Planning and Environmental Consultants

Natura Impact Statement

Proposed Wind Farm at Ballynagare, Co. Kerry

DOCUMENT DETAILS

The Client	**EM Power**
Project Title:	**Proposed wind farm at Ballynagare, Co. Kerry**
Project Number:	**200512**
Document Title:	**Natura Impact Statement**
Document File Name:	**NIS F– 2021.11.17 – 200512**
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Rev	Status	Date	Author(s)	Approved By
01	Final	17/11/2021	OOG	JH

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1. INTRODUCTION

1.1 Background

MKO has been appointed to prepare a Natura Impact Statement to allow the competent authority to conduct an Appropriate Assessment of a Proposed Wind Farm development at Ballynagare, Co. Kerry.

An Appropriate Assessment Screening Report has been prepared and is provided in **Appendix 1**. This Article 6(3) Appropriate Assessment Screening Report has identified the European Sites upon which the proposed development has the potential to result in significant effects and the pathways by which those effects may occur. It has also identified those qualifying interests/special conservation interests that have the potential to be affected by the proposed development. The Screening Report identifies the European Sites upon which significant effects could not be excluded. Those sites will be assessed in this Natura Impact Statement.

This report has been prepared in compliance with Part XAB of the Planning and Development Acts 2000-2019, the Planning and Development Regulations 2001-2019 and relevant jurisprudence of the European and Irish courts. It has also been prepared in accordance with the European Commission guidance document Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2001), European Communities (2018) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission and the Department of the Environment's Guidance on the Appropriate Assessment of Plans and Projects in Ireland (December 2009, amended 11 February 2010).

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

1. *European Communities (2000) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission,*
2. *Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg. European Commission,*

EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission

1.2 Statement of Authority

Ecological baseline surveys, including bat surveys, were conducted by MKO ecologists; John Hynes (B.Sc., M.Sc MCIEEM), Olivia O' Gorman (B.Sc., M.Sc), Aoife Joyce (BSc., MSc.), Luke Dodebier (BSc.). All surveyors have relevant academic qualifications and experience in undertaking habitat and ecological assessments.

Bat survey data was compiled and assessed by Aoife Joyce and Luke Dodebier. The final bat report was prepared by Aoife Joyce and reviewed by John Hynes (B.Sc., M.Sc., MCIEEM).

The scope of works and survey methodology was devised by Senior Ornithologist, Padraig Cregg and is fully compliant with recent NatureScot guidance. Field surveys were undertaken by Ciaran McKenna (BSc.) and Gerry Murphy (Dip.). of the above surveyors are suitably qualified and can be considered competent experts for the purposes of the preparation of this NIS.

This EIAR chapter has been prepared by Olivia O' Gorman (B.Sc., M.Sc) and reviewed by Pat Roberts (B.Sc., M.Sc., MCIEEM). Olivia is an experienced ecologist with over 5 years professional experience. John is an experienced ecologist who has over 14 years' professional experience in environmental management and ecological assessment.

The report has been prepared by Olivia O'Gorman (B.Sc., M.Sc.) and reviewed by Pat Roberts (B.Sc., M.Sc., MCIEEM).

1.3 Structure and Format of this NIS

This NIS firstly provides a summary of the findings of the Article 6(3) Appropriate Assessment Screening Report. This clearly identifies the European Sites that have the potential to be significantly affected by the proposed development and the pathways by which they might be affected. This sets out the scope of the NIS. Following this, all elements of the proposed project are fully described as is the baseline environment with respect to the relevant QI/SCI of the screened in European Sites.

Section 5 provides an assessment of the potential for adverse effects on the identified European Sites and prescribes mitigation to robustly block any identified pathways for impact. Section 6 provides an assessment of residual effects taking into consideration the proposed mitigation.

In Section 7, the potential in combination effects of the proposed project on European Sites, when considered in combination with other plans and projects was considered. A concluding statement is provided in Section 8.

2. SUMMARY OF ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING REPORT

The Article 6(3) Appropriate Assessment Screening report identified the potential for the proposed development to result in significant effects on the following European Sites:

- Lower River Shannon SAC [002165]
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]
- Tralee Bay Complex SPA [004188]

Each of these sites is discussed individually below in terms of the Qualifying Interests/Special Conservation Interests with the potential to be affected and the pathways by which any such effects may occur.

2.1 Lower River Shannon SAC [002165]

The individual pathways for effect that were identified in Table 3.1 of the AA Screening Report (Appendix 1) and the QIs with the potential to be affected are described below.

2.1.1 Pathway for Effect

There is hydrological connectivity between the proposed development and this European site.

Following the precautionary principle, the proposed works have the potential to cause deterioration in water quality through the runoff of sediment, hydrocarbons, cementitious material and other pollutants during the construction, operational and decommissioning phase of the development.

- Reefs [1170]
- Estuaries [1130]
- Large shallow inlets and bays [1160]
- Sandbanks which are slightly covered by sea water all the time [1110]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation [3260]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)**[91EO]
- Bottlenose Dolphin *(Tursiops truncates)* [1349]
- Sea Lamprey *(Petromyzon marinus)* [1095]
- Brook Lamprey *(Lampetra planeri)* [1096]
- River Lamprey *(Lampetra fluviatilis)* [1099]
- Atlantic Salmon *(Salmo salar)* (only in fresh water) [1106]
- Otter *(Lutra lutra)* [1355]

The proposed development is located immediately adjacent to the SAC. According to the Otter Threat Response Plan NPWS (2009), otters occupy exclusive home ranges averaging 7.5 ± 1.5km. As such, the proposed development had potential to impact SAC population in relation to habitat loss, fragmentation or disturbance and these will be assessed in the sections below

Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]

The individual pathways for effect that were identified in Table 3.1 of the AA Screening Report (Appendix 1) and the QIs with the potential to be affected are described below.

2.1.2 Pathway for Effect

The SPA is designated for one SCI species: Hen Harrier *(Circus cyaneus)* [A082]. As per SNH Guidance, the core foraging range of Hen Harrier is 2km. The wind farm site is located approximately 4.8km from the SPA, however the proposed grid connection route option 1 is located adjacent to and also traverses the SPA for approximately 200 m. All works associated with the grid connection are confined to the existing public road infrastructure corridor.

The potential for habitat loss and displacement will be assessed in this NIS.

Tralee Bay Complex SPA [004188]

The individual pathways for effect that were identified in Table 3.1 of the AA Screening Report (Appendix 1) and the QIs with the potential to be affected are described below.

2.1.3 Pathway for Effect

The SPA is designated for a number of SCI species and of these species Common Gull have been identified as having potential to use the agricultural habitats within the proposed development. Common Gull have mean foraging range of 25km. The wind farm site is located approximately 12.9km from the SPA.

The potential for habitat loss and displacement has been assessed in this NIS.

3. DESCRIPTION OF PROPOSED DEVELOPMENT

3.1 Site Location

The proposed development site is located in Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The proposed development site is located in the townlands of Ballynagare, Dysert Marshes, Dysert and Curraghcroneen. The approximate location for the centre of the proposed development site is Irish Transverse Mercator (ITM) E489,500 N632,000. The proposed development site covers an area of approximately 529 hectares.

The proposed development site has an approximate elevation of between 2 and 5 metres above ordnance datum (m OD). The site is located at the confluence of the Cashen Estuary (to which the River Feale flows) and the Brick River. The Cashen Estuary forms the northern boundary of the proposed development site, while the Brick River forms the western boundary. The Cashen Estuary flows in a northwest direction to discharge into the mouth of the Shannon estuary at Ballybunnion.

The site is accessed via a number of local roads and bog tracks. From the south the site is accessed via local roads adjoining the R557 regional road which is located south of the site, which in turn adjoins the N69 National Secondary Road, south of Listowel. The south of the site can also be accessed from the west via a bridge over the Brick River.

The proposed grid connection options traverse the Lower River Shannon SAC at a number of points. The proposed grid connection route includes two options, both of which have been assessed in this NIS, but only one of which will be ultimately constructed. Option 1 is approximately 13.4 km in length and starts in Ballnagare and finishes in Pallas. The proposed route partially occurs within and adjacent to the Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. The proposed route crosses the Lower River Shannon SAC at three locations. The proposed grid connection route option 2 is approximately 21.2 km in length and starts in Ballynagrare and finishing in Trienearagh. The proposed route crosses the Lower River Shannon SAC at one location.

The site location is show in Figure 3.1

3.2 Characteristics of the Proposed Development

The proposed development comprises the construction of a wind farm comprising seven wind turbines, all associated works, and a grid connection to the national grid. The proposed turbines will have a maximum blade tip height of up to 170 metres. The application is seeking a ten-year planning permission. The full description of the proposed development is as follows:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
    - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
    - Hub height of 95m
    - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit

- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The application is seeking a ten-year planning permission and 35 year operational life from the date of commissioning of the wind farm.

Chapter 4 of the EIAR, included as **Appendix 2** of this NIS, fully describes all elements of the development proposal. All elements of the Proposed Development including the wind turbines, roads, substation, construction compound and replanting have been considered in this assessment. All phases of the development including construction, operation and decommissioning have been fully assessed.

The overall layout of the proposed development is shown in Figure 4-1 of the EIAR. This drawing shows the proposed locations of the wind turbines & ancillary infrastructure, electricity substation, borrow pits, construction compound, internal roads layout and the site entrances. Detailed site layout drawings of the Proposed Development are included in Appendix 4.1 of the EIAR for the proposed development.

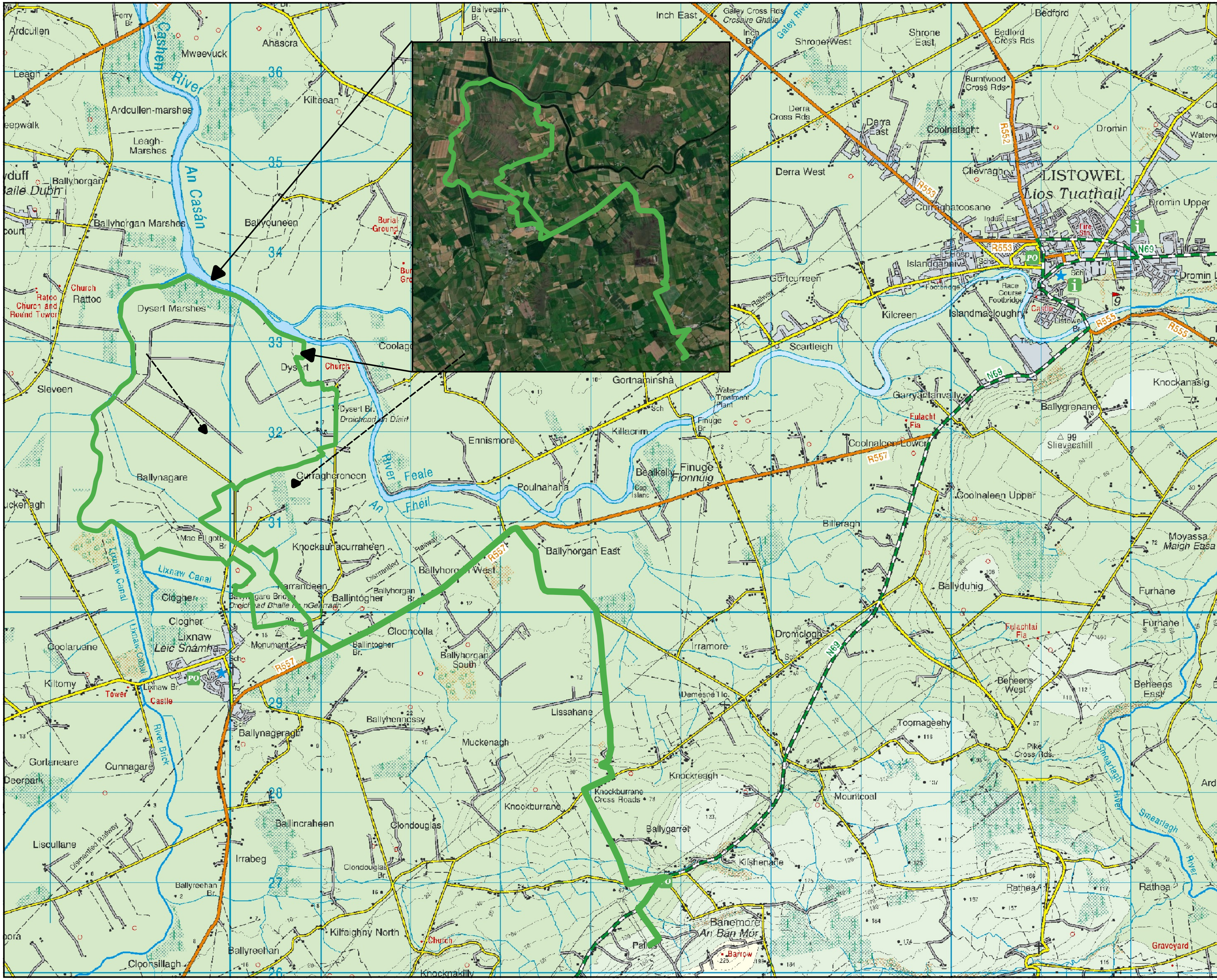
The Proposed Development layout makes maximum use of the existing access road and tracks within the site where practicable and has been designed to minimise the potential environmental effects of the wind farm, while at the same time maximising the energy yield of the wind resource associated with the proposed site.

3.3 Mitigation Measures and Best Practice

The design of the Proposed Development, as described in **Appendix 2** accompanying this NIS, sets out very clearly how the wind farm including the grid connection has been designed and will be operated in accordance with best industry practice to avoid any significant effects outside the site including the prevention of impacts on watercourses.

A Construction and Environmental Management Plan (CEMP) has been prepared and is included as **Appendix 3** of this NIS. The CEMP will be in place prior to the start of the construction phase. Best practice measures which form part of the design of the project are included in Chapter 4 (Description of the Proposed Development) and in the relevant chapters of the EIAR.

The CEMP also outlines that a Site Supervisor/Construction Manager and/or Environmental Manager will be appointed to maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. In addition, an Environmental Clerk of Works or Project Ecologist, Project Hydrologist, Project Geotechnical engineer will visit the site regularly and report to the Site Environmental Office. This structure will provide a “triple lock” review/interaction by external specialists during the construction phase.



Map Legend

Ballynagare Wind Farm Study Area

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Drawing Title	
Site Location	
Project Title	
Ballynagare Wind Farm	
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 3-1
Scale: 1:54826	Date: 08.10.2021

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4. CHARACTERISTICS OF THE RECEIVING ENVIRONMENT

The sections below describe the details of the desk study and field surveys undertaken to inform this assessment regarding the "Screened in" Sites and associated Qualifying Interests/Special Conservation Interests.

4.1 Ecological Survey Methodologies

4.1.1 Desk Study

The desk study undertaken for this assessment included a thorough review of the available ecological data including the following:

- Review of NPWS Site Synopses, Conservation Objectives for the European Sites
- Review of 2019, 2013 and 2007 EU Habitats Directive (Article 17) Reports.
- Review of online web-mappers: National Parks and Wildlife Service (NPWS), EPA, Water Framework Directive (WFD),
- Review of specially requested records from the NPWS Rare and Protected Species Database for the hectads which overlap with the study area.
- Review of OS maps and aerial photographs of the site of the proposed project.
- Review of relevant databases including National Biodiversity Ireland Database and available literature of previous surveys conducted in the area.
- Review of other plans and projects within the area.
- Biodiversity Data Centre (NBDC), Irish Wetland Bird Survey I-WeBS.
- Review of Bird Atlases: (Sharrock, 1976; Lack, 1986; Gibbons et al., 1993; Balmer et al., 2013).
- Review of Birds of Conservation Concern (BoCCI) in Ireland 2014-2019 (Colhoun & Cummins, 2013).

4.1.2 Scoping and Consultation

MKO undertook a scoping exercise during preparation of the NIS and EIAR, as described in Chapter 2, Section 2.6 of the EIAR.

Copies of all scoping responses are included in Appendix 2.3 of the EIAR. The recommendations of the consultees have informed the NIS preparation process and the contents of this assessment. No comments that related specifically to European Sites were included in any of the consultation responses.

Table 4- 1 Organisations consulted with regard to biodiversity

Consultee	Response from consultee
Department of Culture, Heritage, and the Gaeltacht (includes National Parks & Wildlife Service, National Monuments Service)	No response relating to Biodiversity.
Kerry County Council – Environment Section	No response relating to Biodiversity.
Bat Conservation Ireland	No comment.
An Taisce	No response relating to Biodiversity.
BirdWatch Ireland	No response relating to Biodiversity.
Inland Fisheries Ireland – South Western RBD	No response relating to Biodiversity.
Irish Peatland Conservation Council	No response relating to Biodiversity.
Irish Wildlife Trust	No response relating to Biodiversity.
Irish Red Grouse Association	No response relating to Biodiversity.
Irish Raptor Study Group	No response relating to Biodiversity.
Waterways Ireland	No response relating to Biodiversity.
The Heritage Council	No response relating to Biodiversity.

4.1.3 Field Surveys

4.1.3.1 Ecological Multidisciplinary Walkover Surveys

A comprehensive survey of the biodiversity of the entire site was undertaken on various dates undertaken 11th May, 26th May, 02nd July, 16th July, 09th September, 11th September and 24th September 2020 and on 1st April, 18th June and 21st June 2021. The grid connection route was surveyed on the 18th June, 21st June, 1st September and 8th October 2021.

The following sections describe the ecological surveys that have been undertaken and provide details of the methodologies, dates of survey and guidance followed.

The multi-disciplinary walkover survey was designed to detect the presence, or likely presence, of a range of protected habitats and species. Incidental sighting/observations of birds and additional fauna were noted during the site visits. In addition to multi-disciplinary walkover surveys, targeted species surveys were also undertaken on a number of survey dates and followed methodologies outlined in TII, 2008: *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*).

The habitats were classified in accordance with the Heritage Council's *'Guide to Habitats in Ireland'* (Fossitt, 2000).

Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follows '*Mosses and Liverworts of Britain and Ireland - a field guide'* (British Bryological Society, 2010).

The multi-disciplinary walkover surveys comprehensively covered the entire development footprint and based on the survey findings, further detailed targeted surveys were carried out for habitats, features and locations of ecological significance, particularly the habitats surrounding the proposed development footprint. These surveys were carried out in accordance with NRA *Guidelines on Ecological Surveying Techniques for Protected Flora and Fauna* on National Road Schemes (NRA, 2009).

During the multi-disciplinary walkover survey, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

4.1.3.2 Otter Survey

Areas identified as providing potential habitat for otter, i.e. watercourses within and in close proximity to the site, were subject to specialist targeted survey. Potential habitat for otter was noted during the initial site survey in 2020 and a dedicated otter survey of watercourses was conducted on the 11th of September 2020 and 18th June and 21st June 2021. The purpose of the visits was to survey the windfarm site and cable route for any evidence of otter in proximity to the development footprint (including the grid connection routes).

All otter surveys were conducted as per NRA (2009) guidelines (Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes). This involved a search for all otter signs e.g., spraints, scat, prints, slides, trails, couches and holts. In addition to the width of the rivers/watercourses, a 10m riparian buffer (both banks) was considered to comprise part of the otter habitat (NPWS 2009). The dedicated otter survey also followed the guidance as set out in NRA (2008) *'Guidelines for the Treatment of Otters Prior to the Construction of National Roads Schemes'* and following CIEEM best practice competencies for species surveys (CIEEM, 2018).

There is a total of 5 EPA Mapped stream crossings along the proposed grid connection route. There will be no requirement for instream works. The grid connection routes were surveyed for Otter on the 18th June, 21st June 2021, 1st September and 8th October 2021.

4.1.3.3 Bird Surveys

Field surveys were undertaken during the survey period April 2019 – March 2021, consisting of two breeding seasons (April – September) and two non-breeding seasons (October – March), in compliance with SNH guidance on surveys for onshore windfarms (SNH, 2017). Field survey methodologies were devised to survey for the bird species composition and assemblages that occur within the study area. The data provided is robust and allows clear, precise and definitive conclusions to be made on the avian receptors identified within the study site.

4.1.3.3.1 *Initial Site Assessment*

Based on the results of the desk study, consultation and reconnaissance site visits, the likely importance of the study area for bird species was ascertained. Based on the collated information available from the above preliminary assessment, and adopting a precautionary approach, a site-specific scope for the ornithological survey was developed.

4.1.3.3.2 *Survey Methodologies*

The survey work undertaken between April 2019 and March 2021 forms the core dataset for the assessment of effects on ornithology. In the absence of specific national bird survey guidelines, the ornithological surveys were designed and undertaken in full accordance with the guidance document 'Recommended bird survey methods to inform impact assessment of onshore wind farms' (SNH, 2017). The various survey types undertaken are described below.

4.1.3.3.3 Vantage Point Surveys

Vantage point surveys were undertaken in accordance with SNH (2017) from April 2019 to March 2021. These surveys aimed to monitor flight activity on the wind farm study area to a 500m radius of the proposed turbines. Surveys were conducted monthly throughout this period from one fixed point vantage point with comprehensive coverage of the study area (Figure 7-1). The vantage point location was selected by undertaking a viewshed analysis (described below) and confirmed by a recce visit and initial field surveys to ensure that the proposed turbine layout is entirely covered. Initially, three vantage points were surveyed from the commencement of surveys (April 2019) until December 2019 (Figure 7-2). However, surveys at these two additional vantage points were discontinued from January 2020 because the wind farm study area was reduced, and turbines were no longer proposed within their viewsheds. Data from surveys at the two additional vantage points is included as supplementary information in Appendix 7-4 of the EIAR Ornithology Chapter.

4.1.3.3.4 Viewshed Analysis

Viewshed analysis was carried out to inform coverage of the study area from the fixed vantage point location. A 500m buffer was applied to the outermost proposed turbines, in line with SNH (2017). Viewsheds were calculated using Resoft Wind Farm ZTV (Zone of Theoretical Visibility) software in combination with Mapinfo Professional (Version 10.0) using a notional layer suspended at 15m, which is representative of the minimum height considered for the Potential Collision Risk Area based on a worst-case scenario turbine model at the time the vantage point locations were selected. Note that while the relevance of being able to view as much of the site to ground level is acknowledged, the NatureScot guidance emphasises the importance of visibility of the 'collision risk volume' when the data is to be used to estimate the risk of collision with turbines by birds.

The viewshed analysis aims to identify the most suitable locations to site vantage points such that the airspace of the turbine rotor swept area is in view. The analysis aims to achieve this using the fewest possible number of vantage points. The vantage point location was tested for visibility coverage by creating a viewshed point 1.5 meters in height (to represent the height of observer) on a map using 10 metre contours terrain data. The relative height of any surrounding forestry and its effects on visibility is also accounted for in the analysis. Using the ZTV software, a viewshed of 360 degrees was produced calculating an area 15m from ground level up to a 2km radius. The resulting viewshed image was then cropped to 180 degrees to give the viewshed, in line with SNH (2017). The visible view shed at 15m is presented in Figure 7-3 of the EIAR Ornithology Chapter.

4.1.3.3.5 Data Recording and Digitisation

Data on bird observations and flight activity was collected from a scanning arc of 180° and a 2km radius by an observer at the fixed vantage point location for two 3-hour watches separated by a minimum 30 minute break (ie. 6 hours total) per month. Surveys were scheduled to provide a spread over the full daylight period, including dawn and dusk watches to coincide with the highest periods of bird activity. Along with target species, any additional (non-target) species observed were recorded to inform the evaluation of supporting habitat. The survey effort is presented in Appendix 7-2, Table 1 of the EIAR Ornithology Chapter. Table 4-2 provides a brief summary of the survey effort.

