-12.6	-12.3	-12.3
H123	501100	656250	-20.6	-17.2	-13.6	-12.2	-11.8	-12.0	-12.1	-11.8	-11.8
H124	500601	656510	-19.9	-16.8	-13.1	-11.7	-11.3	-11.4	-11.5	-11.2	-11.2
H125	500994	656249	-20.7	-17.3	-13.7	-12.3	-11.9	-12.1	-12.2	-11.9	-11.9
H126	501472	656103	-21.3	-17.6	-14.1	-12.7	-12.4	-12.6	-12.7	-12.4	-12.4
H127	503549	659345	-21.2	-17.6	-14.2	-12.7	-12.5	-12.7	-12.9	-12.6	-12.6

House ID	ING Easting	ING Northing	4m/s dBA	5m/s dBA	6m/s dBA	7m/s dBA	8m/s dBA	9m/s dBA	10m/s dBA	11m/s dBA	12m/s dBA
H128	499985	657478	-16.5	-14.5	-10.3	-8.9	-8.1	-8.0	-8.1	-7.9	-7.9
H129	501177	660305	-15.6	-14.3	-10.5	-8.9	-8.3	-8.2	-8.3	-8.2	-8.2
H130	499752	657399	-16.7	-15.1	-10.7	-9.3	-8.4	-8.2	-8.3	-8.2	-8.2
H131	499595	658007	-13.1	-12.3	-7.4	-6.0	-4.9	-4.5	-4.5	-4.5	-4.5
H132	501016	656203	-20.8	-17.5	-13.9	-12.5	-12.1	-12.2	-12.4	-12.1	-12.1
H133	501555	660347	-17.4	-15.5	-11.7	-10.2	-9.7	-9.7	-9.8	-9.6	-9.6
H134	503662	657388	-22.0	-17.8	-14.5	-13.1	-12.9	-13.2	-13.4	-13.1	-13.1
H135	501513	656022	-21.7	-18.1	-14.6	-13.2	-12.9	-13.0	-13.2	-12.9	-12.9
H136	501915	656014	-22.1	-18.3	-14.8	-13.4	-13.1	-13.3	-13.5	-13.2	-13.2
H137	503692	657399	-22.1	-17.9	-14.6	-13.2	-13.0	-13.3	-13.5	-13.2	-13.2
H138	500976	656185	-20.9	-17.7	-14.0	-12.6	-12.2	-12.4	-12.5	-12.2	-12.2
H139	503724	657423	-22.2	-18.0	-14.7	-13.3	-13.1	-13.4	-13.6	-13.2	-13.2
H140	501607	660418	-17.6	-15.7	-12.0	-10.5	-9.9	-9.9	-10.0	-9.8	-9.8
H141	501978	655955	-22.3	-18.5	-15.1	-13.7	-13.4	-13.6	-13.8	-13.5	-13.5
H142	499544	657840	-14.5	-13.5	-8.8	-7.3	-6.2	-5.9	-5.9	-5.9	-5.9
H143	503779	657431	-22.5	-18.3	-15.0	-13.6	-13.5	-13.8	-13.9	-13.6	-13.6
H144	500810	656224	-20.9	-17.7	-14.0	-12.6	-12.2	-12.3	-12.4	-12.2	-12.2
H145	499828	657009	-18.8	-16.7	-12.6	-11.1	-10.4	-10.3	-10.4	-10.2	-10.2
H146	502025	660073	-13.4	-12.2	-7.5	-6.1	-5.1	-4.8	-4.8	-4.7	-4.7

*H1 is an abandoned house which still has an intact roof so has been included in the assessment.

**H2 is a workshop and not considered therefore to be noise sensitive.

It can be seen that the predicted noise level at each of the receptors is within the 43dB limit applicable within the WEDG. This considers the predicted noise levels from all of the cumulative turbines to equivalent of the noise level in a downwind direction from the turbine to the receptor simultaneously. In practice this is not possible due to the location of the turbines.

10.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

10.5.1 Construction Noise Mitigation

No significant construction or decommissioning noise effects have been identified. Therefore, no specific mitigation measures are required. However, general guidance for controlling construction noise through the use of good practice given in BS 5228 will be followed. Construction and Decommissioning of the Project shall be limited to working times given and any controls incorporated in any planning permission.

During the Decommissioning phase of the Project, noise levels are likely be no more than predicted in **Table 10.15,** however, it is envisaged that Decommissioning will be of shorter duration. Any legislation, guidance, or best practice relevant at the time of Decommissioning will be complied with. Construction and Decommissioning are a temporary day time activity.

10.5.1.1 Residual Construction and Decommissioning Effects

The residual effects are the same as the construction and Decommissioning effects identified in this assessment.

10.5.2 Operational Noise Mitigation

The Development has been designed to comply with the WEDG06 noise Guidelines and recent An Bord Pleanála noise limits. The operational noise emissions are predicted to be compliant and well within these guidelines with no special mitigation required apart from fitting rotors with STE which is now considered best practice.

All turbines will have STE fitted as standard to reduce noise emission levels. Any additional mitigation is not considered necessary.

10.5.2.1 Residual Operational Effects

The residual effects are the same as the operational effects identified in this assessment.

10.5.3 Cumulative Effects

As identified in Section 10.2.4, the cumulative effects of the existing permitted Tullabrack and Ballykett Wind Farms, both located within 2km, have been assessed and found to be in compliance with the noise limits set in the WEDG06.

10.6 SUMMARY OF EFFECTS

Table 10.20 below summarises the effects.

Table 10.20: Summary of Effects

	Quality	Significance	Duration
Construction noise	Negative	Not Significant	Temporary
Operational Noise	Negative	Not Significant	Long Term
Decommissioning noise	Negative	Not Significant	Temporary

10.7 STATEMENT OF SIGNIFICANCE

This section has assessed the significance of the potential effects of the Project during operation, construction and Decommissioning.

The effects of noise from the operation of the Project has been assessed using WEDG06 with the methodology described in ETSU-R-97 and the IOA Good Practice Guide. Noise levels during operation of the Development have been predicted using the best practice of calculation technique, compared with the noise limits in the WEDG06 and recent An Bord Pleanála limits and found to be compliant.

There has been a consultation process in relation to the revision of the 2019 Wind Energy Development Guidelines. This document provided the basis for a discussion on amendments of the noise limits applicable to wind turbine developments. It is understood that there will be revisions to the draft consultation documents, however a mitigation strategy to incorporate a reduction in sound power level outputs with respect to directionality can be put in place to comply with any specific variation in noise limit levels if new more restrictive guidelines are adopted. All turbines have software incorporated so that the sound power levels can be reduced by direction and energy output.

The noise levels predicted at the nearest receptors are orders of magnitude below the level at which risk of hearing damage, or indeed negative health effects are possible.

Noise during construction and Decommissioning of the Project will be managed to comply with current best practice, legislation and guidelines so that effects are not significant.