Table 4-2- Vantage Point Survey Effort

Survey Season	Months	Effort per Vantage Point
2019 Breeding Season (1VP and 2 supplementary VPs)	Apr-Sep	36 hours per VP
2019/2020 Winter Season (1VP and 2 supplementary VPs)	Oct-Dec	18 hours per VP
2019/2020 Winter Season (1VP)	Jan-Mar	18 hours per VP
2019 Breeding Season (1VP)	Apr-Sep	36 hours per VP
2020/2021 Winter Season (1VP)	Oct-Mar	36 hours per VP

Each flight observation was assigned a unique identifier when mapped in the field and subsequently digitised using QGIS software. Observed flight activity was recorded as per defined flight bands which were chosen in relation to the dimensions of potential turbine models for the site. Bands were split into 0-10m, 10-25m, 25-175m and >175m for surveys between April 2019 and December 2019. From January 2020 to the end of the survey period (March 2021), bands were split into 0-15m, 15-25m, 25-200m and >200m. All flight activity within a height band 10-200m (i.e. all activity in survey bands 10-25m and 25-175m from April to December 2019, and in bands 15-25m and 25-200m from January 2020 to March 2021) is considered to be within the Potential Collision Height (PCH) with regard to the turbine swept area, based on a worst-case scenario for turbine modelling.

4.1.3.3.6 Breeding Walkover Surveys

Breeding walkover surveys were undertaken to determine possible, probable or confirmed breeding bird activity within the wind farm study area to a 500m radius. The methodology was based on Brown and Shepherd (Brown and Shepherd, 1993; Calladine et al. 2009), combined with Common Bird Census methods (British Trust for Ornithology, 2021) for dense habitat, as per SNH (2017) recommendations. Transect routes were walked across different habitat complexes where access allowed[1]. The surveyor regularly scanned with their binoculars the wider surroundings of each transect for target species. Along with target species, all additional (non-target) species observed were recorded to inform the evaluation of supporting habitat.

Breeding walkover surveys were conducted in daylight hours (08:00-18:00) over four visits during the core breeding season months April to July. All four visits were successfully conducted in 2019. However, due the COVID-19 restrictions, three visits were conducted in May, June and July in 2020. Survey effort is presented in Appendix 7-2 of the EIAR Ornithology Chapter., including full details of dates, times and weather conditions for each survey. Figure 7-4 of the EIAR Ornithology Chapter shows the transect routes.

4.1.3.3.7 Breeding Raptor Surveys

Raptors include all harrier, falcon, buzzard, eagle, hawk, owl, kite and osprey species. Breeding raptor surveys were undertaken within the wind farm study area and within a 2km radius. Survey methodology followed Hardy *et al.* (2013), as per SNH (2017) recommendations. All raptor species were recorded during these surveys to identify occupied raptor territories and monitor their breeding success within the study area.

Breeding raptor watches of 3 hours (supplemented by transects if necessary) were conducted at four breeding raptor vantage point (BRVP) locations during daylight hours. Each BRVP was surveyed once per month during the core breeding season between April and July. All four visits were successfully conducted in 2019. However, due the COVID-19 restrictions, three visits were conducted in May, June and July in 2020. Survey effort is presented in Appendix 7-2 of the EIAR Ornithology Chapter, including

[1] *the onsite areas were boggy and quite treacherous under foot, which limited access to some areas.*

full details of dates, times and weather conditions. Figure 7-5 of the EIAR Ornithology Chapter shows the BRVPs.

4.1.3.3.8 *Hen Harrier Roost Surveys*

Hen harrier roost surveys were undertaken within the wind farm study area and within a 2km radius. Survey methodology followed SNH (2017) and Gilbert *et al.* (1998) recommendations. These surveys aimed to identify active winter hen harrier roosts within the study area. Roost watches of 2-3 hours were conducted at two hen harrier vantage point (HHVP) locations from dusk until last visible light during which all hen harrier observations were mapped. Each HHVP was surveyed once per month during the winter season between October and March (in winter 2019/2020 and 2020/2021). Survey effort is presented in Appendix 7-2, of the EIAR Ornithology Chapter including full details of dates, times and weather conditions. Figure 7-6 of the EIAR Ornithology Chapter shows the HHVPs.

4.1.3.3.9 *Winter Walkover Surveys*

Winter walkover surveys were undertaken to record the presence of bird species within the wind farm study area to a 500m radius. The methodology was adapted from the breeding walkover surveys outlined above. Transect routes were walked across different habitat complexes within the study area where access allowed. Along with target species, all additional (non-target) species observed were recorded to inform the evaluation of supporting habitat.

Winter walkover surveys were conducted in daylight hours over four visits between October and March (i.e. four visits in winter 2019/2020 and four visits in winter 2020/2021). All target species observations were mapped. Survey effort is presented in Appendix 7-2, including full details of dates, times and weather conditions for each survey. Figure 7-4 shows the transect routes.

4.2 Desk Study Results

4.2.1 EPA River Catchments and Water Quality Data

The EPA Envision map viewer was consulted on 22th June 2021 regarding the water quality status of the Feale watercourse. The Biotic Index of Water Quality (BIWQ) was developed in Ireland by the Environmental Protection Agency (EPA). Q-values are assigned using a combination of habitat characteristics and structure of the macro-invertebrate community within the waterbody. Individual macro-invertebrate families are classified according to their sensitivity to organic pollution and the Q-value is assessed based primarily on their relative abundance within a sample.

The site is located in the Tralee Bay-Feale catchment (Catchement_23) and Brick sub-catchment (Brick_SC_010). The development is located within following river sub basins; Brick_030, Brick_040, Smearlagh_040, Mountcoal_010, Feale_080, Feale_090.

The Monument watercourse (EPA code: 23M41) flows northward through the western section of the proposed development site. The Monument watercourse flows to the Brick watercourse (EPA code: 23B03) which flows in a north-eastward direction the Cahen Estuary. The Cashen Estuary classified as a transitional watercourse. There are a number of watercourses classified as lowland/depositing rivers (FW2) or drainage ditches (FW4) within the proposed development site study area. These watercourses drain to the Cashen Estuary and therefore, to the Lower River Shannon SAC.

To the west of the proposed development study area, the Dysert Marshes [EPA code: 12D19] flows in a northward direction merging with the Ballyoween [EPA code: 23B32] which flows parallel to the Dysert Marshes watercourse. Both watercourses flow in a northward direction and drain to the Cashen Estuary and to the Lower River Shannon SAC.

Table 4.3 presents the latest Q-value results from watercourses within the vicinity of the propose development.

Table 4- 2 Q-value Status within the vicinity of the proposed development site

Station Location and Name	Grid Reference	Q Status	Assessment Year
Feale [EPA Code: 23F01] - Finuge Bridge	E95135.87, N132124.31	Q-Value 3-4 - Moderate	2020
Galey [EPA Code: 23G01] - Br d/s Inch Br	E94164.38, N134362.52	Q-Value 3 - Poor	2020
Brick [EPA Code: Br W of Garrynagore	E87828.34, N125477.46	Q-Value 3-4 - Moderate	2020

Beyond the River Galey, the Upper Feale Estuary becomes the Cashen Estuary which covers an area of 2.67km^2 before it reaches the Atlantic Ocean (The Central and Regional Fisheries Board, 2008). The Cashen Estuary has a status of 'At risk'.

4.2.2 Fisheries -Inland Fisheries Ireland Data

The proposed development site drains northward into the Feale River. The Feale River flows to the Lower River Shannon SAC. A search of the Inland Fisheries Ireland (IFI) online database was carried out to determine the species richness of the Feale River.

The Feale watercourse is located within the Tralee Bay-Feale water catchment and is hydrologically connected to the proposed development. The Upper Feale Estuary provides suitable habitat for a variety of aquatic species including European eel (*Anguilla anguilla*), brown trout (*Salmo trutta*), sea trout *(Salmo trutta trutta),* salmon, flounder, three-spined stickleback and minnow (The Central and Regional Fisheries Board, 2008).

The River Feale is listed in the first schedule of the '*European Communities (Quality of Salmonid Waters) Regulations, 1988*' (S.I. No. 293) as a 'salmonid water' and therefore, is an important river for Atlantic Salmon (*Salmo salar*) and also Sea Trout (*Salmo trutta* morpha *trutta*).

Brook and River Lamprey have been recorded within the main Feale Catchment around Listowel and Fingue (O' Connor, 2006). Sea Lamprey (*Petromyzon marinus*) were also recorded within the River Feale between Listowel and the open sea. O' Connor (2006) recorded a total of 97 juvenile sea lampreys and 280 river/brook juveniles within a total fished area of 165 m^2 with the highest densities of lamprey species occurring in the lower reaches of the river between Duagh and Listowel. It is noted that some gravel and cobble were removed upstream of the Duagh Bridge during this period and that the river was displaying enrichment with substantial growth of filamentous algae in the vicinity of Listowel.

4.2.3 Lower River Shannon SAC [002165]

The Conservation Objectives document and Natura 2000 Data Form for this site as available on the NPWS website was reviewed during this assessment. Information in relation to the conservation objectives of the QI's and site-specific pressures and threats for the SAC is detailed below.

4.2.3.1 Review of Conservation Objectives

The relevant QIs and the associated conservation objectives of the site are presented in Table 4.4. The Targets and Attributes for the relevant habitats and species, as described in the Lower River Shannon SAC Conservation Objectives supporting documents, were reviewed and considered in this assessment.

Table 4- 3 Qualifying Interests and Conservation Objectives (Version 1, 2012)

Qualifying Interest	Conservation Objective
Reefs [1170]	To maintain the favourable conservation condition of Reefs in the Lower River Shannon SAC
Estuaries [1130]	To maintain the favourable conservation condition of Estuaries in the Lower River Shannon SAC
Large shallow inlets and bays [1160]	To maintain the favourable conservation condition Large shallow inlets and bays in the Lower River Shannon SAC
Sandbanks which are slightly covered by sea water all the time [1110]	To maintain the favourable conservation condition Sandbanks which are slightly covered by sea water all the time in the Lower River Shannon SAC
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the Lower River Shannon SAC
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae) [91E0]	To restore the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)* in the Lower River Shannon SAC
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]	To maintain the favourable conservation condition of Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation in the Lower River Shannon SAC
Bottlenose Dolphin *(Tursiops truncates)* [1349]	To maintain the favourable conservation condition of Bottlenose Dolphin in the Lower River Shannon SAC
Sea Lamprey *(Petromyzon marinus)* [1095]	To restore the favourable conservation condition of Sea lamprey in the Lower River Shannon SAC
Brook Lamprey *(Lampetra planeri)* [1096]	To maintain the favourable conservation condition of Brook lamprey in the Lower River Shannon SAC
River Lamprey *(Lampetra fluviatilis)* [1099]	To maintain the favourable conservation condition of River lamprey in the Lower River Shannon SAC
Atlantic Salmon *(Salmo salar)* (only in fresh water) [1106]	To restore the favourable conservation condition of Salmon in the Lower River Shannon SAC
Otter *(Lutra lutra)* [1355]	To restore the favourable conservation condition of Otter in the Lower River Shannon SAC

4.2.3.2 Site Specific Pressures and Threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to effect on the SAC were reviewed and considered in relation to the proposed works. These are provided in Table 4.5.

Table 4- 4 Site-specific threats, pressures and activities with potential to have effects on the SAC

Negative Impacts			
Rank	Threats and pressures [code]		Inside/outside/both [i] o [b]
L	I01	invasive non-native species	.i
M	A08	Fertilisation	O
M	E01	Urbanised areas, human habitation	O
M	H04	Air pollution, air-borne pollutants	O
M	A08	Fertilisation	I
M	E03	Discharges	O
L	D01.01	paths, tracks, cycling tracks	I
M	K02.03	eutrophication (natural)	O
L	G01.01	nautical sports	I
L	B	nautical sports	i
L	F01	Marine and Freshwater Aquaculture	i
L	F03.01	Hunting	i
L	C01.01.02	removal of beach materials	i
M	E03	Discharges	i
L	C01.03.01	hand cutting of peat	i
M	A04	Grazing	i
L	J02.12.01	sea defense or coast protection works, tidal barrages	i
M	J02.01.01	Polderisation	i
L	J02.10	Landfill, land reclamation and drying out, general	i
M	J02.01.02	reclamation of land from sea, estuary or marsh	o

Rank: H = high, M = medium, L = low
i = inside, o = outside, b = both

4.2.3.3 Annex I habitats of Lower River Shannon SAC [002165]

Reefs [1170]

NPWS have estimated this habitat area as 21,421ha from intertidal and subtidal reef survey conducted in 2010 (Aquafact, 2011b, 2011c) with the distribution of Reefs stable, subject to natural processes. The extent of this habitat within the SAC is illustrated on Map 8 of the SSCOs (NPWS 2012). This habitat was not recorded within the proposed development site.

Estuaries [1130]

NPWS have estimated this habitat area as 24,273ha using OSI data and the Transitional Waterbody area as defined under the Water Framework Directive with the permanent habitat area stable or increasing, subject to natural processes. The extent of this habitat within the SAC is illustrated on Map 4 of the SSCOs (NPWS 2012). This habitat was not recorded within the proposed development site.

Large shallow inlets and bays [1160]

NPWS have estimated this habitat area as 35,282ha using OSi data and the Transitional Water Body area as defined under the Water Framework Directive with the permanent habitat area stable or increasing, subject to natural processes. The extent of this habitat within the SAC is illustrated on Map 7 of the SSCOs (NPWS 2012). This habitat was not recorded within the proposed development site.

Sandbanks which are slightly covered by sea water all the time [1110]

NPWS have estimated this habitat area as 1,353ha using the Valentia Island to River Shannon Admiralty Chart (no. 1819_0) with the distribution and permanent habitat area is stable or increasing, subject to natural processes. The extent of this habitat within the SAC is illustrated on Map 3 of the SSCOs (NPWS 2012). This habitat was not recorded within the proposed development site.

Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0]*

The extent of this habitat within the SAC is illustrated on Map 14 of the SSCOs (NPWS 2012). As per the conservation objectives document the total extent within the SAC is likely to be somewhat greater there is an absence of suitable terrain for the occurrence of extensive alluvial woodland. Continuity of woodland cover is provided by oak woodlands, ash woodlands and conifer plantations. This habitat was not recorded within or adjacent to the proposed development.

Water courses of plain to montane levels with the *Ranunculion fuitantis* and *Callitricho-Batrachion* vegetation [3260]

Three sub-types of high conservation value are known to occur in the SAC: *Groenlandia densa*, (Opposite-leaved Pondweed), *Schoenoplectus triqueter* (Triangular Club-rush) and Bryophyte-rich streams and rivers with the area stable or increasing, subject to natural processes. While the known extent of the three sub-types has been generally mapped within the SAC, Map 13 of the SSCOs (NPWS 2012), the exact area of each sub-types has not been quantified with the area of the *Schoeoplectus triqueter* sub-type likely to be smaller than the mapped range and both the *Groenlandia densa* and the bryophyte-rich sub-types are thought to be more widespread than mapped. These habitat was not recorded within or adjacent to the proposed development.

4.2.3.4 Annex II species of Lower River Shannon SAC

Bottlenose Dolphin *(Tursiops truncates)* [1349]

The following relevant information has been taken from NPWS Site Specific Conservation Objectives and supporting documentation specifically; Lower River Shannon SAC (site code: 2165) Conservation objectives supporting document marine habitats and species and Bottlenose dolphin survey in the Lower River Shannon SAC, 2018;

'Bottlenose dolphins are known to range widely throughout the site. Members of the Shannon dolphin population have occasionally been recorded outside the site (e.g. within Tralee Bay or Brandon Bay; generally, within 25km of the estuary). Within its downstream study area, robust research effort has led to the identification of two core locations within which the majority of dolphin records occur. These 'critical areas' represent high value habitats used preferentially by the species within its overall range at the site. Certain individuals and/or groups are more likely to occur further upstream than others. As the upstream area within the site has seen significantly less survey coverage, it should be noted that all suitable aquatic habitat is considered relevant to the species' range and ecological requirements within the site and is therefore of potential use by bottlenose dolphins. Bottlenose dolphins using industrially

developed coastal waters such as the Shannon Estuary are particularly vulnerable to anthropogenic disturbance and to habitat degradation. Threats may include industrial and agricultural pollutant contamination (Jepson et al., 1999, 2016; Pierce et al., 2008).'

The distribution and core areas for this species within the SAC are illustrated on Map 16 of the SSCOs (NPWS 2012). This map illustrates that habitat for the species occurs within the Cashen Estuary.

Lamprey species

Lower River Shannon SAC is designated for three species of lamprey; Sea Lamprey *(Petromyzon marinus),* River Lamprey (*Lampetra fluviatilis*) and Brook Lamprey *(Lampetra planeri).* Artificial barriers are currently preventing lampreys from accessing the full extent of suitable habitat. Specific barriers serve to limit the up- river migration of sea lamprey while generating genetic isolation within River and Brook Lamprey populations. There is potential for Lamprey species to occur within and downstream of the development area.

Salmon *(Salmo salar)* [1106]

NPWS have identified that Salmon occurs in 100% of river channels down to second order watercourses that area accessible from estuarine habitat. The hyrdoelectric station at Ardnacrusha and the Parteen regulating weir are significant barriers to upstream passage of salmon on the Shannon main channel. Further weirs upstream on the Shannon also restrict access to spawning habitat. No such obstacles, causing significant fish passage issues for salmon are present on the Feale and Mulkear. Potential habitat for this species occurs within and downstream of the proposed development. The River Feale is a designated Salmonid Water under the E.U. Freshwater Fish Directive.

Otter *(Lutra lutra)* [1355]

Terrestrial habitat area for otter in the SAC is mapped and calculated as 596.8ha above high water mark (HWM); 958.9ha along riverbanks / around ponds. Areas mapped include 10m terrestrial buffer along shoreline (above HWM and along riverbanks) identified as critical for otters (NPWS, 2007). Marine area mapped and calculated as 4,461.6ha Area mapped based on evidence that otters tend to forage within 80m of the shoreline (HWM) (NPWS, 2007; Kruuk, 2006). Freshwater River habitat length mapped and calculated as 500.1km. River length calculated on the basis that otters will utilise freshwater habitats from estuary to headwaters (Chapman and Chapman, 1982). Potential commuting and foraging habitat for this species was recorded within the study area.

4.2.4 Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]

The Conservation Objectives document and Natura 2000 Data Form for this site as available on the NPWS website was reviewed during this assessment. Information in relation to the conservation objectives of the QI's and site-specific pressures and threats for the SAC is detailed below.

4.2.4.1 Review of Conservation Objectives

The relevant SCI and the associated conservation objective of the site are presented in Table 4.6.

Table 4- 5 Special Conservation Interest and Conservation Objectives (Version 7 2020)

Qualifying Interest	Conservation Objective
Hen Harrier *(Circus cyaneus)* [A082]	To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA

4.2.4.2 Site Specific Pressures and Threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to effect on the SAC were reviewed and considered in relation to the proposed works. These are provided in Table 4.7.

Table 4- 6 Site-specific threats, pressures and activities with potential to have effects on the SPA

Negative Impacts			
Rank	Threats and pressures [code]		Inside/outside/both [i] o [b]
L	A09	Irrigation	I
L	E01.03	dispersed habitation	I
L	D01.02	discontinuous urbanisation	I
M	C01.03	Peat extraction	I

4.2.4.3 NPWS Site Synopsis and Natura 2000 Data Form

The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Hen Harrier with the habitat extent within the SPA estimated as 56,649 ha. The following relevant extracts have been gleaned from the NPWS site synopsis and Natura 2000 Data Form for the SPA:

'The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is a very large site centred on the borders between the counties of Cork, Kerry and Limerick. The site consists of a variety of upland habitats, though almost half is afforested.

This SPA is a stronghold for Hen Harrier and supports the largest concentration of the species in the country. A survey in 2005 recorded 45 pairs, which represents over 20% of the all-Ireland total. A similar number of pairs had been recorded in the 1998-2000 period. The mix of forestry and open areas provides optimum habitat conditions for this rare bird, which is listed on Annex I of the E.U. Birds Directive. The early stages of new and second-rotation conifer plantations are the most frequently used nesting sites, though some pairs may still nest in tall heather of unplanted bogs and heath. Hen Harriers will forage up to c. 5 km from the nest site, utilising open bog and moorland, young conifer plantations and hill farmland that is not too rank.

The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is of ornithological importance because it provides excellent nesting and foraging habitat for breeding Hen Harrier and is one the top sites in the country for the species. The presence of three species, Hen Harrier, Merlin and Short-eared Owl, which are listed on Annex I of the E.U. Birds Directive is of note.'

4.2.4.4 NPWS Data - Rare and Protected Species Datas

Hen harrier was recorded in the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA during the National Hen Harrier Surveys in 2005, 2010 and 2015 (there was no survey conducted in 2020). In 2005, there was one confirmed hen harrier breeding site between 0-3km from the wind farm site and one confirmed breeding site between 3-5km from the wind farm site. In 2010, there was one confirmed hen harrier breeding site and one additional hen harrier sighting between 0-3km from the wind farm site and one confirmed breeding site and one additional sighting between 3-5km from the wind farm site. In 2015, there were no hen harrier records between 0-3km from the wind farm site, but there was one confirmed and one possible breeding site between 3-5km from the wind farm site.

4.2.4.5 National Survey of Breeding Hen Harrier in Ireland, 2015

There have been four national surveys of Hen Harriers carried out in 1998-2000, 2005, 2010 and 2015[2]. These surveys aimed to quantify the size and distribution of the breeding Hen Harrier populations and examine changes since the previous national surveys had taken place. In the 2015 report, it is sated that the SPA network held between 44% and 47% of the national population (51 – 69 pairs) with the population of hen harriers within the SPA network declining by 26.6% since 2005. A decline of 37.7% was recorded across the 15-Year period of surveying within the Stacks, Mullaghareirks, Mount Eagle and West Limerick Hills SPA.

4.2.4.6 Hen Harrier Programme Monitoring

The Hen Harrier Programme conducts monitor of breeding hen harrier across all the SPA in Ireland[3]. The work is completed on behalf of the programme by the Golden Eagle Trust Monitoring Team. Surveys are undertaken between March and August each year. The objectives of the monitoring are to establish the occupancy of territorial breeding birds in each SPA and determine whether a breeding attempt was initiated. Surveys are conducted from vantage points that provide good view of the study areas.

The Hen Harrier Programme (2019) states that the Stacks, Mullaghareirks, Mount Eagle and West Limerick Hills SPA supports the highest proportion of breeding Hen Harrier within the SPA network. The population has declined by a third in the last ten years, however, has stabilised in the last five years. There were twenty-eight confirmed and four possible territories recorded in the SPA during surveys in 2019. There was one additional confirmed pair outside the designation boundary. Seventeen confirmed pairs were successful, fledging a total of 51 young. The SPA accounted for over 60% of the total Hen Harrier fledged in the network in 2019. In 2020[4], there were 30 confirmed pairs and one possible pair recorded. 2019 was a record-breaking year for numbers of fledged young with 51 fledged from 17 confirmed pairs. However, there was a drop in productivity in 2020, with 13 pairs successfully fledging 33 young. The nest failure rate of 58% was relatively high however the number of chicks per successful nest is relatively good averaging over 2.5 chicks per nest.

4.2.4.7 Breeding and Wintering Bird Atlas Records

Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland' (Balmer et al., 2013) is the most recent comprehensive work on wintering and breeding birds in Ireland. Previous Bird Atlases have been the primary source of information on the distribution and abundance of British and Irish birds prior to Bird Atlas 2007–11. The three previously published atlases were:

- The atlas of breeding birds in Britain and Ireland (Sharrock, 1976)
- The atlas of wintering birds in Britain and Ireland (Lack, 1986)
- The new atlas of breeding birds in Britain and Ireland: 1988-1991. (Gibbons *et al.,* 1993)

The wind farm study area lies within hectads Q83 and Q93, while the cable route also extends into hectads Q92 and R03. Table 4.8 presents a list of Hen Harrier records form the relevant hectads during the breeding season:

Table 4- 7 Breeding Bird Atlas Data (Hectads Q83 and Q93):

[2] *The 2015 National Survey of Breeding Hen Harrier in Ireland*
[3] *Hen Harrier Programme, Hen Harrier Monitoring 2019 (October 2019)*
[4] *Hen Harrier Programme, Hen Harrier Monitoring 2020 (November 2020)*

Species Name	Breeding Atlas 1968-1972		Breeding Atlas 1988-1991		Breeding Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	Q83	Q93	
Hen Harrier (*Circus cyaneus*)	-	-	-	-	possible breeding	-	Annex I Birds

Table 4.9 presents a list of Hen Harrier records form the relevant hectads during the wintering season:

Table 4- 8 Wintering Bird Atlas Data (Hectads Q92 and Q93):

Species Name	Wintering Atlas 1981-1984		Wintering Atlas 2007-2011	Conservation Status	
	Q92	Q93	Q92	Q93	
Hen Harrier (*Circus cyaneus*)	-	-	present	present	Annex I Birds Directive & Schedule 4 and Section 19 Wildlife Acts 1976-2018

4.2.4.8 Bird Sensitivity Mapping Tool

A Bird Sensitivity Mapping Tool for wind energy development was developed by BirdWatch Ireland to provide a measured spatial indication of where protected birds are likely to be sensitive to wind energy developments. The tool can be accessed via the National Biodiversity Data Centre Website (www.biodiversityireland.ie) and is accompanied by a guidance document (McGuiness *et al.*, 2015). The criteria for estimating a zone of sensitivity (i.e. 'low', 'medium', 'high' and 'highest') is based on a review of the behavioural, ecological and distributional data available for each species.

The wind farm study area is located within areas of **medium** and **low** bird sensitivity to wind energy developments. The wind farm study area boundary is 1.2km from the nearest area of high sensitivity (Cashen River estuary). The grid connection is also within areas of medium and low sensitivity and is 2.3km from the nearest area of high sensitivity (Duagh).

4.2.5 Tralee Bay Complex SPA [004188]

The Conservation Objectives document and Natura 2000 Data Form for this site as available on the NPWS website was reviewed during this assessment. Information in relation to the conservation objectives of the QI's and site-specific pressures and threats for the SAC is detailed below.

4.2.5.1 Review of Conservation Objectives

The relevant SCI and the associated conservation objective of the site are presented in Table 4.10.

Table 4- 10 Special Conservation Interest and Conservation Objectives (Version 1 April 2014)

Qualifying Interest	Conservation Objective
Common Gull [A182]	To maintain the favorable conservation condition of Common Gull in Tralee Bay Complex SPA

4.2.5.2 Site Specific Pressures and Threats

As per the Natura 2000 Data Form, the site-specific threats, pressures and activities with potential to effect on the SAC were reviewed and considered in relation to the proposed works. These are provided in Table 4.11.

Table 4- 11 Site-specific threats, pressures and activities with potential to have effects on the SPA

Negative Impacts			
Rank	Threats and pressures [code]		Inside/outside/both [i] o [b]
H	E01	Urbanised areas, human habitation	.o
M	A04	Grazing	.o
H	G01.02	Walking, horse-riding and non-motorised vehicles	.i
L	G01.01	Nautical sports	.i
M	C01.01.02	Removal of beach materials	.i
M	A04	Grazing	.i
M	A08	Fertilisation	.o

4.2.5.3 NPWS Site Synopsis and Natura 2000 Data Form

The Tralee Bay Complex is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for the following species: Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Mallard, Pintail, Scaup, Oystercatcher, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Sanderling, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Turnstone, Black-headed Gull and Common Gull. with the habitat extent within the SPA estimated as 3655 ha. The following relevant extracts have been gleaned from the NPWS site synopsis and Natura 2000 Data Form for the SPA:

'Tralee Bay Complex SPA is an internationally important wetland for wintering waders and wildfowl. It supports an internationally important population of Lightbellied Brent Goose (1,412) and nationally important populations of a further 21 species, i.e. Whooper Swan (101), Shelduck (220), Wigeon (1,634), Teal (623), Mallard (571), Pintail (54), Scaup (892), Oystercatcher (1,011), Ringed Plover (344), Golden Plover (6,393), Grey Plover (195), Lapwing (6,106), Sanderling (228), Dunlin (2,444), Black-tailed Godwit (139), Bar-tailed Godwit (608), Curlew (1,170), Redshank (635), Turnstone (229), Black-headed Gull (1,320) and Common Gull (599) – all figures are five year mean peak counts for the period 1995/96 to 1999/2000, except the gulls which are four year mean peak counts for the period 1996/97 to 1999/2000.

Tralee Bay Complex SPA is of high ornithological importance as it annually supports over 20,000 wintering waterbirds, including an international important population of Light-bellied Brent Goose and nationally important populations of 21 other species. It is of note that three of the species that regularly occur, Whooper Swan, Golden Plover and Bar-tailed Godwit, are listed on Annex I of the E.U. Birds Directive. Tralee Bay is a Ramsar Convention site and parts of the Tralee Bay Complex SPA are designated as Nature Reserves. Lough Gill is a Wildfowl Sanctuary'

4.2.5.4 Breeding and Wintering Bird Atlas Records

Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland' (Balmer et al., 2013) is the most recent comprehensive work on wintering and breeding birds in Ireland. Previous Bird Atlases have been the primary source of information on the distribution and abundance of British and Irish birds prior to Bird Atlas 2007–11. The three previously published atlases were:

- The atlas of breeding birds in Britain and Ireland (Sharrock, 1976)
- The atlas of wintering birds in Britain and Ireland (Lack, 1986)
- The new atlas of breeding birds in Britain and Ireland: 1988-1991. (Gibbons *et al.,* 1993)

The wind farm study area lies within hectads Q83 and Q93, while the cable route also extends into hectads Q92 and R03. Table 4.12 presents a list of Common Gull records from the relevant hectads during the breeding season:

Table 4- 12 Breeding Bird Atlas Data (Hectads Q83 and Q93):

Species Name	Breeding Atlas 1968-1972		Breeding Atlas 1988-1991		Breeding Atlas 2007-2011		Conservation Status
	Q83	Q93	Q83	Q93	Q83	Q93	
Common Gull (*Larus canus*)	-	-	seen	-	Non-breeding	-	Section 19 Wildlife Acts 1976-2018

BD = Birds Directive; RL= BoCCI Red List; AL= BoCCI Amber List; GL= BoCCI Green List; Seen = recorded; Breed = breeding; Non-B = non-breeding; Poss = possible breeding; Prob = probable breeding; Conf = confirmed breeding

Table 4.13 presents a list of Common Gull records form the relevant hectads during the wintering season:

Table 4- 13 Wintering Bird Atlas Data (Hectads Q92 and Q93):

Species Name	Wintering Atlas 1981-1984		Wintering Atlas 2007-2011	Conservation Status	
	Q92	Q93	Q92	Q93	
Common Gull (*Larus canus*)	Present	Present	present	-	Section 19 Wildlife Acts 1976-2018

BD = Birds Directive; RL= BoCCI Red List; AL= BoCCI Amber List; GL= BoCCI Green List; Seen = recorded; Breed = breeding; Non-B = non-breeding; Poss = possible breeding; Prob = probable breeding; Conf = confirmed breeding

4.2.5.5 Bird Sensitivity Mapping Tool

A Bird Sensitivity Mapping Tool for wind energy development was developed by BirdWatch Ireland to provide a measured spatial indication of where protected birds are likely to be sensitive to wind energy developments. The tool can be accessed via the National Biodiversity Data Centre Website (www.biodiversityireland.ie) and is accompanied by a guidance document (McGuiness *et al*., 2015). The criteria for estimating a zone of sensitivity (i.e. 'low', 'medium', 'high' and 'highest') is based on a review of the behavioural, ecological and distributional data available for each species.

The wind farm study area is located within areas of **medium** and **low** bird sensitivity to wind energy developments. The wind farm study area boundary is 1.2km from the nearest area of high sensitivity (Cashen River estuary). The grid connection is also within areas of medium and low sensitivity and is 2.3km from the nearest area of high sensitivity (Duagh).

4.2.6 Field Study Results

4.2.6.1 Overview of the Wind Farm Site

A description of the habitats within and adjacent to the proposed works is described in full in Chapter 6 of the EIAR accompanying this application.

The proposed wind farm development site is located Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The site is located at the confluence of the River Feale and Brick River. The River Feale forms the northern boundary of the proposed development site, while the Brick River forms the western boundary. The River Feale continues to flow northwest to discharge into the mouth of the Shannon estuary at Ballybunnion.

The site is accessed via a number of local roads and bog tracks. From the south the site is accessed via local roads adjoining the R557 regional road which is located south of the site, which in turn adjoins the N69 National Secondary Road, south of Listowel. The south of the site can also be accessed from the west via a bridge over the Brick River.

The study area comprises 15 habitat types with the site predominately composed of cut-over bog (PB4). The improved agricultural grassland habitat surrounds the cut-over bog habitats with some of the agricultural areas having been reclaimed from peatland. The cut-over bog (PB4) habitat remains in use for turbary activities, and the vast majority of the habitat had been degraded by these activities. The cut-over habitat now shows variations in the vegetation which has become to recolonise the area. Some areas of the habitat remaining relatively bare, with little vegetation, however other areas have regenerated with Reed and large sedge swamps vegetation, peatland type vegetation including Purple-moor grass *(Molinia caerulea*), heather *(Calluna vulgaris),* Cross leaved Heath *(Erica tetralix),* Bog Mytrle *(Myrica gale)* and Bog Asphodel *(Narthecium ossifragum)* and also areas with scrub (WS1). There are two relatedly small areas of intact raised bog habitat of approximately 5.9 ha in total, located to the west of the cut-over habitats adjacent to the local access roadway and within the east of the proposed development site. Although this habitat remains intact the drainage of the surrounding habitat has resulted in degradation of the habitat.

The additional habitats within the study area include raised bog (PB1), conifer plantation (WD4), wet grassland (GS4), hedgerows (WL1), treeline (WL2), spoil and bare ground (ED2), dry meadows and grassy verges (GS2), reed and large sedge swamp (FS1), drainage ditches (FW4), depositing/lowland rivers (FW2) and buildings and artificial surfaces (BL3).

The proposed development site is drained by a number of watercourse and an extensive network of drainage ditches that flow towards the Cashen Estuary.

4.2.6.2 Overview of Grid Connection Route

A description of the habitats within and adjacent to the proposed works is described in full in Chapter 6 of the EIAR accompanying this application.

The proposed grid connection route is approximately 13.8 km in length and will commence from the proposed Ballynagare substation and connect to the existing 110kV Clahane switching station.

The proposed grid connection route will be located within the existing road corridor, which is classified as Building and artificial surfaces (BL3) and there will be no requirement for works within habitats located outside of the existing corridor.

The existing road corridor associated with the grid connection is bordered by grass verges classified as dry meadows and grassy verges (GS2). Adjacent to the immediately road corridor a several habitat types occur including hedgerows (WL1), treelines (WL2), earth banks (BL2), improved agricultural grassland (GA1), scrub (WS1), stone walls (BL1), drainage ditches (FW4) and dwellings houses and agricultural buildings (BL3).

There are a total of 5 watercourse crossings associated with proposed grid connection route. The construction methodology has been designed to eliminate the requirement for in-stream works at watercourse crossing locations with all crossings to be achieved via directional drilling. Further details are provided in section 4.8.9.4 of Chapter 4 and Table 4.5 of Chapter 4 of the EIAR.

The grid connection route is confined to the existing road carriageway which does not provide supporting habitat for QI/SCI species associated with the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

4.2.6.1 Overview of the Proposed Abnormal Size Load Delivery Route (Turbine Delivery Route)

A description of the habitats along the Proposed Abnormal Size Load Delivery Route is described in full in Chapter 6 of the EIAR.

The proposed transport route for the large wind turbine plant will be via the entry point at the port of Foynes, east to Limerick on the N69, south to Abbeyfeale and Castleisland via the M20 and N21, to Tralee on the N21 and finally, north on the N69 towards the site where it exits the N69 at Mountcoal.

The transport route leaves the national road network on the N69 to join the L6055, before heading northwest for approximately 4km to the priority junction with the R557. The route then heads southwest for 2.5kms before turning right into an unnamed local road towards the site at Ballynagare.

4.2.6.1.1 *Route Assessment – Local Context*

The route assessment in a local context considered comprises for the following locations;

- Location 1 - the N69 / L6055 junction at Mountcoal,
- Location 2 - the left-hand bend on the L6055 at Mountcoal,
- Location 3 - the crossroads on the L6055 with the L1027,
- Locations 4, 5 and 6 – bends on the L6055,
- Location 7 - the R557 / L6055 junction,
- Location 8 – R557 – Local road junction,
- Locations 9 to 12 – Access junctions A to D providing access to the site.

The proposed Abnormal Size Load Delivery Route route makes use of the existing road which is classified as Building and artificial surfaces (BL3). The existing road corridor associated with the local delivery route for is bordered several habitat types including hedgerows (WL1), treelines (WL2), earth banks (BL2), improved agricultural grassland (GA1), scrub (WS1) and dwellings houses and agricultural buildings (BL3).

4.2.6.2 Otter Survey

Areas identified as providing potential habitat for otter, i.e., watercourses within and in close proximity to the site, were subject to specialist targeted survey. The otter surveys of the watercourses within the proposed development site were conducted on the 09th September 2020, 18th and 21st of June 2021. The purpose of the visits was to survey for any evidence of otter in proximity to the development footprint including the proposed grid connection route.

The proposed grid connection crosses 5 watercourses. The construction methodology has been designed to eliminate the requirement for in-stream works at watercourse crossing locations. Further details are provided in section 4.8.9.4 of Chapter 4 and Table 4.5 of Chapter 4 of the EIAR. An Otter survey was conducted of the watercourses on the grid route on the18th June, 21st June, 1st September and 8th October 2021.

Evidence of otter was recorded during the dedicated survey described above and also during the additional surveys including bat and bird surveys undertaken within the proposed development site. Given these records and that there is potential habitat for the species within and adjacent to the proposed development site boundary, it has been demonstrated that otter use the habitats within and surrounding the study area for both commuting and foraging purposes.

4.2.6.3 Hen Harrier

Raw survey Hen Harrier was recorded during the breeding and winter season. Raw Survey data for hen harrier is provided in Appendix 7-4 of the EIAR Ornithology Chapter. Survey maps relating to the hen harrier roost are contained in a Confidential Appendix 7-8. Note that hen harrier was not recorded during breeding raptor surveys.

Vantage Point Survey

Hen harrier was observed twice during vantage point surveys in September 2020 (both on the same day). Individuals were observed hunting, including 30 seconds (s) at PCH. Both flights were partly within the wind farm study area boundary, in the north-western area.

Walkover Survey

Hen harrier was observed once during walkover surveys in October 2019. A female was being mobbed by other birds at the Ballyhorgan Marshes, 600m north of the wind farm study area boundary.

Hen Harrier Winter Roost Survey

There were 30 records of hen harrier during hen harrier winter roost surveys. Up to 3 birds were observed at once (2 females/juveniles and 1 male) using the wider area. A confirmed roost is located in Ballyouneen bog, approximately 1.4km north of the wind farm study area boundary (Confidential Appendix 7-8). Birds were observed landing within the wind farm study area on the eastern side in Ballynagare bog at dusk in January 2020. However, these birds were subsequently observed flying again 10 minutes before sunset and their final roosting location is uncertain. A male was also observed flying in this area close to dusk in January 2021. No further hen harrier observations were made in the same area during winter roost or any other surveys.

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Incidental Records

There were 4 incidental records of hen harrier over the survey period. Of these, 2 were individual birds on Ballynagare bog within western side of the wind farm study area, observed during the day in November and December 2020. The remaining records were further than 500m north of the wind farm study area boundary.

Supplementary Data

There are 10 hen harrier records in the supplementary data. All are records of individuals in flight and hunting outside the wind farm study area boundary, to the north-east. These birds were observed in the post-breeding and winter season, between August and December 2020. A total of 3 flights were within 500m of the wind farm study area boundary. Both a male and female were observed.

4.2.6.4 Common Gull

Common gull was recorded during the winter and passage season. Raw survey data and maps for common gull is provided in Appendix 7-4 of the EIAR Ornithology Chapter.

Vantage Point Survey

Common gull was observed once during vantage point surveys in October 2019. A flock of 13 birds flew partially within the wind farm study area boundary on the west side, involving 20s at PCH.

Walkover Survey

Common gull was observed once during winter walkover surveys in October 2019. A flock of 6 birds were foraging with other gulls on agricultural farmland at Ballyouneen, 1km north-east of the wind farm study area boundary.

Waterbird Distribution Survey

Common gull was observed 8 times during waterbird distribution surveys in the months of August, September, October, December 2019 and January 2021. Of these, 2 were within 500m of the northern wind farm study area boundary, comprising individual birds. All observations were around the Cashen River and estuary and the largest flock size in the wider area was 86 birds..

Incidental Records

There were 2 incidental records of common gull over the survey period, in April and September 2019. In both cases, the surveyor observed large mixed flocks of gulls, including common gull, flying in the dark. Both records were within 500m of the wind farm study area to the north-east, at Ballyouneen

Supplementary Data

There are 9 records of common gull in the supplementary data from the months of April, August, September and October 2019. Of these records, 2 are flights within 500m north of the north-eastern wind farm study area boundary, along the Cashen River.

4.2.6.5 Invasive Species Survey

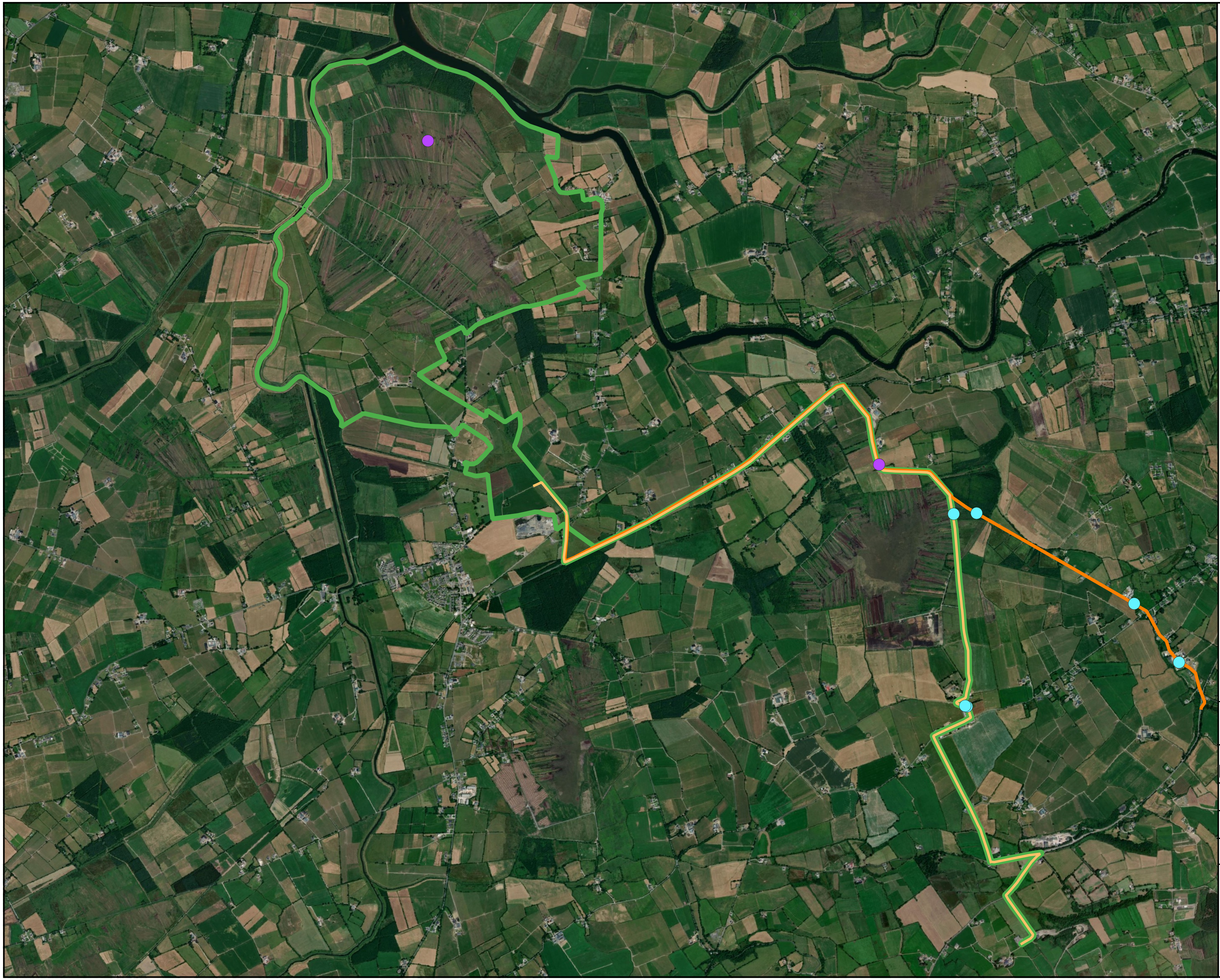
Rhododendron (*Rhododendron ponticum),* a Third Schedule non-native species was recorded within the proposed development site. One individual plant was recorded within the cut-over bog habitat and this individual including a 7m buffer zone, are avoided by the proposed development footprint.

A number of infestations of Rhododendron (*Rhododendron ponticum*) and Japanese Knotweed *(Fallopia japonica)* were recorded along the proposed grid connection route and turbine delivery route. Along the grid connection route, Japanese Knotweed was recorded adjacent to the road corridor adjacent to agricultural grassland fields. Rhododendron was recorded within hedgerow associated with dwellings.

The locations of the infestations are mapped in Figure 4-1. Details of all infestations are provided in Table 4-14 below.

Table 4- 14 Location of invasive species

ID Ref	Species	Grid ref	Details
Proposed Development Study Site			
PD1	Rhododendron *(Rhododendron ponticum)*	489712, 633013	Located within the cut-over bog habitat.
Grid Connection Route/Turbine Delivery Route			
CG101	Japanese Knotweed *(Fallopia japonica)*	94088, 124877	Recorded adjacent to roadway.
GC102	Japanese Knotweed *(Fallopia japonica)*	94197, 128272	Recorded adjacent to roadside, Extensive stand
GC103	Japanese Knotweed *(Fallopia japonica)*	94177, 128278	Recorded adjacent to roadside, Extensive stand
T/GCR104	Rhododendron *(Rhododendron ponticum)*	93466, 130277	Recorded adjacent to roadway and existing dwelling house
T/GCR105	Japanese Knotweed *(Fallopia japonica)*	95972, 128633	Recorded adjacent to roadway.
T/GCR106	Japanese Knotweed *(Fallopia japonica)*	94300, 129866	Recorded adjacent to roadway
T/GCR107	Japanese Knotweed *(Fallopia japonica)*	95592, 129113	Recorded adjacent to roadway.
T/GCR108	Japanese Knotweed *(Fallopia japonica)*	95972, 128633	Recorded adjacent to roadway.



Map Legend

- Ballynagare Wind Farm Study Area
- Grid Connection Route
- Local Turbine Delivery Route

Invasive species

- Japanese Knotweed
- Rhododendron

Drawing Title	Invasive Species
Project Title	Ballynagare Wind Farm
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 4-1
Scale: 1:40924	Date: 15.10.2021

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5. ASSESSMENT OF POTENTIAL EFFECTS & ASSOCIATED MITIGATION

5.1 Potential for Direct Effects on the European Sites

5.1.1 Lower River Shannon SAC

The wind farm site is located immediately adjacent to the SAC boundary, however there will no direct impact on any QI habitat for which the SAC is designated.

The project will not result in the loss of any aquatic habitat or mortality of QI aquatic species. There will be no loss of fisheries habitat and there is no potential for the proposed development to result in any barrier to the movement of aquatic species.

No breeding, resting or foraging sites for Otter will be impacted. In addition, there is no potential for the proposed development to result in any barrier to the movement of aquatic species.

No direct impact on the QI habitats or species of this SAC will occur.

5.1.2 Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]

Hen Harrier were recorded flying at potential collision risk height during VP survey work undertaken. Consequently, the potential for collision mortality was identified as a potential direct impact on the species.

A “Random” collision risk analysis has been undertaken and full details are provided in Appendix 7-5 of the EIAR Ornithology Chapter.

The species was recorded flying within PCH during vantage point surveys.

The collision risk has been calculated at a ratio of 0.001 collisions per year, or one bird every 913 years. The predicted collision risk is insignificant. Based on the above it can be concluded that the negligible adverse impact would not result in any adverse effects on the Hen Harrier populations of the SPA will occur as a results of collision mortality.

Hen harrier were not found to be reliant on the habitats within the wind farm site and although the grid connection route options is partially located within the SPA, the proposed development works will be is confined to the existing public road carriageway and thus, will not result in the loss of any potential supporting habitat for Hen Harrier.

There will be no direct impacts on supporting habitat for this species, within or outside the SPA, as a result of the proposed development.

5.1.3 Tralee Bay Complex SPA [004188]

Common Gull were recorded flying at potential collision risk height during vantage point survey work undertaken. Consequently, the potential for collision mortality was identified as a potential direct impact on the species.

A "Random" collision risk analysis has been undertaken and full details are provided in Appendix 7-5 of the EIAR Ornithology Chapter.

The species was recorded flying within PCH during vantage point surveys.

The collision risk has been calculated at a ratio of 0.03 collisions per year, or one bird every 34 years. The predicted collision risk is insignificant. Based on the above it can be concluded that the negligible adverse impact would not result in any adverse effects on the Common Gull populations of the SPA will occur as a results of collision mortality.

Common Gull were not found to be reliant on the habitats within the wind farm site for foraging or breeding and there is suitable habitat for this species in the wider areas surrounding the proposed development. Additionally given, the very low level of activity within the wind farm study area, no significant effects of displacement or barrier effects are anticipated.

There will be no direct impacts on supporting habitat for this species, within or outside the SPA, as a result of the proposed development.

5.2 Potential for Indirect Effects on the European Sites

5.2.1 Deterioration of Water Quality

Taking a precautionary approach, the proposed works have the potential to cause deterioration in water quality during the construction, operational and decommissioning phase of the development due to the release of pollutants including suspended solids and hydrocarbons, potentially affecting the following aquatic QI habitats and species associated with the Lower River Shannon SAC , in the absence of mitigation:

- Reefs [1170]
- Estuaries [1130]
- Large shallow inlets and bays [1160]
- Sandbanks which are slightly covered by sea water all the time [1110]
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation [3260]
- Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)* *[91EO]
- Bottlenose Dolphin *(Tursiops truncates)* [1349]
- Sea Lamprey *(Petromyzon marinus)* [1095]
- Brook Lamprey *(Lampetra planeri)* [1096]
- River Lamprey *(Lampetra fluviatilis)* [1099]
- Atlantic Salmon *(Salmo salar)* (only in fresh water) [1106]
- Otter *(Lutra lutra)* [1355]

5.2.1.1 Mitigation by Design

The current proposal has been designed to minimise impacts on the receiving environment and maximises the use of existing infrastructure including the local road network.

The project design has followed the basic principles outlined below to eliminate the potential for adverse impacts on QI and SCI receptors:

- Sensitive hydrological features have and will be avoided where possible, by application of suitable buffer zones (i.e. 50m to main watercourses). All of the key proposed development areas are located significantly away from the delineated 50m watercourse buffer zones with the exception of the upgrading of the existing watercourse crossing, new drain and water course crossings, and certain proposed access roads.
- Hard standing areas have been designed to the minimum size necessary to accommodate the turbine model that is selected.
- The proposed substation and associated grid connection route will be located entirely within the development site boundary.

5.2.1.2 Construction Phase Mitigation

The drainage philosophy overall is to minimise waters arising on site, to adequately treat any water that may arise and to ensure that the hydrological function of the watercourses on the site and in the wider catchment are not affected by the proposed works. This philosophy including all associated mitigation measures to protect local surface water quality are fully described in the Construction and Environmental Management Plan (CEMP) and Chapter 9 (Hydrology and Hydrogeology Chapter) of the EIAR, included as **Appendix 3** and **Appendix 4** respectively.

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

The Hydrology and Hydrogeology Chapter (Chapter 9) of the EIAR accompanying this application (**Appendix 4**) sets out in full the mitigation measures that will be implemented to protect water quality.

The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas where possible, by application of suitable buffer zones (i.e. 50m to natural watercourses)All of the key proposed development areas are located significantly away from the delineated 50m watercourse buffer zones with the exception of the upgrade of the existing watercourse crossing, new drain crossing and upgrades to existing site access tracks.

5.2.1.2.1 *Hydrocarbons and Waste Material*

The use of hydrocarbons during the construction process could lead to the potential for pollution of the wider environment, including entering drainage ditches and watercourses. Leaks from poorly maintained plant and machinery could lead to hydrocarbon dispersal over the works areas. Leaks in fuel storage tanks and spillages during refuelling operations could lead to larger releases of hydrocarbons into the environment.

5.2.1.2.2 *Refuelling, Fuel and Hazardous Materials Storage*

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling should occur at a controlled fuelling station;
- On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site and will be towed around the site by a 4x4 vehicle to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the dumpers, excavators, etc. that will be used during construction. The 4x4 vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site.

Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction. The bunded area will be roofed to prevent the ingress of rainwater and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical substation will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used should be regularly inspected for leaks and fitness for purpose; and, an emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan.
- Spill kits will be available to deal with any accidental spillage in and outside the refuelling area.

5.2.1.2.3 Cement Based Products Control Measures

The following mitigation measures are proposed to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site;
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute need be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Use weather forecasting to plan dry days for pouring concrete;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plate 3-1 below. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is taken off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

The 50 m wide river buffer zone and 10 m existing artificial drainage buffer will be emplaced for the duration of the construction phase. No construction activity will occur within the buffer zone with the exception of bridge and culvert, and access road construction. The buffer zone will:

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

5.2.1.2.4 Ecological/Environmental Supervision

An Environmental Clerk of Works (ECoW) will be appointed. Duties will include:

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

5.2.1.3 Project Ecologist

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

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

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with ECoW, oversee and provide advice on all relevant ecology mitigation measures set out in the planning documents for the proposed development;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Carry out ecological monitoring and survey work as may be required by the planning authority; and,
- Complete a pre-commencement invasive species survey at the site.

5.2.1.4 Operational Phase Mitigation

The potential for increased volumes of surface water runoff during the operational phase of the development was considered, as vegetated surfaces will be replaced with impermeable surfaces including hardstand areas and the substation site.

The operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work. The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.

The operational phase drainage system will be maintained in conjunction with the existing site drainage network and will include the following:

- Runoff from individual turbine hardstanding areas will be not be discharged into the existing drain network but discharged locally at each turbine location through settlement ponds and drainage swales;
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff (or existing drains will be utilised), in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained;
- Swales/roadside drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock; and,
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to existing drains.
- The electrical substation compound will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor,

Full detail of the operational phase mitigation is described in the Construction and Environmental Management Plan (CEMP) and Chapter 9 (Hydrology and Hydrogeology Chapter) of the EIAR, included as **Appendix 3** and **Appendix 4** respectively.

5.2.1.5 Decommissioning Phase Mitigation

Decommissioning phase impacts will be similar to construction phase but the potential for impacts will be significantly less given that much of the infrastructure will remain in-situ (Site roadways could be used for purposes other than operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site roads in-situ for future use. If the roads are not required in the future, they could be removed). Underground cables will be removed, and the ducting left in place. Temporary drainage measures as outlined in the Hydrology and Hydrogeology Chapter of the EIAR (**Appendix 4**) and best practice fuel/hydrocarbon cement management will be employed as required.

5.2.2 Disturbance & Displacement

Taking a precautionary approach, a potential pathway for indirect effects on following Qualifying Interests (Qis) of the Lower River Shannon SAC [002165] and Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161] has been identified as a result of disturbance associated with the construction, operation and decommissioning phase of the proposed works;

- Otter *(Lutra lutra)* [1355]
- Hen Harrier *(Circus cyanus)* [A028]
- Common Gull *(Larus canus)* [A182]

5.2.2.1 Disturbance to Otter

Otter was recorded during the dedicated surveys and potential supporting habitat for the species exists in the wider area and the potential for disturbance to the Otter population associated with the Lower River Shannon SAC is considered below.

Taking a precautionary approach, there is potential for the disturbance of Otter during the construction phase of the proposed development as a result of increased human activity associated with the installation of infrastructure including turbine infrastructure, site substation and general site preparation works including groundworks, excavation and installation of site construction compounds, The installation of the grid connection cabling also poses a risk of disturbance specifically where the grid connection crosses watercourses within the SAC boundary.

Otters are crepuscular in nature and are unlikely to be adversely impacted by the proposed works. The NPWS Threat Response Plan for Otter acknowledges that "*Little evidence has come to light in recent studies to suggest that disturbance by recreation is a significant pressure.*" It also identifies that Otter are known to travel significant distances from streams and lakes in search of new territory and feeding areas.

Chanin P (2003) provides a literary review with regard to anthropogenic disturbance and refers to several reports which have found that disturbance is not detrimental to Otters (Jefferies (1987), (Durbin 1993). (Green & Green 1997). The report also describes successful breeding in towns, under ferry terminals and under the jetties of one of Europe's largest oil and gas terminals at Sullom Voe in Shetland, Scotland.

Irish Wildlife Manual No 23 (National Otter Survey of Ireland 2004/2005) found no significant relationship between disturbance and otter occurrence. In addition, no significant difference in otter presence was found between sites with and without recreational activity. It also states, "*the lowest percentage occurrence was found at the sites with the lowest recorded disturbance!*"

Irish Wildlife Manual No 76 (*National Otter Survey of Ireland 2010/2012*) notes that the occurrence of Otter was unaffected by perceived levels of disturbance at the survey sites. It also notes that there is little published evidence demonstrating any consistent relationship between Otter occurrence and human disturbance (Mason & Macdonald 1986, Delibes et al. 1991; Bailey &Rochford, 2006).

Best practice disturbance limitation measures have been included in the project design and are described below.

Based on the above review of scientific literature, and based on the best practice disturbance limitation measures included below, the potential for adverse impact on the integrity of the otter population associated with the Lower River Shannon SAC can be excluded.

There will be no adverse impacts on otter associated with the operational phase of the development and potential impacts associated within decommissioning will be similar, although to a lesser extent, to that described above in relation to construction.

5.2.2.1.1 Best Practice

Pre-construction Otter Survey

Prior to any works being carried out, a pre-construction Otter survey will be undertaken by a qualified ecologist to ensure that Otter has not taken up residence within or close to the proposed works area.

It is not anticipated that any Otter holts will require to be excluded as part of project based on the findings of the Otter surveys undertaken. However, should any holt be encountered within the proposed development footprint during the pre-construction surveys, it will be subject to exclusion procedures as outlined in the TII/NRA guidelines (2006).

The requirement for a preconstruction survey comes from *NRA (2008) Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes*. The function of the preconstruction survey is to access any changes to the baseline conditions of the site that may have occurred between the planning consent and construction stage. This measure does not represent an omission in the assessment and is in accordance with industry best practice.

Disturbance Limitation Measures

Best practice disturbance limitation measures will be implemented during the construction phase of the development. These are described below:

The methodology of British Standard WS 5228: 1997 "Noise and Vibration Control on Construction and Open Sites" Part I, will be deployed during works, to 38inimize emission of any noise. In addition, the following best practice measures will be deployed:

- Work will be completed during daylight hours. No artificial lighting will be used to illuminate any works area in proximity to watercourses.
- The best means practical and available, including proper maintenance of plant, will be employed to 38inimize the noise produced by on-site operations.
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract.
- Compressors will be of the "sound reduced" models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers.
- Machines which are used intermittently will be shut down or throttled back to a minimum during those periods when they are not in use.
- Any plant such as generators or pumps which are required to work outside of normal working hours will be surrounded by an acoustic enclosure.

5.2.3 Displacement of Hen Harrier

No roosting was recorded within the wind farm site between April 2019 and March 2021. During roost surveys, up to 3 hen harriers were observed in the wider area (further than 500m from the wind farm site boundary) and there is an existing roost 1.4km north of the wind farm site boundary. Hen harrier were observed within the wind farm site at Ballynagare at dusk on 1 occasion however, no roost was confirmed. This species was also recorded in flight 7 times within the wind farm site to a 500m radius and 9 times further than 500m from the wind farm site boundary. In total, there were 16 observations of hen harrier hunting within the proposed development site throughout the two years of surveys.

Overall, no displacement or barrier effect impacts are predicted in association with the existing roost located 1.4km north of the proposed development study area given the separation distance. Similarly. Displacement and barrier effects are not predicted in relation to foraging given the frequency with which the proposed development site was frequented by this species over a two-year period.

Grid connection route is located within and adjacent to the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. Although the grid connection route is partially located within the SPA, it will be confined to the existing public road carriageway and will not result in the loss of any potential supporting habitat for Hen Harrier. The works are confined to the existing public road corridor and as they will be carried out in sequential stages; no potential for adverse disturbance related impact has been identified. None the less, the following best practice measures in relation to timing of works and disturbance limitation will be implemented on a precautionary basis.

5.2.3.1.1 *Best Practice*

Taking a precautionary approach, it is proposed that construction works along the section of the proposed cable route, approximately 3 km of which is within the vicinity of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA will be undertaken outside the bird breeding season (1st of March to the 31st of August inclusive). Works conducted outside the breeding season will adhere to the disturbance limitation measures described above in relation to otter.

5.2.4 Displacement of Common Gull

Common gull was recorded 21 times during the survey period. Flocks up to 13 birds (County Importance) were recorded in the wind farm study area. Flocks up to 230 birds (National Importance) were recorded in the wider area.

Common gull was recorded once within the wind farm study area boundary and is not dependent on the wind farm study area for foraging or breeding. Furthermore, suitable habitat for common gull is widely available in the surrounding area. As such, significant effects are not anticipated.

This species was also recorded flying through the wind farm study area once, in winter. Given the very low level of activity within the wind farm study area, no significant effects of displacement or barrier effects are anticipated.

5.2.5 Spread of Invasive Species

5.2.5.1 General Biosecurity Measures

- Prior to commencement on site, an invasive species survey of the entire wind farm site, turbine delivery route and grid connection route will be undertaken by a suitably qualified ecologist in accordance with the most up to date guidance available at that time. This will ensure that any invasive species that have entered the site in the period between the surveys that have already been undertaken and the construction of the wind farm or if the identified stands have expanded, they will be appropriately managed.
- All identified stands will be identified and, where possible, fenced off. Fencing may not be possible where stands occur adjacent to the public road along the grid connection route and turbine delivery route. These stands will be clearly marked and the fences/markers located over 7 metres from the identified stands.
- No works will be undertaken within seven metres of an identified stand without following the specific procedures described in the following sections of this report.
- All earthworks machinery will be thoroughly pressure-washed prior to arrival on site to avoid introducing invasive species onto the site from external sources.

- Any materials brought onto site will be checked to ensure that they are free from invasive species to avoid introducing invasive species onto the site from external sources.

5.2.5.2 Measures to be undertaken when working within the vicinity of Invasive Species

- Any works required within seven metres of an identified stand of invasive species will be supervised by a suitably qualified ecologist (within the fenced or marked areas).

5.2.5.2.1 *Rhododendron*

Rhododendron was only found in locations where it is unlikely to be affected by the proposed works within the windfarm site and adjacent to the works areas along the grid connection route. It is unlikely to be significantly affected by the proposed works. However, the following measures are in place to ensure that biosecurity is maintained.

- In the case of rhododendron, it will be ensured that, where possible, there is no contact with the plant during the operations. This will avoid the potential for the works to assist in it spreading or the dispersal of seed.
- In the unlikely event that there is the requirement to remove rhododendron, the plant will be cut and chipped on site or removed to a licenced waste facility in a sealed container (under licence from the NPWS).

5.2.5.2.2 *Japanese Knotweed*

This species was not recorded on the wind farm site but was recorded at seven locations along the grid connection and turbine delivery route. Whilst, the stands will not be disturbed, there will be the excavation of the existing road within 7metres of them. Thus, there is potential for the excavated material to be contaminated with rhizomes. This could lead to the spreading of contaminated spoil if undertaken without the necessary precautions in place. The biosecurity measures that will be employed in these areas are described below:

- Where works occur within 7m of a Knotweed stand these will be carried out under the supervision of a suitably qualified ecologist.
- Machinery will no leave the contaminated area without being thoroughly washed/brushed down and inspected by the supervising ecologist to ensure that it is clean and free from Knotweed material. Any run-off or spoil will be isolated and treated as contaminated material.
- The supervising ecologist will survey the excavations and will determine whether the material is contaminated (by searching for rhizomes).
- Any contaminated material will be retained within the contaminated area and used for backfilling of the trench.
- The cables will be wrapped in root barrier membrane prior to being laid within 7m of the contaminated areas.
- The trench will be backfilled and the road resurfaced as required.
- It is likely that all contaminated material will be used in the backfilling of the trench. However, should any Knotweed material be required to be removed off site, this will be taken to a licenced waste facility under licence from the NPWS. Information required by the Wildlife Licensing Unit, NPWS, DAHG typically includes
  - Methods of removal
  - Methods of transport
  - Biosecurity measures
  - Copy of Management Plan
  - Timeframe for completion of works
  - Documentary evidence that chosen landfill facility will accept the material

- The machinery must be thoroughly cleaned down under supervision of an ecologist prior to moving away from the Knotweed contaminated area.
- All contractors and staff will be briefed about the presence, identification and significance of Knotweed before commencement of works.
- Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant species such as Knotweed. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.

The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority - *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (NRA 2010) and Irish Water (2016) *Information and Guidance Document on Japanese Knotweed*.

6. ASSESSMENT OF RESIDUAL ADVERSE EFFECTS

The sections provided below detail the site-specific residual impact assessment in relation to the relevant QIs of the above EU sites in light of their site-specific targets and attributes.

6.1 Lower River Shannon SAC [002165]

6.1.1 Reefs [1170]

The conservation objective for Reefs [1170] is:

'To maintain the favourable conservation condition of Reefs in the Lower River Shannon SAC'

The attributes and targets for Reefs as per the Site-Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.1 below

Table 6- 1 Targets and attributes associated with nominated site-specific conservation objectives for Reefs [1170]

Attribute	Target	Assessment
Habitat distribution	The distribution of Reefs is stable, subject to natural processes	There will be no direct impact on the distribution or area of this habitat as this habitat does not occur within the footprint of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Habitat area	The permanent habitat area is stable, subject to natural processes.	
Community distribution	Conserve the following reef community types in a natural condition: Fucoid-dominated intertidal reef community complex; Mixed subtidal reef community complex; Faunal turf-dominated subtidal reef community; Anemone-dominated subtidal reef community; and Laminaria- dominated community complex.	There will be no direct impact on the community distribution of this habitat as this habitat does not occur within the footprint of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.

6.1.2 Estuaries [1130]

The conservation objective for Estuaries [1130] is:

'To maintain the favourable conservation condition of Estuaries [1130] in the Lower River Shannon SAC'

The attributes and targets for Estuaries [1130] as per the Site-Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.2 below

Table 6- 2 Targets and attributes associated with nominated site-specific conservation objectives Estuaries [1130]

Attribute	Target	Assessment
Habitat area	The permanent habitat area is stable or increasing, subject to natural processes	There will be no direct impact on habitat area as this habitat does not occur within the footprint of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Community distribution	Conserve the following community types in a natural condition: Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; Estuarine subtidal muddy sand to mixed sediment with gammarids community complex; Subtidal sand to mixed sediment with *Nucula nucleus* community complex; Subtidal sand to mixed sediment with *Nephtys spp.* community complex; Fucoid-dominated intertidal reef community complex; Faunal turf-dominated subtidal reef community; and Anemone-dominated subtidal reef community.	There will be no direct impact on the community distribution of this habitat as this habitat does not occur within the footprint of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.

6.1.3 Sandbanks which are slightly covered by sea water all the time [1110]

The conservation objective for Sandbanks which are slightly covered by sea water all the time [1110] is:

'*To maintain the favourable conservation condition of Sandbanks which are slightly covered by sea water all the time in the Lower River Shannon SAC*'

The attributes and targets of Sandbanks which are slightly covered by sea water all the time as per the Site Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.3 below

Table 6- 3 Targets and attributes associated with nominated site-specific conservation objectives for Sandbanks which are slightly covered by sea water all the time [1110]

Attribute	Target	Assessment
Habitat distribution	The distribution of sandbanks is stable, subject to natural processes.	There will be no direct impact on the habitat distribution or area of this habitat as this habitat does not occur within the footprint of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction
Habitat area	The permanent habitat area is stable or increasing, subject to natural processes.	

Community distribution	Conserve the following community type in a natural condition: Subtidal sand to mixed sediment with Nephtys spp. community complex.	There will be no direct impact on the community distribution of this habitat as this habitat does not occur within the footprint of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction

6.1.4 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* [91E0] *

The conservation objective for Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0) * is:

'To maintain the favourable conservation condition of Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)* in Lower River Shannon SAC'

The attributes and targets for Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0)*as per the Site Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.4 below

*Table 6- 4 Targets and attributes associated with nominated site-specific conservation objectives for Alluvial forests with Alnus glutinosa and Fraxinus excelsior (91E0)**

Attribute	Target	Assessment
Habitat area	Area stable or increasing, subject to natural processes	As this habitat was not identified as occurring within the footprint of the proposed development, there will be no direct impacts to the habitat area, habitat distribution or woodland size of associated with the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Habitat distribution	No decline	
Woodland size	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	
Woodland Structure: Cover and height	Diverse structure with a relatively closed canopy containing mature trees; sub canopy layer with semi mature trees and shrubs and well-developed herb layer	As this habitat was not identified as occurring within the footprint of the proposed development, there will be no direct impacts to the woodland structure including cover and height, community diversity and extent or natural regeneration associated with the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Woodland Structure: community diversity and extent	Maintain diversity and extent of community types	
Woodland Structure: natural regeneration	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	

Hydrological regime: flooding depth/height of water table	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	As this habitat was not identified as occurring within the footprint of the proposed development, there will be no direct impacts to the hydrological regime including flooding depth/height of water table associated with the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Woodland Structure: dead wood	At least 30m³/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter (greater than 20cm diameter in the case of alder)	As this habitat was not identified as occurring within the footprint of the proposed development, there will be no direct impacts which could result in a change to the woodland structure including dead wood or veteran trees, to this habitat resulting from the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Woodland Structure: veteran trees	No decline	As this habitat was not identified as occurring within the footprint of the proposed development, there will be no direct impacts which could result in a change to the vegetation structure or composition of this habitat as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Vegetation structure: Indicators of local distinctiveness	No decline. Native tree covers not less than 95%	
Vegetative composition: Typical species	A variety of typical native species present, depending on woodland type, including alder (*Alnus glutinosa*), willows (*Salix* spp) and, locally, oak (*Quercus robur*) and ash (*Fraxinus excelsior*)	
Vegetative Composition: negative indicator species	Negative indicator species, particularly non-native invasive species, absent or under control.	

6.1.5 Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]

The conservation objective for Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] is:

'*To maintain the favourable conservation condition of Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation in the Lower River Shannon SAC"*

The attributes and targets for water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] as per the Site-Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.5 below

Table 6- 5 Targets and attributes associated with nominated site-specific conservation objectives for Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260]

Attribute	Target	Assessment
Habitat distribution	No decline, subject to natural processes	As this habitat was not identified as occurring within the watercourses associated with the footprint of the proposed development, there will be no direct impacts to the distribution, area, hydrological regime, groundwater discharge or substrate composition of this habitat as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Habitat area	Area stable or increasing, subject to natural processes	
Hydrological regime: river flow	Maintain appropriate hydrological regimes	
Hydrological regime: groundwater discharge	The groundwater flow to the habitat should be permanent and sufficient to maintain tufa formation	
Substratum composition: particle size range	The substratum should be dominated by large particles and free from fine sediments	
Water chemistry: minerals	The groundwater and surface water should have sufficient concentrations of minerals to allow deposition and persistence of tufa deposits	As this habitat was not identified as occurring within the watercourses associated with footprint of the proposed development, there will be no direct impacts to the water chemistry of this habitat as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Water quality: suspended sediment	The concentration of suspended solids in the water column should be sufficiently low to prevent excessive deposition of fine sediments	
Water quality: nutrients	The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition	

6.1.6 Sea Lamprey *(Petromyzon marinus)* [1095]

The conservation objective for Sea Lamprey *(Petromyzon marinus)* is:

'To maintain the favourable conservation condition of Sea Lamprey in Lower River Shannon SAC

The attributes and targets for Sea Lamprey *(Petromyzon marinus)* is as per the Site Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.6 below.

Table 6- 6 Targets and attributes associated with nominated site-specific conservation objectives for Sea Lamprey (Petromyzon marinus) [1095]

Attribute	Target	Assessment
Distribution: extent of anadromy	Greater than 75% of main stem length of rivers accessible from estuary	Sea lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on distribution as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Population structure of juveniles	At least three age/size groups present	Sea lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on population structure or density of juveniles as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction
Juvenile density in fine sediment	Juvenile density at least $1/m^2$	
Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	Sea lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on extent and distribution of spawning habitat availability of juvenile habitat as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the
Availability of juvenile habitat	More than 50% of sample sites positive	

		proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of water quality during construction

6.1.7 River Lamprey *(Lampetra fluviatilis)* [1099]

The conservation objective for River Lamprey *(Lampetra fluviatilis)* is:

'To maintain the favourable conservation condition of River Lamprey in Lower River Shannon SAC

The attributes and targets for River Lamprey *(Lampetra fluviatilis)* is as per the Site-Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.7 below.

Table 6- 7 Targets and attributes associated with nominated site-specific conservation objectives for River Lamprey (Lampetra fluviatilis) [1099]

Attribute	Target	Assessment
Distribution: extent of anadromy	Greater than 75% of main stem and major tributaries down to second order accessible from estuary.	River lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on distribution as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Population structure of juveniles	At least three age/size groups of river/brook lamprey present	River lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on juvenile population structure or density as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the

Juvenile density in fine sediment	Mean catchment juvenile density of brook/river lamprey at least 2/m²	design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	River lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on extent or distrubition of spawing habitat or the availability of juvenile habitat as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Availability of juvenile habitat	More than 50% of sample sites positive	

6.1.8 Brook Lamprey *(Lampetra planeri)* [1096]

The conservation objective for Brook Lamprey (Lampetra planeri) is:

'To maintain the favourable conservation condition of Brook Lamprey in Lower River Shannon SAC'.

The attributes and targets for Brook Lamprey (Lampetra planeri) as per the Site-Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.8 below.

Table 6- 8 Targets and attributes associated with nominated site-specific conservation objectives for Brook Lamprey (Lampetra planeri) [1096]

Attribute	Target	Assessment
Distribution	Access to all watercourses down to first order streams	Brook lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on distribution as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Population structure of juveniles	At least three age/size groups of brook/river lamprey present	Brook lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on juvenile population structure or desnity as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Juvenile density in fine sediment	Mean catchment juvenile density of brook/river lamprey at least 2/m²	
Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	Brook lamprey have been recorded as occurring witin the Upper Feale Estuary however, no instream work will occur within the SAC boundary. There will be no direct negative impact on distribution of spawning habitat or availability of juvenile habitat as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of
Availability of juvenile habitat	More than 50% of sample sites positive	

		measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.

6.1.9 Salmon *(Salmo salar)* [1106]

The conservation objective for Salmon *(Salmo salar)* [1106] is:

'To maintain the favourable conservation condition of Salmon in Lower River Shannon SAC'.

The attributes and targets for Salmon as per the Site-Specific Conservation Objectives (SSCOs) for Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.9 below.

Table 6- 9 Targets and attributes associated with nominated site-specific conservation objectives for Salmon (Salmo salar) [1106]

Attribute	Target	Assessment
Distribution: extent of anadromy	100% of river channels down to second order accessible from estuary	As the proposed development works are located outside of the SAC, there will be no direct negative impact on distribution as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Adult spawning fish	Conservation Limit (CL) for each system consistently exceeded	There will be no reduction in adult spawning fish , salmon fry abundance, out-migrating smolt abundance or the number and distribution of redds as a result of the propsed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Salmon fry abundance	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 minutes sampling	
Out-migrating smolt abundance	No significant decline	
Number and distribution of redds	No decline in number and distribution of spawning redds due to anthropogenic causes	
Water quality	At least Q4 at all sites sampled by EPA	There will be no reduction in water quality as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.

6.1.10 Bottlenose Dolphin (Tursiops truncatus) [1349]

The conservation objective Bottlenose Dolphin *(Tursiops truncatus)* [1349] is:

'To maintain the favourable conservation condition of Bottlenose Dolphin (Tursiops truncatus) in Lower River Shannon SAC'.

The attributes and targets for Bottlenose Dolphin as per the Site-Specific Conservation Objectives (SSCOs) for the Lower River Shannon SAC (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.10 below.

Table 6- 10 Targets and attributes associated with nominated site-specific conservation objectives for Bottlenose Dolphin (Tursiops truncatus) [1349]

Attribute	Target	Assessment
Access to suitable habitat	Species range within the site should not be restricted by artificial barriers to site use.	As the proposed development works are located outside of the SAC, there will be no direct negative impact on this species accesss to suitable habitat as a result of the proposed works. The proposed works will not create any artificial barriers preventing access of this species to suitable habitat. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Access to suitable habitat	Critical areas, representing habitat used preferentially by bottlenose dolphin, should be maintained in a natural condition.	
Disturbance	Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site	As the proposed development works are located outside of the SAC, there will be no direct negative impact on distribution as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.

6.1.11 Otter (Lutra lutra) [1355]

The conservation objective for Otter *(Lutra lutra) [1355]* is:

'To restore the favourable conservation condition of Otter in Lower River Shannon SAC'.

The attributes and targets for Otter *(Lutra lutra)* as per the Site-Specific Conservation Objectives (SSCOs) for Lower River Shannon (NPWS Version 1 2012) and an assessment of the proposed development against the nominated attributes and targets for the species is provided in Table 6.11 below.

Table 6- 11 Targets and attributes associated with nominated site-specific conservation objectives for Otter (Lutra lutra) [1355]

Attribute	Target	Assessment
Distribution	No significant decline	The proposed development has been designed to avoid impacts on watercourses. Appropriate buffers and set back distances will be established and are described within the CEMP. As such, there will be no decline on the species distrubtion as a result of the proposed works. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction
Extent of terrestrial habitat	No significant decline. Area mapped and calculated as 122.8ha above high water mark (HWM); 1136.0ha along river banks / around pond.	There will be no reduction to the terrestiral habitat extent as a result of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction
Extent of marine habitat	No significant decline. Area mapped and calculated as 857.7ha	There will be no reduction to the marine habitat extent as a result of the proposed development as the proposed development work are exclusively located on terrestrial habitat. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction
Extent of freshwater (river) habitat	No significant decline. Length mapped and calculated as 616.6km.	There will be no reduction to the freshwater (river) habitat extent as a result of the proposed development Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Extent of freshwater (lake) habitat	No significant decline. Area mapped and calculated as 2.6ha	There will be no reduction to the freshwater (lake) habitat extent as a result of the proposed development

		Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Couching sites and holts	No significant decline.	There was no evidence of otter holting or couch sites within or surrounding the proposed development footprint. The proposed development will not result in the reduction in holt or couching sites available to otter. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Fish biomass available	No significant decline	There will be no changes to the fish biomass available to Otter as a result of the proposed development. Indirect pathways that would allow impacts to occur were considered in the design of the proposed development and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any deterioration of surface water during construction.
Barries to connectivity	No significant increase.	There will be no changes to the connectivity between communting routes used by Otter as a result of the proposed development.

6.2 Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]

The generic conservation for the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161] is;

'To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA'

There will be no adverse impact on hen harrier as a results of habitat loss or displacement. Indirect pathways that would allow displacement/disturbance related impacts to occur were considered, on a precautionary basis, and a range of measures, described in Section 5 of this report are in place to avoid such impacts.

It can be concluded that the proposed development will not prevent the hen harrier population, associated with the Special Protection Area, reaching and maintaining favourable conservations status.

6.3 Tralee Bay Complex SPA [004188]

The site-specific conservation objective for Common Gull in the Tralee Bay Complex SPA [004188] is;

'To maintain the favourable conservation condition of Common Gull in Tralee Bay Complex SPA'

There will be no adverse impact on hen Common Gull as a results of habitat loss or displacement. Indirect pathways that would allow displacement/disturbance related impacts to occur were considered, on a precautionary basis, and a range of measures, described in Section 5 of this report are in place to avoid such impacts.

It can be concluded that the proposed development will not prevent the Common Gull population, associated with the Special Protection Area, reaching and maintaining favourable conservations status.

6.4 Conclusion of Residual Impact Assessment

Based on the above, in view of best scientific knowledge, on the basis of objective information, the proposed project will not adversely affect water quality in the area during either construction or operation of the proposed project. There is no potential for adverse effect on the identified QIs/SCI and their associated targets and attributes, or on any European Site via this identified pathway, which has been robustly blocked through measures to avoid impacts and the incorporation of best practice/mitigation measures into the project design.

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

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

> *'conservation status of a species means the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within the territory referred to in Article 2;*

The conservation status will be taken as 'favourable' when:

> *Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and*
>
> *The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and*
>
> *There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.'*

Based on the above, it can be concluded in view of best scientific knowledge, on the basis of objective information that the proposed project will not adversely affect the Qualifying Interests/Special Conservation Interest associated with the following EU sites:

- Lower River Shannon SAC [002165]
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]
- Tralee Bay Complex SPA [004188]

7. CUMULATIVE EFFECTS

7.1 Review of other plans and projects

The potential for the proposed works to contribute to a cumulative impact on European Sites was considered.

A number of other relevant plans have also been considered in this assessment and are provided in Table 7.1 below.

7.1.1 Plans

Table 7- 1 Review of plans and policies

Plans	Key Policies/Issues/Objectives Directly Related To European Sites, Biodiversity and Sustainable Development In The Zone of Influence	Assessment of development compliance with policy
Kerry County Development Plan 2015 – 2021	**ES-11:** Ensure all economic development proposals shall demonstrate compliance with the objectives of this Plan and the Development Management, Standards and Guidelines specifically as they relate to landscape flood risk management, biodiversity, built and cultural heritage.	The proposed development will not adversely affect the QI's associated with the Lower River Shannon SAC or SCI's associated with the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. There will be no adverse effects on the listed QIs as a result of indirect effect via deterioration in water quality or disturbance. The proposed development has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development.
	NR-1: Maximise the economic potential and development of natural resources in a sustainable manner while ensuring no significant adverse effect on the environment including the integrity of the Natura 2000 Network through the implementation of the objectives and the Development Management Guidelines and Standards of this Plan.	There will be no impact on the water quality, the QIs of the Lowe River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. The proposed development will not cause impacts on the integrity of the Natura 2000 network as the proposed development has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development.
	NE-11 Ensure that all projects likely to have a significant effect on a Natura 2000 / European site will be subject to Habitats Directive Assessment prior to approval.	There will be no impact on the water quality, the QIs of the Lowe River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. The proposed development will not cause impacts on the integrity of the Natura 2000 network as the proposed project has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development

	NE-12 Ensure that no projects which will be reasonably likely to give rise to significant adverse direct, indirect or secondary impacts on the integrity of any Natura 2000 sites having regard to their conservation objectives, shall be permitted on the basis of this Plan (either individually or in combination with other plans or projects) unless imperative reasons of over riding public interest can be established and there are no feasible alternative solutions.	There will be no impact on the water quality, the QIs of the Lowe River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. The proposed development will not cause impacts on the integrity of the Natura 2000 network as the proposed project has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development
	NE-13 Maintain the nature conservation value and integrity of all Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Nature Reserves and Killarney National Park. This shall include any other sites that may be designated at national level during the lifetime of the plan in co-operation with relevant state agencies	There will be no impact on the water quality, the QIs of the Lowe River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. The proposed development will not cause impacts on the integrity of the Natura 2000 network as the proposed project has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development
	ES-28: Proposals for any economic development in rural areas must demonstrate: - That there will be no significant adverse effects on the environment including the integrity of Natura 2000 network - That there is existing or programmed capacity in the water infrastructure (supply and/or effluent disposal) or suitable developer-led improvements can be identified, delivered and maintained. - The proposal shall include sustainable waste management practices both at the construction and operation stages of the proposal. - The proposal will not compromise water quality nor the programme of measures contained within the South Western or Shannon River Basin Management Plans 2009-2015 (or subsequent updates). - Compliance, where appropriate, with the measures contained in the Plan as they relate to biodiversity protection and enhancement.	The proposed development will not adversely affect the QI's associated with the Lower River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. There will be no adverse effects on the listed QIs as a result of indirect effect via deterioration in water quality or disturbance. The proposed development has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development.

	EP-1 Support and facilitate the sustainable provision of a reliable energy supply in the County, with emphasis on increasing energy supplies derived from renewable resources whilst seeking to protect and maintain biodiversity, archaeological and built heritage, the landscape and residential amenity	The proposed development will not adversely affect the QI's associated with the Lower River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. There will be no adverse effects on the listed QIs as a result of indirect effect via deterioration in water quality or disturbance. The proposed development has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development.
	NE-5 Ensure that the cumulative impacts are taken into account when evaluating the impacts of a particular proposal on biodiversity, particularly in relation to habitat loss and wildlife disturbance.	The proposed development will not adversely affect the QI's associated with the Lower River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. There will be no adverse effects on the listed QIs as a result of indirect effect via deterioration in water quality or disturbance. The proposed project has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development.
Regional Planning Guidelines for the South – West Region 2010 – 2022	**RKI-01 Key Issues:** 11. The South West Region supports a diverse range of terrestrial, freshwater, coastal and marine habitats, which support species of local, national and international importance. In providing for the development of the region it is important that the conservation and sustainable use of biodiversity is provided for. **REAS-03 Management of Natural Heritage:** 1.Local authorities are required to carry out screening of proposed projects and any draft land use plan or amendment/variation to any such plan for any potential ecological impact on areas designated or proposed for inclusion as Natura 2000 / European Sites and shall make a determination if a Habitats Directive	The proposed development will not adversely affect the QIs of the Lowe River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. The proposed development will not impact on water quality, QI's or SCI's of the European sites within or cause impacts on the biodiversity of the wider area as the proposed project has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development.

	Assessment is necessary, of the potential impacts of the project or plan on the conservation objectives of any Natura 2000 / European Site. 2.It is an objective for local authorities to carry out, monitor and review biodiversity plans throughout the region. Planning authorities should set policies in their development plans to implement and monitor the actions as set out in the National and County Biodiversity Plans, as the conservation of biodiversity is an essential component of sustainable development. Local Authorities should address the issue of fisheries protection and invasive introduced species and encourage the use of native species for landscape planting in rural areas, in the review of their biodiversity plans. 3.It is an objective for local authorities to work with all stakeholders in order to conserve, manage and where possible enhance the regions natural heritage including all habitats, species, landscapes and geological heritage of conservation interest and to promote increased understanding and awareness of the natural heritage of the region	
	REAS-02 Regional Coastline: It is an objective to promote integrated coastal management strategies for the region's coastline that will involve the key stakeholders and which will examine the impact of sea level rise, examine the potential of off-shore renewables, identify potential social and economic development, recognise the environmental sensitivity of the coastal areas, including Natura 2000 sites, seascapes and landscapes and promote coordinated land and maritime zone spatial planning.	There will be no impact on the water quality or the QIs of the Lower River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA. The proposed development will not impact on water quality within the site or cause impacts on the connectivity of the wider area as the proposed development has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development
National Biodiversity Action Plan 2017-2021	**Target 6.2:** Sufficiency, coherence, connectivity, and resilience of the protected areas network substantially enhanced by 2020.	There will be no impact on the water quality or the QIs of the Lowe River Shannon SAC or SCI's of the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA or Tralee Bay Complex SPA.

		The proposed development will not impact on water quality within the site or cause impacts on the connectivity of the wider area as the proposed development has been designed and a range of measures, outlined in Section 5 of this report and in the CEMP in Appendix 3, are in place to avoid any potential indirect effects resulting from the proposed development.

7.2 Other Projects

The projects considered in relation to the potential for cumulative impacts and for which all relevant data was reviewed (e.g. individual EIS/EIAR's, layouts, drawings etc) include those listed in Section 2.7 of Chapter 2 the EIAR.

The current proposal, associated with the Ballynagare Wind Farm Development, is not the only wind energy development within West Kerry. Other wind farm infrastructure proposals comprise:

Table 7- 2 Wind Energy Applications within 20km of the Development Site

Pl.Ref	Description	Decision and status
Ballylongford Wind Farm		
17/902	Construct a windfarm consisting of 8 wind turbines, battery units, and all associated works.	Refused by KCC Refused by An Bord Pleanála (300368-17) 08/01/2019
19/381	Construct a windfarm consisting of six wind turbines include battery units, and all associated works.	Refused by KCC Granted by An Bord Pleanála (304807-19) 06/01/2020 Not constructed.
Shronowen Wind Farm		
SID 08.309156	12 wind turbines, substation, grid connection and ancillary site works.	New Application
Tullahennel Wind Farm (made up of Tullahennel South, Tullahennel North and Larha wind farm)		
08/2086	Construct a wind farm of two wind turbines, and all associated works.	Granted by KCC 11/05/2009 2 turbines constructed.
08/2500	Erect an electricity generating windfarm consisting of two (2) wind turbines of hub height and all associated works	Granted by KCC 29/09/2009 2 turbines constructed.
09/1175	Construct a wind farm consisting of 9 no. wind turbines, control building, access roads, electrical sub-station, anemometer and ancillary works	Granted by KCC 04/05/2010 9 turbines constructed.
15/679	Modify the operational period of the permitted wind farm under planning reg. no. 08/2500 from a period of 10 years to a period of 25 years	Granted by KCC 28/10/2015
15/725	Modification of 20-year operational period of wind farm permitted under 09/1175 to 25 years	Refused by KCC 12/10/2015
17/1146	Extend the operational life of the existing wind farm from 20 to 25 years. the permission relates to the continuance of use of the existing wind farm granted under planning ref 09/1175 and 15/725 for a further period of five years.	Granted by KCC 22/02/2018
Tylagh Wind Farm		
02/2123	Erect a windfarm consisting of 4no. wind turbines, a meteorological mast, associated access road and control building.	Granted 21/11/2003 4 turbines constructed.
02/92123	Extension of duration for 02/2123.	Granted 10th November 2008 4 no turbines constructed
12/169	Construct two (2 no.) wind turbines extension (maximum hub height of 55.6 metres, maximum rotor blade diameter of 48 metres, maximum blade tip height of 79.6 metres) and all associated works.	Granted by KCC Granted by ABP on appeal (08.241171) 01/05/2013 No turbines constructed.
Ballincollig Hill		

Pl.Ref	Description	Decision and status
02/3135	Construct a wind farm consisting of 15 wind turbines (50m hub height and 52m blade diameter, with a total height not exceeding 76m).	Granted by KCC Granted by ABP (08.204645) 18/06/2004 8 turbines constructed.
02/93135	Extension of duration for 02/3135.	Granted by KCC 08/06/2009
Stacks Mountain		
03/1749	Four no. wind turbine generators, meteorological tower, one control building, a control building compound and associated access roads.	Granted by KCC 09/01/2004 4 turbines constructed.
03/91749	Extension of duration for 03/1749.	Granted by KCC 08/01/2009
Knocknagoum/Maghanknockane		
03/886	Construction of a wind farm consisting of no.2 mw turbines (78 meters hub height and 80 meters rotor blade diameter).	Granted by KCC 24/02/2004
03/2676	Construct a wind farm consisting of 6 no. 2mw turbines (78metres hub height and 80 metres rotor blade diameter).	Granted by KCC 28/07/2004
03/9886	Extension of duration for 03/886.	Granted by KCC 07/04/2009
03/92676	Extension of duration for 03/2676	Granted by KCC 17/09/2009
10/874	Construction of a 9 turbines and ancillary works	Granted by KCC 05/07/2011
11/912	Construct a wind farm consisting of 15 turbines and ancillary works	Granted by KCC 06/06/2012 15 turbines constructed.
Beennageeha		
98/487	A wind farm comprising of 6 turbines and ancillary works	Granted by KCC 26/04/2016 Operational
Pallas/Clahane Wind Farm		
01/2720	To construct a windfarm comprising of 26 turbines and ancillary works	Granted by KCC Granted by An Bord Pleanála (08.130918) 17/04/2003 26 turbines constructed.
01/92720	Extension of duration for 01/2720	Granted by KCC 22/02/2008.
01/82720	Second extension of duration to a wind farm granted under Pl. Ref: 01/2720	Granted by KCC 21/06/2013
08/471	Construct a wind turbine with a hub height of 65 metres and a rotor diameter of 72 metres, connecting road and all associated ancillaries.	Granted by KCC 28/05/2008
08/1461	Construct three no. wind turbines with a hub height of 65 metres and a rotor diameter of 72 metres, connecting roads and all associated ancillary site works	Granted by KCC 22/05/2009
11/571	Relocate proposed wind turbine to new location, 127 metres west (planning reg. no. 08/471)	Granted by KCC 19/01/2012
Beale Hill		
97/2365	Construct a wind-farm incorporating a) 7 turbines, b) a control house, c) an anemometer station, d) service road	Granted by KCC 19/10/1998 6 turbines constructed.
99/30	Change turbine no. 7 to a 1.65 megawatt wind turbine from that granted under previous planning	Granted by KCC 05/03/1999
04/1065	Erect two vestas v52 wind turbines and construct an extra sub-station on existing wind farm	Granted by KCC 09/06/2004
04/91065	Extension of duration for 04/1065.	Granted by KCC

Pl.Ref	Description	Decision and status
		17/07/2009
09/689	2no. Vestas V52 wind turbines with 55m towers and substation.	Granted by KCC 09/11/2009 2 turbines constructed.
09/9689	Extension of duration for 09/689.	Granted by KCC 17/11/2014
14/163	Erect 2 no. wind turbines (vestas v52) having a maximum ground to blade tip height of 91m (with a tower height of 65m)	Refused 23rd May 2014
Cahercullanagh		
03/1284	To construct a windfarm consisting of 17 turbines and ancillary works	Granted by KCC 17/02/2004 11 turbines constructed
03/91284	Extension of duration for 03/1284.	Granted by KCC 30/03/2009
03/991284	Second extension of duration to the permission granted under Pl. Ref. 03/1284	Granted by KCC 08/10/2012
05/1961	Construct wind farm consisting of 5 turbines vestas v52 and all ancillary works.	Granted by KCC 25/10/2006
05/3286	Construction of a wind farm consisting of 1 turbine vestas v52 (65m hub height, 52 metres rotor blade diameter and a power installed of 0.85mw).	Granted by KCC 31/01/2007
05/991961	Extension of duration for 05/1961	Granted by KCC 25/10/2006
07/595	Construct a wind farm consisting of 2 wind turbines (65mm hub height, 52 metres rotor blade diameter) and ancillary works	Granted by KCC 16/05/2007
07/9595	Extension of duration for 07/595.	Granted by KCC 19/12/2011
Muingnaminane		
01/635	Windfarm with 21 turbines, service roadways, construction of transformer/control housing compound and 50-metre anemometer mast	Granted by KCC Granted by An Bord Pleanála (08.130019) 05/11/2002 18 turbines constructed
01/9635	Extension of duration for 01/635	Granted by KCC 08/01/2008
Wind Farm at Urlea		
98/3014	Erect a wind farm consisting of four wind turbines, associated roads and electrical/control buildings.	Refused by KCC Refused by An Bord Pleanála (08.119245) 27/11/2000
Single Turbine at Aghamore North		
15/341	Erect a single electricity generating wind turbine with a hub height of up to 65m and a rotor diameter of up to 55m giving an overall tip height of up to 92.5m and all ancillary works.	Granted by KCC Granted by An Bord Pleanála (08.245921) 07/07/2016 Not constructed
Dromadda Beg		
01/2719	Erect 3 no 1mw wind turbines, service roadways and control house.	Granted by KCC 19/06/2002
01/92719	Extension of duration for 01/2719	Granted by KCC 09/09/2007
01/992719	Extension of duration for 01/2719	Granted by KCC 20/07/2012
13/544	Construction of a wind farm comprising of 3 no. turbines and ancillary work	Granted by KCC Granted by An Bord Pleanála (08.243573) 8/12/2014 Under construction

Pl.Ref	Description	Decision and status
Dromadda More		
04/2947	Erect 10 no. 2MW wind turbines with a hub height of 82m and a rotor diameter of 82m maximum. 1 no. 60m wind monitoring mast (temporary), associated hardstanding areas, access roadways and control house.	Granted by KCC 11/11/2005
04/92947	Extension of duration for 04/2947.	Granted by KCC 04/10/2010
10/571	Construct 10 no. wind turbine generators with a maximum hub height of 90m, a maximum rotor diameter of 112m and a maximum overall height of 145m, an electrical substation and all associated works.	Granted by KCC 20/05/2011
10/692	Construction of wind farm comprising 28 turbines and ancillary works.	Refused by KCC Granted by An Bord Pleanála (08.239473) 11/05/2012
12/623	An extension of one turbine to 10/692	Granted by KCC 22/11/2012
Wind Farm at Knocknacaheragh		
03/562	To construct a wind farm consisting of 2 turbines (67 metres hub height and 80 metres rotor blade diameter) and all ancillary works.	Granted by KCC 22/12/2003 2 turbines constructed.
Moyvane Wind Farm		
11/293	Erect 2 no. 500 kw wind turbines	Refused by KCC 7th June 2011
13/106	Erect 2 no. 500kw wind turbines (hub height 45.00m) and the construction of a 25.00 sq.m. electrical sub-station, site access road and ancillary works	Granted by KCC Granted by An Bord Pleanála (08.242798) 30/04/2014
13/9106	Extension of Duration for 13/106	Granted by KCC 26/03/2019
Beennanaspuck		
14/571	Develop a wind farm, the development will consist of three (3) no. wind turbines (with a maximum height of up to 125m), provision of two (2) no. new site entrances, the provision of new and upgraded internal site service roads, underground cabling and all associated infrastructure	Granted by KCC Granted by An Bord Pleanála (08.245464) 09/09/2015 3 turbines constructed
Kilathmoy-Toberatooreen		
12/431	Develop a wind farm including seven (7) no. wind turbines (with a maximum height of up to 125m), one (1) no. permanent meteorological mast, one (1) no. substation, provision of two (2) no. new site entrances, the provision of new and upgraded internal site service roads, underground cabling and all associated infrastructure, a ten-year planning permission is being sought to construct the development. An Environmental Impact Statement and Natura Impact Statement have been prepared and submitted as part of this application.	Granted by KCC 13/06/2013 Granted by An Bord Pleanála (08.242170) 12/11/2013 4 turbines constructed
Wind Farm located at Curraghderrig		
06/3997	Erect an electricity generating windfarm consisting of two (2) wind turbine generators of hub height 64m and rotor diameter 71m, a control building, 2 car park spaces and associated site roads and site works.	Refused by KCC Granted by An Bord Pleanála (08.221493) 01/10/2007
06/93997	Extension of duration for 06/3997	Granted by KCC 27/11/2012 2 turbines constructed
Wind Farm at Cloghaneleskirt		
02/2011	Erect 5 no. wind turbines, 40m wind monitoring mast (temporary), service roadways and control house.	Refused by KCC 03/10/2002

Pl.Ref	Description	Decision and status
03/1264	Construct 5 no. 2mw wind turbines 1 no. 60m wind monitoring mast (temporary) service roadways and control house	Granted by KCC 15/12/2003 5 turbines constructed
03/991264	Extension of duration for 03/1264	Granted by KCC 07/10/2015
Tursillagh 1		
97/1865	Construction of a wind farm comprising of 23 turbines and ancillary works	Granted by KCC Granted by An Bord Pelanála (08.105339) 14/07/2998 23 turbines constructed
Tursillagh 2		
01/390	Construction of a wind farm comprising of 8 turbines and ancillary works	Granted by KCC Granted by An Bord Pleanála (08.126623) 09/05/2002 8 turbines constructed
Leanamore		
11/299	Erect (9) no. wind turbines with a maximum height of up to 125m, one (1) no. permanent meteorological mast, one (1) no. substation, provision of three (3) no. new site entrances, the provision of new and upgraded internal site service road, and all underground cabling and associated infrastructure.	Refused Granted by An Bord Pleanála (08.239233) 10/11/2011 9 turbines constructed
Toberatooreen		
12/431	Develop a wind farm including seven (7) no. wind turbines (with a maximum height of up to 125m) and all associated infrastructure.	Granted by KCC Granted by An Bord Pleanála (08.242170) 12/11/2013 4 turbines constructed. (3 turbines omitted under ABP decision)
Ballyhorgan Wind Farm		
14/13	Provision of a total of 10 no. wind turbines, having a maximum ground to blade tip height of up to 156.5 metres and all ancillary works.	Refused by KCC Granted by An Bord Pleanála (08.244066) Subsequently quashed following judicial review and currently under the consideration of An Bord Pleanála under 08.301852.
Meenbannivane		
11/771	Construct one wind turbine generator and ancillary works.	Refused 10/11/2011
Cloghboola		
00/4099	Construct a wind farm comprising 24 wind turbines, service roadways, swithgear/ transformer compound, borrow pit, control house and meteorological mast	Granted by KCC 10/06/2002
00/84099	Extension of duration 00/4099	Granted by KCC
00/94099	Extension of duration for 00/4099	Granted by KCC 12/01/2007
00/994099	Extension of duration for 00/4099	Granted by KCC 12/01/2007
08/1454	Erect 20 no. wind turbine generators of 125m overall height, extension of existing site roads and construction of a windfarm control building as an amendment to planning ref. no. 00/4099	Refused by KCC 01/07/2009

Pl.Ref	Description	Decision and status
10/616	Erect twenty (20) wind turbines of 125 metre overall height, 110kv sub-station/compound and control buildings, extension of existing site roads, associated drainage and site works as an amendment to planning reference no. 00/4099	Granted by KCC 30/03/2011 16 turbines constructed.
Breehva (Co.Clare)		
00/2417	Build a wind farm comprising 4 no. wind turbine generators with towers not exceeding 52m & ancillary equipment for generator of electricity & control building.	Granted by CCC Granted by An Bord Pleanála 03/09/2004 2 turbines constructed.
09/911	Extension of duration for 00/2417.	Granted by CCC 13/10/2009

Other Developments/Landuses

The review of the Kerry County Council planning register documents relevant general development planning applications in the vicinity of the proposed site of the wind farm and all its associated works, most of which relate to the provision and/or alteration of one-off rural housing and agriculture-related structures as listed in Section 2.5 of Chapter 2. These applications have also been taken account in describing the baseline environment and in this assessment. Existing land uses in are including agriculture, forestry and peat extraction have also been considered.

Overall, the proposed development has been designed to mitigate impacts on the environment and particularly water, and a suite of mitigation measures is set out within this NIS and in the EIAR. The mitigation measures set out in this NIS, and associated appendices, have been developed to ensure that adverse cumulative affects do not arise during construction, operational or decommissioning phases of the proposed development.

7.2.1 Conclusion of Cumulative Assessment

Following the detailed assessment provided in the preceding sections, it is concluded that, the proposed development will not result in any residual adverse effects on the QIs/SCIs, the conservation objectives or the integrity of the Lower River Shannon SAC, the Stack's to Mullaghareirk Mountains SPA or the Tralee Bay Complex SPA, when considered on its own. There is therefore no potential for the proposed development to contribute to any cumulative adverse effects on any European Site when considered in-combination with other plans and projects.

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

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

8. CONCLUDING STATEMENT

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

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

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

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APPENDIX 1

APPROPRIATE ASSESSMENT SCREENING REPORT

Article 6 (3) Appropriate Assessment Screening Report

Proposed Wind Farm at Ballynagare, Co. Kerry

DOCUMENT DETAILS

Client:	**EM Power**
Project Title:	**Proposed Wind Farm at Ballynagare, Co. Kerry**
Project Number:	**200512**
Document Title:	**Article 6 (3) Appropriate Assessment Screening Report**
Document File Name:	**AASR F – 2021.11.17 – 200512**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	17/11/2021	OOG	JH

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1. INTRODUCTION

1.1 Background

MKO has been appointed to provide the information necessary to allow the competent authority to conduct an Article 6(3) Screening for Appropriate Assessment of a proposed wind farm development with all associated works at Ballynagare, Co. Kerry.

Screening for Appropriate Assessment is required under Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive). Where it cannot be excluded that a project or plan, either alone or in combination with other projects or plans, would have a significant effect on a European Site then same shall be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives. The current project is not directly connected with, or necessary for, the management of any European Site consequently the project has been subject to the Appropriate Assessment Screening process.

The assessment in this report is based on a desk study and field surveys undertaken in May, July, September 2020 and in April, June, September and October 2021. Field surveys in relation to birds were undertaken during the survey period April 2019 – March 2021. It specifically assesses the potential for the proposed development to result in significant effects on European sites in the absence of any best practice, mitigation or preventative measures.

This Appropriate Assessment Screening Report has been prepared in accordance with the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2001) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010).

In addition to the guidelines referenced above, the following relevant documents were also considered in the preparation of this report:

1. *Council of the European Commission (1992) Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Official Journal of the European Communities. Series L 20, pp. 7-49.*
2. *EC (2000) Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg.*
3. *EC (2007) Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence. Opinion of the commission.*
4. *EC (2013) Interpretation Manual of European Union Habitats. Version EUR 28. European Commission.*

1.2 Appropriate Assessment

1.2.1 Screening for Appropriate Assessment

Screening is the process of determining whether an Appropriate Assessment is required for a plan or project. Under Part XAB of the Planning and Development Act, 2000, as amended, screening must be carried out by the Competent Authority. As per Section 177U of the Planning and Development Act, 2000, as amended 'A screening for appropriate assessment shall be carried out by the competent authority to assess, in view of best scientific knowledge, if that Land use plan or proposed development, individually or in combination with another plan or project is likely to have a significant effect on the European site'. The Competent Authority's determination as to whether an Appropriate Assessment is required must be made on the basis of objective information and should be recorded. The Competent Authority may request information to be supplied to enable it to carry out screening.

Consultants or project proponents may provide for the competent authority, the information necessary for them to determine whether an Appropriate Assessment is required and provide advice to assist them in the Article 6(3) Appropriate Assessment Screening decision.

Where it cannot be excluded beyond reasonable scientific doubt at the Screening stage, that a proposed plan or project, individually or in combination with other plans and projects, would have a significant effect on the conservation objectives of a European site, an Appropriate Assessment is required.

Where an Appropriate Assessment is required, the Competent Authority may require the applicant to prepare a Natura Impact Statement.

The term Natura Impact Statement (NIS) is defined in legislation[1]. An NIS, where required, should present the data, information and analysis necessary to reach a definitive determination as to 1) the implications of the plan or project, alone or in combination with other plans and projects, for a European site in view of its conservation objectives, and 2) whether there will be adverse effects on the integrity of a European site. The NIS should be underpinned by best scientific knowledge, objective information and by the precautionary principle.

This Article 6(3) Appropriate Assessment Screening Report has been prepared in compliance with the provision of section 177U of the Planning & Development Act 2010 as amended.

Statement of Authority

Baseline ecological surveys were undertaken on undertaken on May, July and September 2020 and April, June, September and October 2021. This report has been prepared by Olivia O'Gorman. The report has been reviewed by Pat Roberts (B.Sc., M.Sc., MCIEEM) who has over 14 years' experience in ecological assessment.

[1] As defined in Section 177T of the Planning and Development Act, 2000 as amended, an NIS means a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a proposed development, on its own and in combination with other plans and projects, for a European site in view of its conservation objectives. It is required to include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for the European site in view of its conservation objectives

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

2.1 Site Location

The proposed wind farm development site is located in Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The development is located in the townlands of Ballynagare, Dysert Marshes, Dysert and Curraghcroneen. The approximate location for the centre of the site is Irish Transverse Mercator (ITM) E489,500 N632,000. The proposed site covers an area of approximately 529 hectares.

The proposed site has an approximate elevation of between 2 and 5 metres above ordnance datum (m OD). The site is located at the confluence of the Cashen Estuary (to which the River Feale flows) and the Brick River. The Cashen Estuary forms the northern boundary of the proposed development site, while the Brick River forms the western boundary. The Cashen Estuary flows in a northwest direction to discharge into the mouth of the Shannon estuary at Ballybunnion.

The site is accessed via a number of local roads and bog tracks. From the south the site is accessed via local roads adjoining the R557 regional road which is located south of the site, which in turn adjoins the N69 National Secondary Road, south of Listowel. The south of the site can also be accessed from the west via a bridge over the Brick River.

The site location is shown in Figure 2.1.

2.2 Characteristics of the Proposed Development

2.2.1 Description of the project

The proposed development comprises the construction of a wind farm comprising of seven wind turbines, all associated works, and a grid connection to the national grid. The proposed turbines will have a maximum blade tip height of up to 170 metres. The application is seeking a ten-year planning permission. The full description of the proposed development is as follows:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation

- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The application is seeking a ten-year planning permission and 35-year operational life from the date of commissioning of the wind farm. Current and future wind turbine generator technology will ensure that the wind turbine model, chosen for the proposed development, will have an operational lifespan greater than the 35 year operational life that is being sought as part of this application.

It is proposed to construct a 38 kV substation as part proposed development, and to connect to the National Grid via an underground cable connection running from the proposed on-site substation to the existing Clahane Substation, located approximately 7 kilometres to the southeast, in the townland of Pallas. The underground cabling will follow the route of existing public roadways.

All elements of the Proposed Development, as described in Chapter 4 of the EIAR accompanying this application, including the wind turbines, roads, substation and construction compound have been assessed as part of this assessment.

3. IDENTIFICATION OF RELEVANT EUROPEAN SITES

3.1 Identification of the European Sites within the Likely Zone of Impact

The following methodology was used to establish which European Sites are within the Likely Zone of Impact of the proposed development:

- Initially the most up to date GIS spatial datasets for European designated sites and water catchments were downloaded from the NPWS website (www.npws.ie) and the EPA website (www.epa.ie) on the 09/07/2021. The datasets were utilized to identify European Sites which could feasibly be affected by the proposed development.
- All European Sites within a distance of 15km surrounding the development site were identified and are shown on Figure 3.1. In addition, the potential for connectivity with European Sites at distances of greater than 15km from the proposed development was also considered in this initial assessment. In this case, no potential connectivity with sites located at a distance of over 15km from the proposed development was identified.
- The catchment mapping was used to establish or discount potential hydrological connectivity between the site of the proposed development and any European Sites. The hydrological catchments are also shown in Figure 3.1.
- In relation to Special Protection Areas, in the absence of any specific European or Irish guidance in relation to such sites, the NatureScot (formerly Scottish Natural Heritage [SNH]) Guidance, 'Assessing Connectivity with Special Protection Areas (SPA)' (2016) was consulted. This document provides guidance in relation to the identification of connectivity between proposed development and SPAs. The guidance takes into consideration the distances species may travel beyond the boundary of their SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects.
- Table 3.1, provides details of all relevant European Sites as identified in the preceding steps and assesses which are within the likely Zone of Impact. The assessment considers any likely direct or indirect impacts of the proposed development, both alone and in combination with other plans and projects, on European Sites by virtue of the following criteria: size and scale, land-take, distance from the European Site or key features of the site, resource requirements, emissions, excavation requirements, transportation requirements and duration of construction, operation and decommissioning were considered in this screening assessment
- The site synopses and conservation objectives of these sites, as per the NPWS website (www.npws.ie), were consulted and reviewed at the time of preparing this report 09/07/2021. Figure 3.1 shows the location of the proposed development in relation to all European sites within 15km of the proposed development.
- Where potential pathways for Significant Effect are identified, the site is included within the Likely Zone of Impact and further assessment is required.

Table 3.1 Identification of Designated sites within the Likely Zone of Impact

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
Special Areas of Conservation (SAC)			
Lower River Shannon SAC [002165] **Distance:** 0m from windfarm site.	› 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	Detailed conservation objectives for this site, (Version 1.0, August 2012), were reviewed as part of the assessment and are available at www.npws.ie	The European site is located directly adjacent to the proposed windfarm site. Works relating to the grid connection options are confined to the existing road corridor and therefore, will not result in any direct impact on the QIs of the SAC. No pathway for impact exists in relation to the following terrestrial and coastal QIs of the European site, which are not recorded in the vicinity of the proposed development. › Sandbanks which are slightly covered by sea water all the time [1110] › Mudflats and sandflats not covered by seawater at low tide [1140] › Coastal lagoons* [1150] › Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] › Perennial vegetation of stony banks [1220] › Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] › Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] › Mediterranean salt meadows (Juncetalia maritimi) [1410] › Salicornia and other annuals colonizing mud and sand [1310] The Freshwater Pearl Mussel [1029] population for which the SAC is designated is located in the Cloon River in County Clare (See Map 15 of the NPWS Conservation Objective Document). Given that the proposed development is located within a separate hydrological sub-

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
	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)**[91EO] › Bottlenose Dolphin *(Tursiops truncates)* [1349] › Freshwater Pearl Mussel *(Margaritifera margaritifera)* [1029] › Sea Lamprey *(Petromyzon marinus)* [1095] › Brook Lamprey *(Lampetra planeri)* [1096] › River Lamprey *(Lampetra fluviatilis)* [1099] › Atlantic Salmon *(Salmo salar)* (only in fresh water) [1106] › Otter *(Lutra lutra)* [1355]		catchment to the SAC designed population (EPA, 2020), there is no hydrological connectivity between the development site and the SAC population. Therefore, no potential pathway for impact exists. There is hydrological connectivity between the proposed development and this European site via the onsite watercourses – Ballyouneen [EPA code: 23B32), Dysert Marshes [EPA code: 23D19] and Monument [EPA code: 23M41]. Therefore, a potential pathway for indirect effect has been identified via deterioration of water quality in relation to the following QI's; › Reefs [1170] › Estuaries [1130] › Sandbanks which are slightly covered by sea water all the time [1110] › Large shallow inlets and bays [1160] › Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* Vegetation [3260] › Alluvial forests with *Alnus glutinosa* and Fraxinus excelsior (*Alno-Padion, Alnion incanae, Salicion albae*)*[91EO] › Bottlenose Dolphin (*Tursiops truncates*) [1349] › Sea Lamprey (*Petromyzon marinus*) [1095] › Brook Lamprey (*Lampetra planeri*) [1096] › River Lamprey (*Lampetra fluviatilis*) [1099] › Atlantic Salmon (*Salmo salar*) (only in fresh water) [1106] › Otter (*Lutra lutra)* [1355] The windfarm site is located immediately adjacent to the SAC and overall, the grid connection options traverse the SAC at four locations.

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
			Therefore, taking precautionary approach the potential for disturbance to Otter requires further assessment. **This site is within the Likely Zone of Impact and further assessment will be provided in the Natura Impact Statement.**
Moanveanlagh Bog SAC [0022351] **Distance:** 12.2 km	› Active raised bogs [7110] › Degraded raised bogs still capable of natural regeneration [7120] › Depressions on peat substrates of the *Rhynchosporion* [7150]	Detailed conservation objectives for this site, (Version 1, Dec 2015), were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct impacts on the QI's of this European site as the proposed development site is located 12.2 km from the SAC. This site is designated for terrestrial peatland habitats. The development site and the SAC are in separate River Sub-basins (EPA 2020) and there is no hydrological connectivity. Therefore, there is no potential for indirect impacts which would result in the deterioration of water quality. **This site is not within the Likely Zone of Impact and does not require further assessment.**
Akeragh, Banna and Barrow Harbour SAC [000332] **Distance:** 13.0 km	› Annual vegetation of drift lines [1210] › Salicornia and other annuals colonising mud and sand [1310] › Atlantic salt meadows *(Glauco-Puccinellietalia maritimae)* [1330] › Mediterranean salt meadows *(Juncetalia maritimi)* [1410] › Embryonic shifting dunes [2110]	Detailed conservation objectives for this site, (Version 1, Jan 2017), were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct impacts on the QI's of this European site as the proposed development is located entirely outside and 8.8km from the SAC. This site is designated for coastal, shoreline habitats. The development site and the SAC are in separate River Sub-basins (EPA 2020) and there is no hydrological connectivity. Therefore, there is no potential for indirect impacts which would result in the deterioration of water quality. **This site is not within the Likely Zone of Impact and does not require further assessment.**

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
	- Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] - Fixed coastal dunes with herbaceous vegetation (grey dunes)* [2130] - Humid dune slacks [2190] - European dry heaths [4030]		
Ballyseedy Wood SAC [002351] **Distance:** 17.0 km	- Alluvial forests with *Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)** [91E0]	Generic conservation objectives for this site, (Version 8, March 2021), were reviewed as part of the assessment and are available at www.npws.ie	There will be no direct impacts on the QI's of this European site as the proposed development is located 17.0 km from the SAC. This site is designated for terrestrial alluvial woodland habitat. The development site and the SAC are in separate River Sub-basins (EPA 2020) and there is no hydrological connectivity. Therefore, there is no potential for indirect impacts which would result in the deterioration of water quality. **This site is not within the Likely Zone of Impact and does not require further assessment.**
Special Protection Area (SPA)			
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161] **Distance:** 4.8 km	- Hen Harrier *Circus cyaneus* [A082]	Generic conservation objectives for this site, (Version 8.0, March 2021), were reviewed as part of the	The wind farm site is located entirely outside of this European Site. However, the terminal section of proposed grid connection route is located adjacent to the SPA. All works associated with the grid connection options will be confined to the existing public road corridor.

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
		assessment and are available at www.npws.ie	However, and on a precautionary basis, there is potential for disturbance or displacement effects. The core foraging range of Hen Harrier is 2km as per SNH guidelines. Therefore, the potential for habitat loss, displacement and collision mortality can be discounted. **This site is within the Likely Zone of Impact and further assessment will be provided in the Natura Impact Statement.**
Kerry Head SPA [004189] **Distance:** 6.8 km	› Fulmar *Fulmarus glacialis* [A009] › Chough *Pyrrhocorax pyrrhocorax* [A346]	Generic conservation objectives for this site, (Version 8.0, March 2021), were reviewed as part of the assessment and are available at www.npws.ie	This site is located approximately 6.8km km from the proposed development location. Of the SCIs, fulmar are pelagic and do not forage or commute over terrestrial habitats. Similarly, chough are typically sedentary and forage along coasts. Therefore, the potential for direct and indirect impacts on populations of SCI species associated with the SPA can be discounted. The development site has no connectivity with the SPA. Therefore, there is no potential for indirect effects in relation to surface water pollution or deterioration of supporting habitat for SCI within or outside the SPA. **This site is not within the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
Tralee Bay Complex SPA [004188] **Distance:** 12.9 km	- Whooper Swan *Cygnus cygnus* [A038] - Brent Goose *Branta bernicla hrota* [A046] - Shelduck *Tadorna tadorna* [A048] - Wigeon *Anas Penelope* [A050] - Teal *Anas crecca* [A052] - Mallard *Anas platyrhynchos* [A053] - Pintail *Anas acuta* [A054] - Scaup *Aythya marila* [A062] - Oystercatcher *Haematopus ostralegus* [A130] - Ringed Plover *Charadrius hiaticula* [A137] - Golden Plover *Pluvialis apricaria* [A140] - Grey Plover *Pluvialis squatarola* [A141] - Lapwing *Vanellus vanellus* [A142] - Sanderling *Calidris alba* [A144] - Dunlin *Calidris alpina alpine* [A149] - Black-tailed Godwit *Limosa limosa* [A156]	Detailed conservation objectives for this site, (Version 1.0, April 2014), were reviewed as part of the assessment and are available at www.npws.ie	This site is located approximately 12.9km from the proposed development location. The development site has no connectivity with this SPA and there is no potential for indirect effects in relation to deterioration of water quality or supporting habitat for SCI species within or outside the SPA. Common gull have a mean foraging range of up to 25km from an SPA, which is within range of the wind farm study area. This species is known to utilise agricultural fields such as those that are characteristic of the landscape around the wind farm study area Therefore, there is potential for direct and indirect impacts via collision mortality, disturbance, or displacement of the SCI on populations Common Gull associated with the SPA. **This site is within the Likely Zone of Impact and further assessment is required.**

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
	› Bar-tailed Godwit *Limosa lapponica* [A157] › Curlew *Numenius arquata* [A160] › Redshank *Tringa tetanus* [A162] › Turnstone *Arenaria interpres* [A169] › Black-headed Gull *Chroicocephalus ridibundus [*A179] › Common Gull *Larus canus* [A182] › Wetlands [A999]		
River Shannon and River Fergus Estuaries SPA [004077] **Distance:** 13.8 km	› 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]	Detailed conservation objectives for this site, (Version 1.0, Sept 2012), were reviewed as part of the assessment and are available at www.npws.ie	This site is located approximately 13.8km from the proposed development location. The development site has no connectivity with this SPA and there is no potential for indirect effects in relation to deterioration of water quality or supporting habitat for SCI species within or outside the SPA. Therefore, potential for direct and indirect impacts on populations of SCI species associated with the SPA can be discounted. **This site is not within the Likely Zone of Impact and no further assessment is required.**

European Sites and distance from proposed development	Qualify Interests/Special Conservation Interests for which the European site has been designated (Sourced from NPWS online Conservation Objectives, www.npws.ie on the 19/06/2021	Conservation Objectives	Likely Zone of Impact Determination
	- Golden Plover *Pluvialis apricaria* [A130] - 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] - Wetlands [A999]		

4. ARTICLE 6(3) APPROPRIATE ASSESSMENT SCREENING STATEMENT AND CONCLUSIONS

The findings of this Screening Assessment are presented following the European Commission's Assessment of Plans and Projects Significantly affecting Natura 2000 Sites: Methodological Guidance on the provisions of Article 6(3) and 6(4) of the Habitats Directive 92/43/EEC (EC, 2001) and Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (EC, 2018) as well as the Department of the Environment's Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities (DoEHLG, 2010).

4.1 Data Collected to Carry Out Assessment

In preparation of the report, the following sources were used to gather information:

- Review of NPWS Site Synopses, Conservation Objectives for the European Sites
- Review of 2019, 2013 and 2007 EU Habitats Directive (Article 17) Reports.
- Review of OS maps and aerial photographs of the site of the proposed project.
- Site visits conducted in May, July and September 2020 and April, June, September and October 2021.

4.2 Concluding Statement

It cannot be excluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed development, individually or in combination with other plans and projects, would be likely to have a significant effect on the **Lower River Shannon SAC [002165]**, **Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161]** and **Tralee Bay Complex SPA [004188].**

As a result, an Appropriate Assessment is required, and a Natura Impact Statement shall be prepared in respect of the proposed development. No potential for likely significant effects on any European Site other than those listed here exists.

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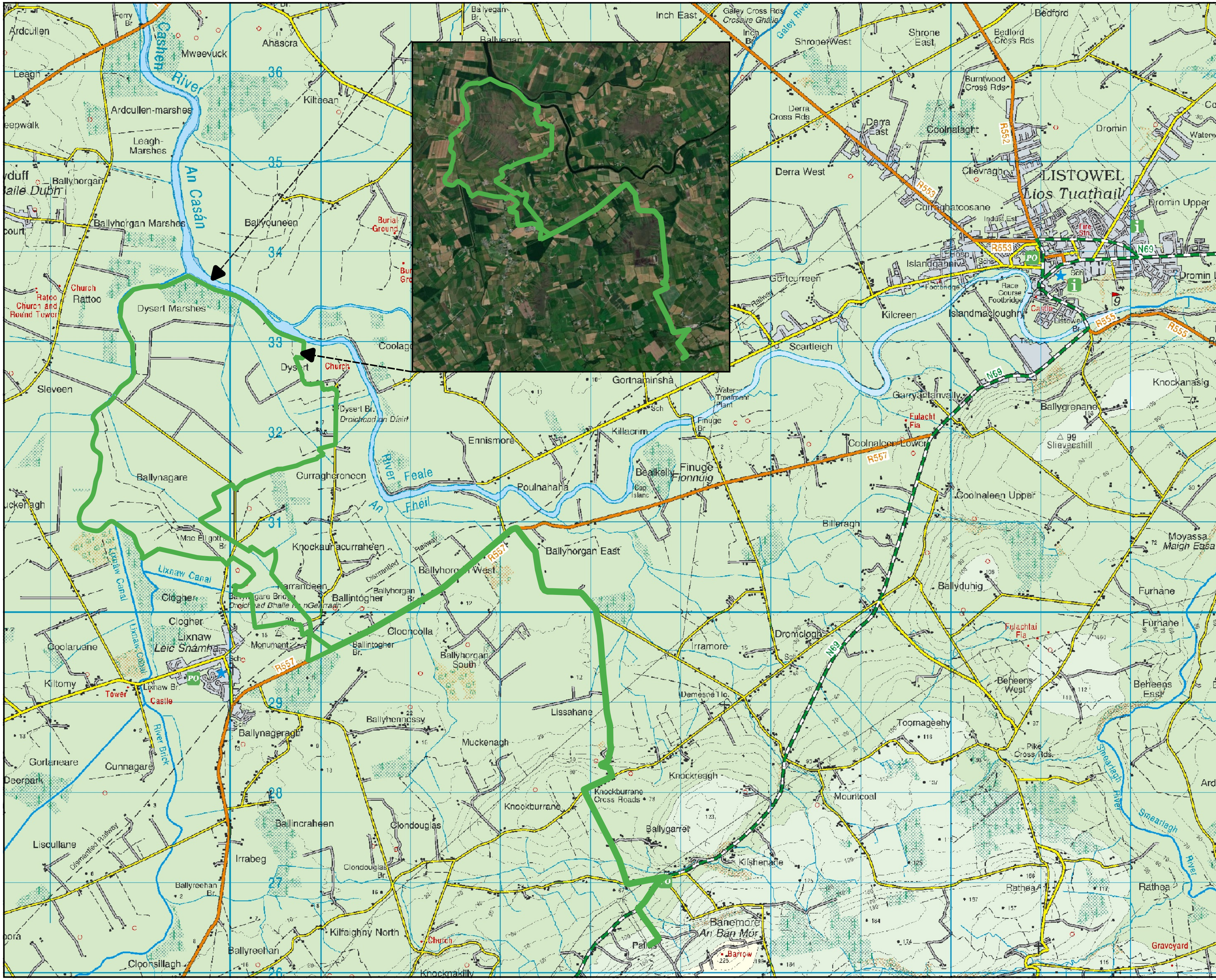

Map Legend

Ballynagare Wind Farm Study Area

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Drawing Title	Site Location
Project Title	Ballynagare Wind Farm
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 2.1
Scale: 1:54826	Date: 08.10.2021

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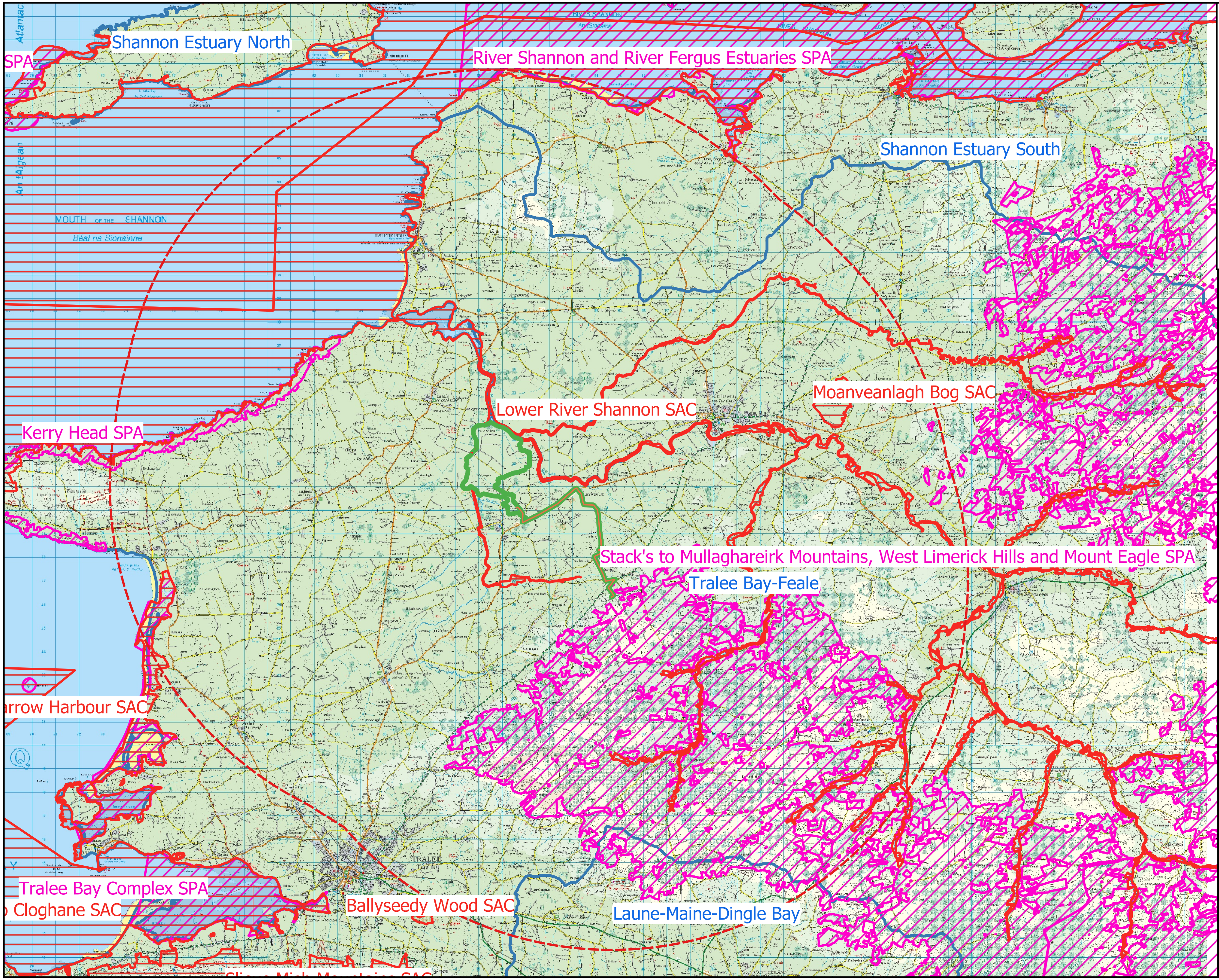

Map Legend

- Ballynagare Wind Farm Study Area
- 15km Buffer Zone
- Grid Connection Route
- Hydrological Catchments
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

Drawing Title	European Designated sites within 15km Buffer Zone
Project Title	Ballynagare Wind Farm
Drawn By: OOG	Checked By: PR
Project No.: 200512	Drawing No.: Figure 3-1
Scale: 1:210000	Date: 08.10.2021

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APPENDIX 2

EIAR CHAPTER 4 - DESCRIPTION

4. DESCRIPTION OF THE PROPOSED DEVELOPMENT

4.1 Introduction

This section of the Environmental Impact Assessment Report (EIAR) describes the development and its component parts which is the subject of a proposed application for planning permission to Kerry County Council, ('the proposed development'). This section of the EIAR also describes all those components for which planning permission is not being sought, such as the proposed whooper swan habitat enhancement area. The overall project as described in Chapter 4 has been assessed in the EIAR.

Ballynagare Wind Farm Limited (the Applicant) is seeking planning permission to construct a wind energy development on land at Ballynagare, approximately 9km west of Listowel and approximately 2km north of Lixnaw County Kerry. The development is located in the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument, Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas.

The development comprises:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation
- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The application is seeking a ten-year planning permission and 35 year operational life from the date of commissioning of the wind farm. Current and future wind turbine generator technology will ensure that the wind turbine model, chosen for the proposed development, will have an operational lifespan greater than the 35 year operational life that is being sought as part of this application.

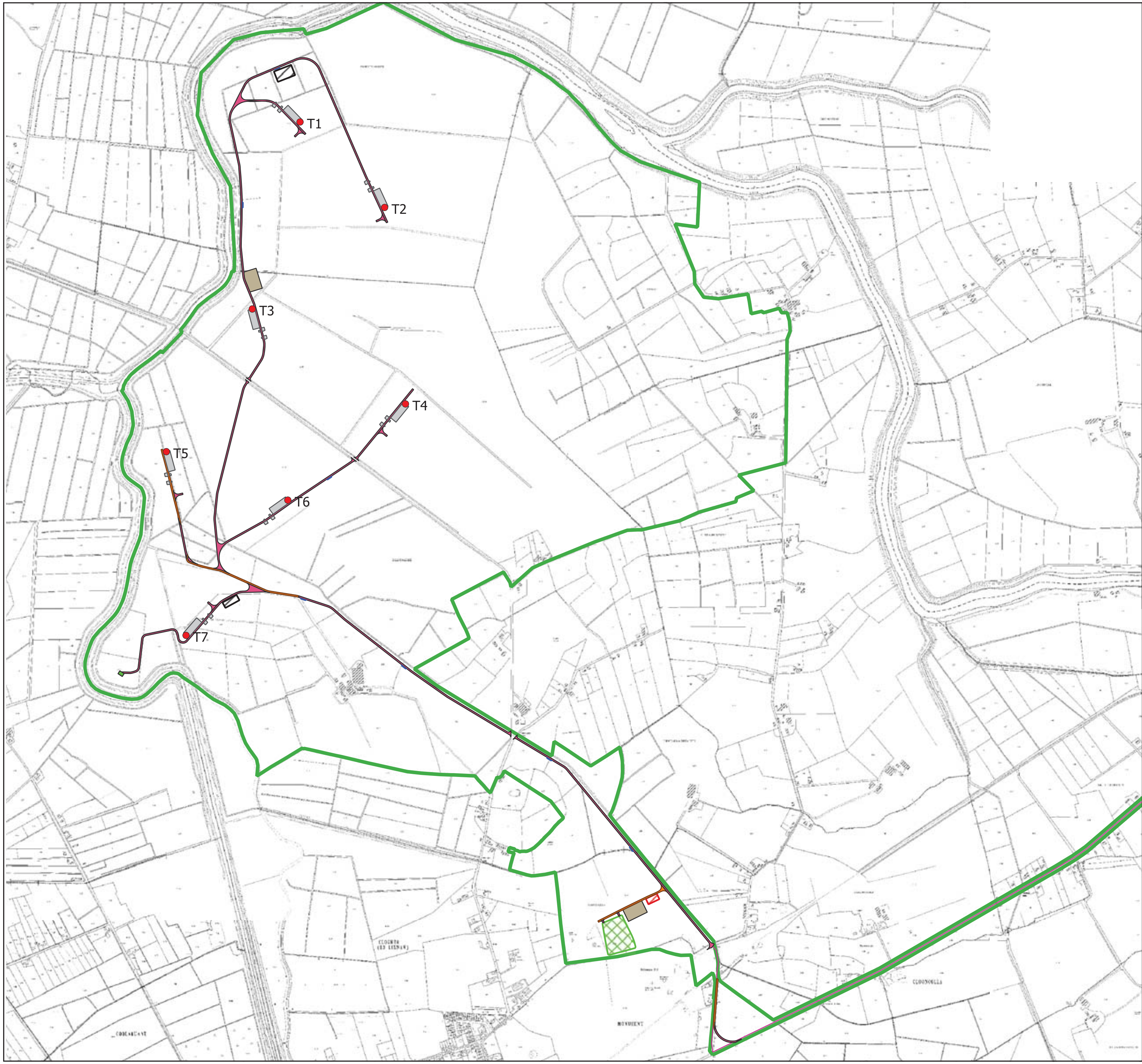
It is proposed to construct a 38 kV substation as part proposed development, and to connect to the National Grid via an underground cable connection running from the proposed on-site substation to the existing Clahane Substation, located approximately 7 kilometres to the southeast, in the townland of Pallas. The underground cabling will follow the route of existing public roadways.

All elements of the proposed development described in the list above together with the Turbine Delivery Route and the whooper swan enhancement lands have been assessed in this EIAR and are described in detail in this chapter.

4.2 Development Layout

The layout of the proposed development has been designed to minimise the potential environmental effects of the proposed development, while at the same time maximising the energy yield of the wind resource passing over the site. A constraints study, as described in Section 3.5.1 of this EIAR, has been carried out to ensure that turbines and ancillary infrastructure are located in the most appropriate areas of the site. Where possible, the proposed development layout makes use of the existing access roads and tracks within the site.

The overall layout of the proposed development is shown on Figure 4-1. This drawing shows the proposed locations of the wind turbines, electricity substation, grid connection route, borrow pit, peat and spoil repository, construction compounds, internal roads layout, the construction access road and the main site entrance. Detailed site layout drawings of the proposed development are included in Appendix 4-1 to this EIAR.



Map Legend

- EIAR Study Area Boundary
- Proposed Turbine Locations
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Turbine Foundation
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed New Roads
- Existing Roads for Upgrade
- Proposed Passing Bay
- Proposed Met Mast Location
- Proposed Temporary Peat Storage Areas
- Proposed 38kV Grid Connection

N

Drawing Title

Proposed Site Layout

Project Title

Ballynagare Wind Farm

Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 4.1
Scale: 1:15000	Date: 2021.10.13

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4.3 Development Components

4.3.1 Wind Turbines

4.3.1.1 Turbine Locations

The proposed wind turbine layout has been optimised using industry standard wind farm design software to maximise the energy yield from the site, while maintaining sufficient distances between the proposed turbines to ensure turbulence and wake effects do not compromise turbine performance. The Grid Reference coordinates of the proposed turbine locations are listed in Table 4 1 below.

The final ground level of the turbine foundations will be determined by the actual ground conditions at each proposed turbine location and may differ slightly from those levels listed in Table 4.1. Also, in accordance with the Wind Energy Development Guidelines for Planning Authorities' (Department of the Environment, Heritage and Local Government (DOEHLG), 2006) micro-siting of the turbine positions may be required within the criteria set out in the guidelines. All sensitive electrical equipment within the proposed turbines will be raised to a level above the theoretical 1,000 year flood elevation.

Table 4.1 Proposed turbine locations

Turbine Number	Easting	Northing	Ground Level Elevation (m OD)
1	489168.9075	633294.2662	0.78
2	489512.6774	632946.997	0.73
3	488974.8514	632534.2959	0.91
4	489597.5548	632148.4197	0.70
5	488625.6129	631954.4156	0.41
6	489119.2683	631757.5398	0.67
7	488705.6813	631207.8471	0.88

4.3.1.2 Turbine Type

Wind turbines use the energy from the wind to generate electricity. A wind turbine, as shown in Plate 4.1 below, consists of four main components:

- Foundation unit
- Tower
- Nacelle (turbine housing)
- Rotor

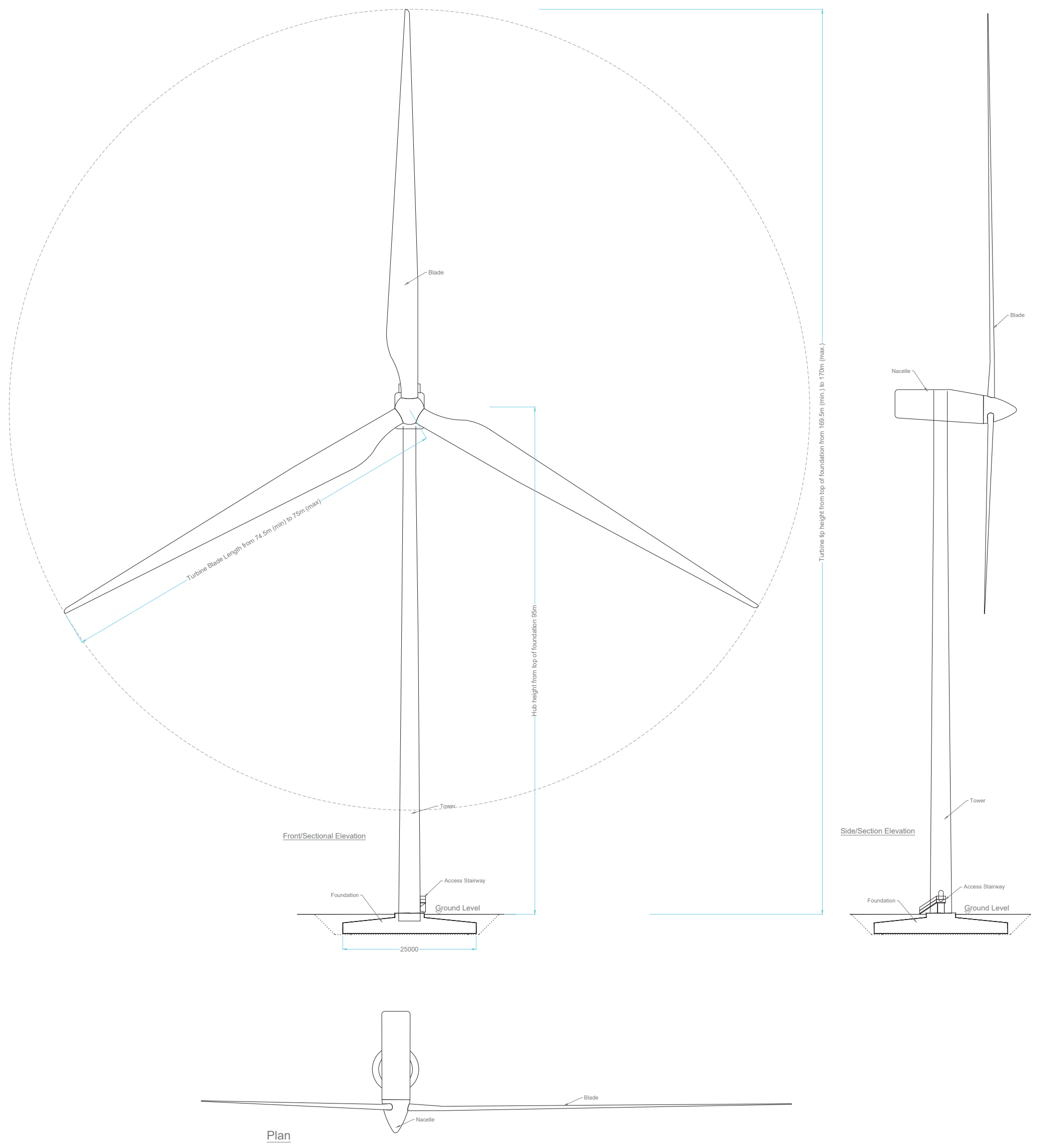
Plate 4.1 Wind turbine components

The proposed wind turbines will have a maximum ground to blade tip height of between 169.5 and 170 metres with a rotor diameter of between 149 and 150 metres.

The exact make and model of the turbine will be dictated by a competitive tender process, but it will not exceed the maximum size envelope set out above. Modern wind turbines from the main turbine manufacturers have evolved to share a common appearance and other major characteristics with only minor cosmetic differences differentiating one from another. The wind turbines that will be installed on the site will be conventional three-blade turbines, that will be geared to ensure the rotors of all turbines rotate in the same direction at all times. The turbines will be light grey matt colour.

Turbine design parameters have a bearing on the assessment of shadow flicker, noise, visual impact, traffic and transport and ecology (specifically birds), as addressed elsewhere in this EIAR. In each EIAR section that requires the consideration of turbine parameters as part of the impact assessment, the turbine design parameters that have been used in the impact assessment are specified. At the turbine selection stage of the project, pre-construction, new turbines models or variants may be available that were not on the market at the pre-planning and EIAR preparation stage, which would better suit the site and fit within the proposed size envelope. Should this circumstance arise, the specific parameters of the new turbines will be assessed for their compliance with the criteria set out and considered in this EIAR, the relevant guidance in place at the time and any conditions that may be attached to any grant of planning permission that might issue.

A drawing of the proposed wind turbine is shown in Figure 4.2. The individual components of a typical geared wind turbine nacelle and hub are shown in Figure 4.3 below.



Drawing Notes

1. Drawing illustrates turbines with the maximum blade tip height of 170m.
2. Exact make and model of the turbine to be dictated by a competitive tender process.
3. Installed wind turbine not to exceed maximum size envelope set out above in any blade length and hub-height configuration.
4. Turbine Foundation to Manufacturers specifications
5. Ground level represents the top of turbine foundation.

Figure 4-2

DRAWING TITLE:

Wind Turbine Hardstanding & Elevations

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No: **200512**	DRAWING No: **200512 - 36**
SCALE: **1:500 @A1**	DATE: **22.11.2021**

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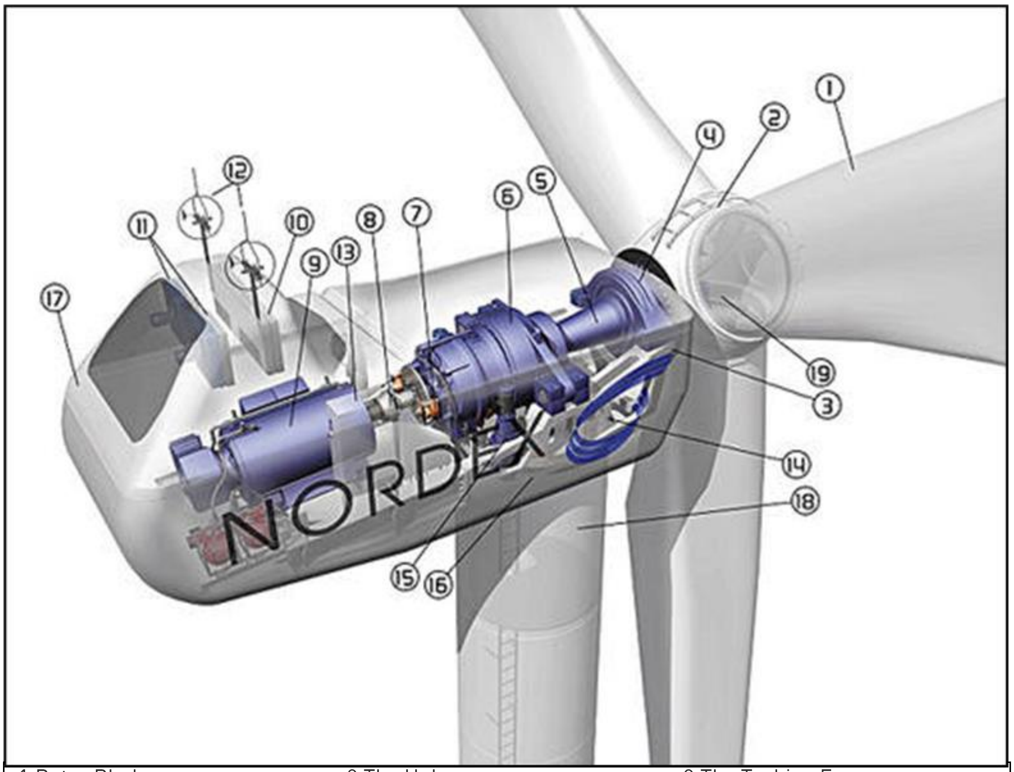

1.Rotor Blades	2.The Hub	3.The Turbine Frame
4.The Rotor Bearing	5.The Rotor Shaft	6.The Gearbox
7.The Disk Brake	8.The Generator Coupling	9.The Generator
10.The Cooling Radiator	11.The Fan Coolers	12.The Wind Measuring System
13.The Control System	14.The Hydraulic System	15.The Yaw Drive
16.The Yaw Bearing	17.The Nacelle Cover	18.The Tower
19.The Pitch system		

Figure 4.3 Turbine nacelle and hub components

Figure 4.4 shows the turbine base layout, including turbine foundation, hard standing areas, assembly area, access road and surrounding works area.

4.3.1.3 Turbine Foundation

Each wind turbine is secured to a reinforced concrete foundation that is installed below the finished ground surface. The size of the foundation will be dictated by the turbine manufacturer, and the final turbine selection will be the subject of a competitive tender process. Different turbine manufacturers use different shaped turbines foundations, ranging from circular to hexagonal and square. Those shown on drawings included in this EIAR are circular, but the final foundation could also be square or hexagonal depending on the requirements of the final turbine supplier. The turbine foundation transmits any load on the wind turbine into the ground. The maximum horizontal and vertical extent of the turbine foundation will be 25m (minimum of 19m) and 6m (minimum of 2.7m) respectively, which has been assessed in the EIAR and shown in Figure 4.2.

After the foundation level of each turbine has been formed using piling methods or on competent strata, the bottom section of the turbine tower “Anchor Cage” is levelled and reinforcing steel is then built up around and through the anchor cage (Plate 4.2 below). The outside of the foundation is shuttered with demountable formwork to allow the pouring of concrete and is backfilled accordingly with appropriate granular fill to finished surface level (Plate 4.3 below).

Plate 4.2 Levelled turbine tower 'can'

Plate 4.3 Steel reinforcement being added

4.3.1.4 Hard Standing Areas

Hard standing areas consisting of levelled and compacted hardcore are required around each turbine base to facilitate access, turbine assembly and turbine erection. The hard-standing areas are used to accommodate cranes used in the assembly and erection of the turbine, offloading and storage of turbine components, and provide a safe, level working area around each turbine position. The hard-standing areas are extended to cover the turbine foundations once the turbine foundation is in place. The sizes, arrangement and positioning of hard standing areas are dictated by turbine suppliers. The proposed hard standing areas are illustrated on Figure 4-4 and on the detailed drawings included in Appendix 4-1 to this report. The extent of the required areas at each turbine location may be optimised on-site within the parameters set out and assessed in this EIAR depending on topography, position of the site access road, the proposed turbine position and the turbine supplier's exact requirements. Where a smaller sized hard standing area is used the environmental impacts would not be more than the proposed hardstand.

4.3.1.5 Assembly Area

Levelled assembly areas, in a roughly rectangular arrangement, will be located to one side of each hard standing area. These assembly areas are required for offloading turbine blades and tower sections from trucks until such time as they are ready to be lifted into position by cranes. The extent of the area required for the assembly areas is shown on Figure 4-4 and the detailed drawing in Appendix 4-1which has been assessed in the EIAR. There are no permanent works associated with the assembly areas.

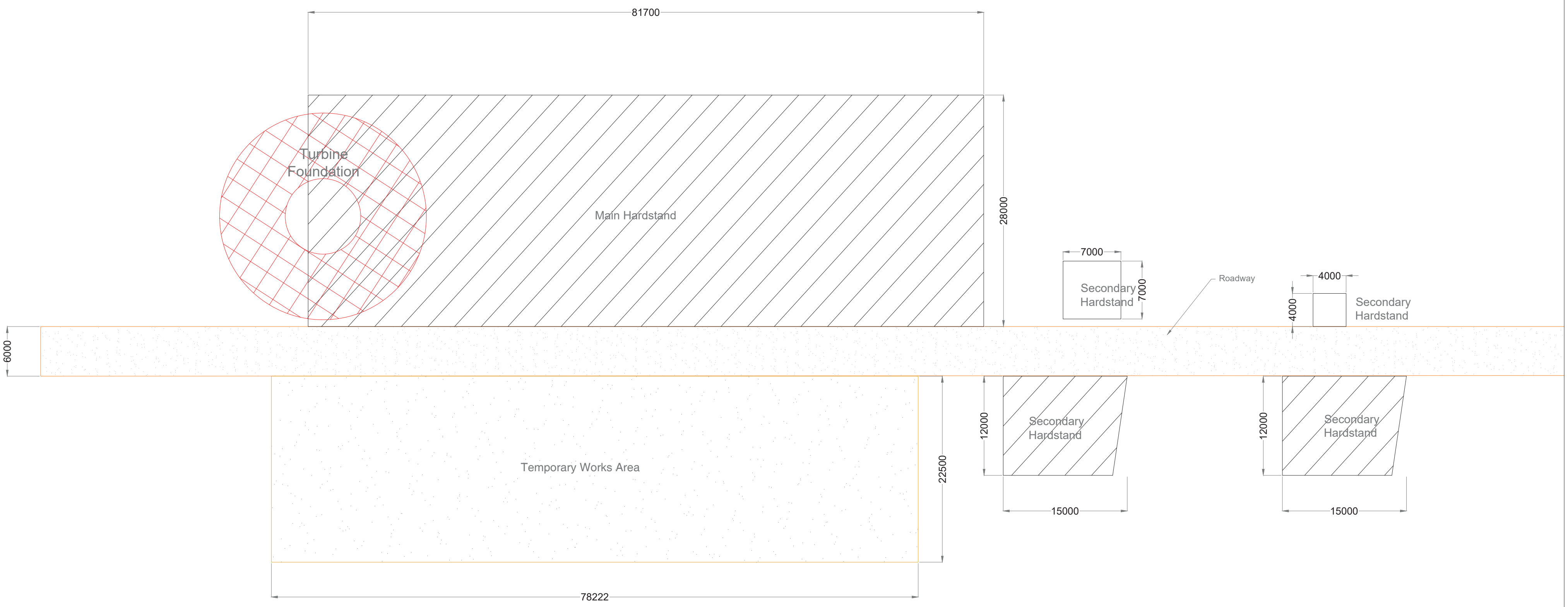

Figure 4-4

DRAWING TITLE:
Turbine Hardstand Layout Standard Detail

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **Fig 4-4**
SCALE: **1:500 @A3**	DATE: **22.11.2021**

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4.3.1.6 Power Output

It is anticipated the proposed wind turbines will have a rated electrical power output in the 5-6 megawatt (MW) range depending on further wind data analysis and power output modelling. Turbines of the exact same make, model and dimensions can also have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. For the purposes of this EIAR, a rated output of 6.0 MW has been chosen to calculate the power output of the proposed 7-turbine wind farm, which would result in an estimated installed capacity of 42MW

The proposed wind farm has the potential to produce up to 128,772 MWh (megawatt hours) of electricity per year, based on the following calculation:

A x B x C = Megawatt Hours of electricity produced per year

- where: A = The number of hours in a year: 8,760 hours
- B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc: 35%
- C = Rated output of the wind farm: 42MW

The capacity factor of a wind farm takes into account the intermittency of the wind and is based on average wind speeds. A load factor of 35% is used here, based on the average figure for Ireland, as referenced by the Irish Wind Energy Association.

The 128,772 MWh of electricity produced by the proposed wind farm would be sufficient to supply 27,824 Irish households with electricity per year, based on the average Irish household using 4,628 kWh of electricity in 2016 (SEAI, 2018).

The 2016 Census of Ireland recorded 54,288 private households in County Kerry. Per annum, based on a load factor of 35%, the proposed wind farm would therefore produce sufficient electricity for approximately 51% of private households in County Kerry.

4.3.2 Site Roads

Maximum use has been made of the local road network and existing on-site roads in accessing the proposed turbine locations so as to minimise the requirement for new roadways within the site.

Straight sections of existing and new proposed roadways will require a running width of six metres to accommodate the transportation of large turbine components. Corners and junctions will have to be wider than six metres to allow the trucks to manoeuvre around bends. All site access roads that are proposed to be use as part of the proposed development, both existing and proposed, will comply with the turbine supplier's requirements. the material required for upgrade and construction of roads within the site will be obtained from the onsite borrow pit, as detailed in Section 4.3.3 below.

4.3.2.1 Existing Roads for Use or Upgrade

The existing roadways and tracks through the site will be upgraded and widened where appropriate for accessing the proposed turbine locations. It is proposed to use 1.11 kilometres of existing on-site roadways as part of the proposed development. All of these 1.11 kilometres will require upgrading. The required upgrade will entail widening of the roadway to a total running width of approximately six metres, with wider sections at corners and on the approaches to turbine locations, and the laying of a new surface dressing on the existing section of roadway where necessary.

Figure 4.5 shows section drawings for road widening within the site, including the location of cable trenches and drainage features relative to the roadway. Widening will be carried out on one side of the road only, on the side that has been identified as being the least sensitive ecologically.

4.3.2.2 New Roads

New roadways will be required for access to turbine locations in areas where existing roads are not already present.

It is proposed to construct 8.21 kilometres of new roadway as part of the proposed development. The routes of the proposed new roads are shown in Figure 4.1.

4.3.2.3 Watercourse Crossings

Across the site there will be twenty water-crossings constructed, three of which will be extensions of existing crossings of man-made drains and the remaining 17 being new crossings. Two of the new water-crossings will cross natural watercourses and 15 of the new water-crossings will cross man-made drains.

Full details of the proposed crossing methods for each watercourse crossing, along with a map of their locations are provided in Appendix 4-3 of this EIAR. Any new culverts of existing watercourses will be the subject of consent applications to the Office of Public Works under Section 50 of the Arterial Drainage Act, 1945. Cable crossings for the proposed grid connection portion of the project are discussed in Section 4.3.8, below.

4.3.2.4 Road Construction

Where relatively shallow depths of overburden are found within the site of the proposed development, it is proposed to construct new or improve existing roads directly on a solid formation. Over much of the site, this solid formation will be bedrock, which is found at shallow depths in the area.

Figure 4.5 shows section drawings for road construction and road widening where the roads are to be constructed or widened on solid formation within the site, including the location of cable trenches and drainage features relative to the roadway.

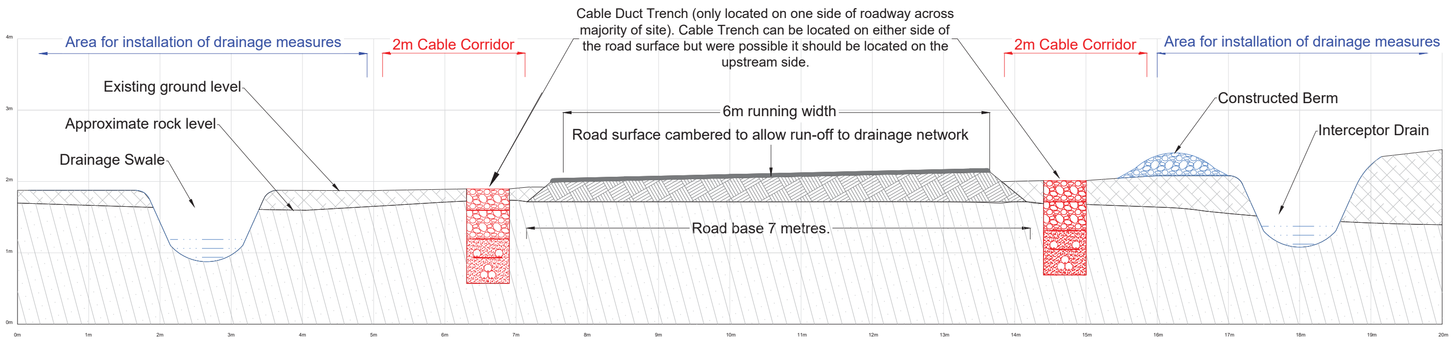
In localised areas across the site, it may be necessary to construct some floating roads over peat. The floating road design will be used typically in areas with two metres of peat depth or greater. The most suitable type of road construction will be selected at the detailed design stage based on shear strength, slope, peat depth and factor of safety of the peat over which the road must traverse.

Floating roads, a typical section of which is shown in Figure 4.6, minimise impact on the peat, particularly peat hydrology, and significantly reduce the volumes of peat requiring management as there is no excavation required and no peat arisings are generated.

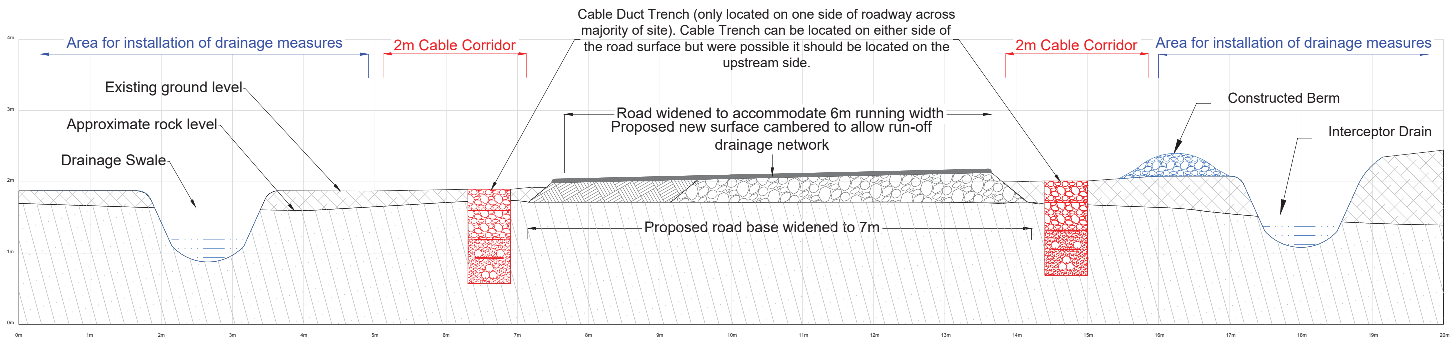
All new roadways will be constructed with a camber to aid drainage and surface water runoff. The gradient and slope of the camber will depend on the site characteristics where the road is actually being constructed.

Drawing Notes

1. Widening can occur to either side of existing roads dependent on site conditions.
2. Depths of road fill to vary dependent on site conditions.



Excavated road section.



Existing excavated road widening section.

Figure 4-5

DRAWING TITLE:

Excavated Road Sections

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 43**
SCALE: **1:75@A3**	DATE: **22.11.2021**

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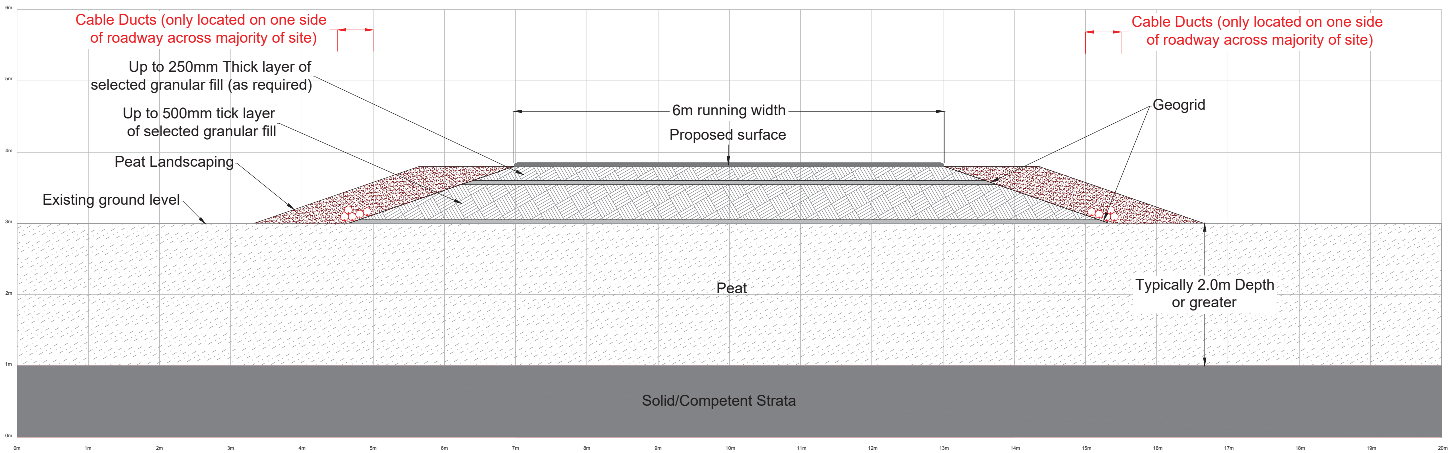
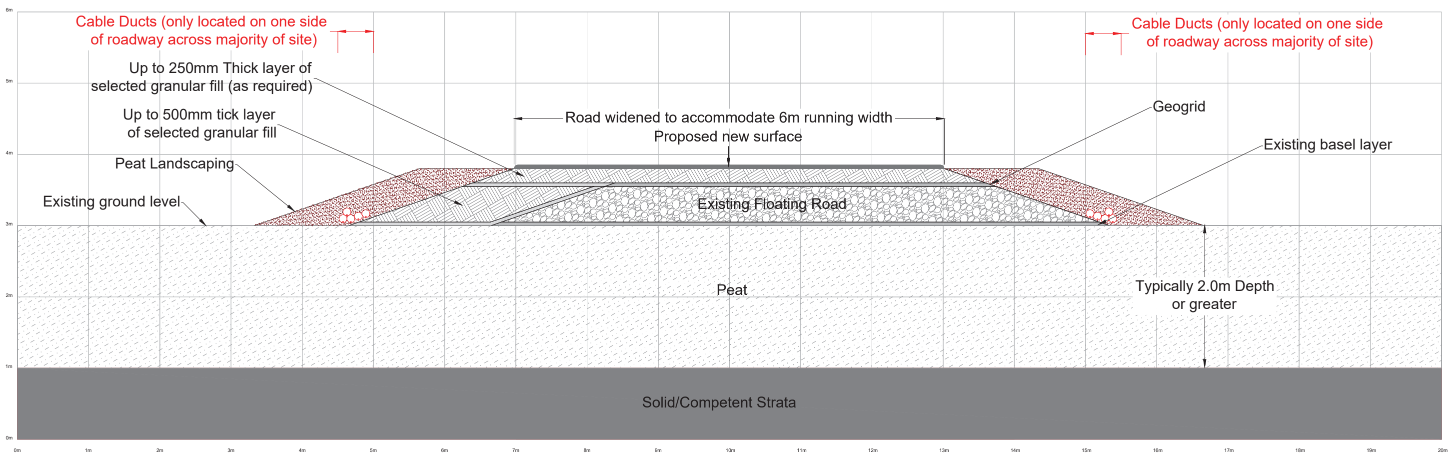
Drawing Notes

1. Widening can occur to either side of existing roads dependent on site conditions.
2. Depths of road fill to vary dependent on site conditions.



Floating road section.



Floating road widening section.

Figure 4-6

DRAWING TITLE:
Floating Road Sections

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 44
SCALE: 1:75 @A3	DATE: 22.11.2021

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4.3.3 Borrow Pit

4.3.3.1 Borrow Pit Location

It is proposed to develop an on-site borrow pit as part of the proposed wind farm development. It is proposed to obtain the majority of all rock and hardcore material that will be required during the construction of the proposed development from the on-site borrow pit. A limited quantity of hardcore and other aggregate materials may have to be imported as it may not be possible to source from the on-site borrow pit, such as bedding sand for duct laying, and hardcore for initial site enabling works required before the borrow pit can be accessed and developed.

Rock is available close to and at the ground surface in an area in the southeast of the site. The proposed borrow pit will be developed at this location in an area measuring approximately 24,000m2 where rock will be extracted for use throughout the site. An area of approximately 2,267m2 will be dedicated to processing and stockpiling of crushed stone which will be used initially until such a time as there is sufficient working space within the extraction area to process and store these materials. It is intended to extract approximately 144,000 m^3 of hardcore materials from the borrow pit for the construction of all turbine foundations, hardstands and access roads thereto.

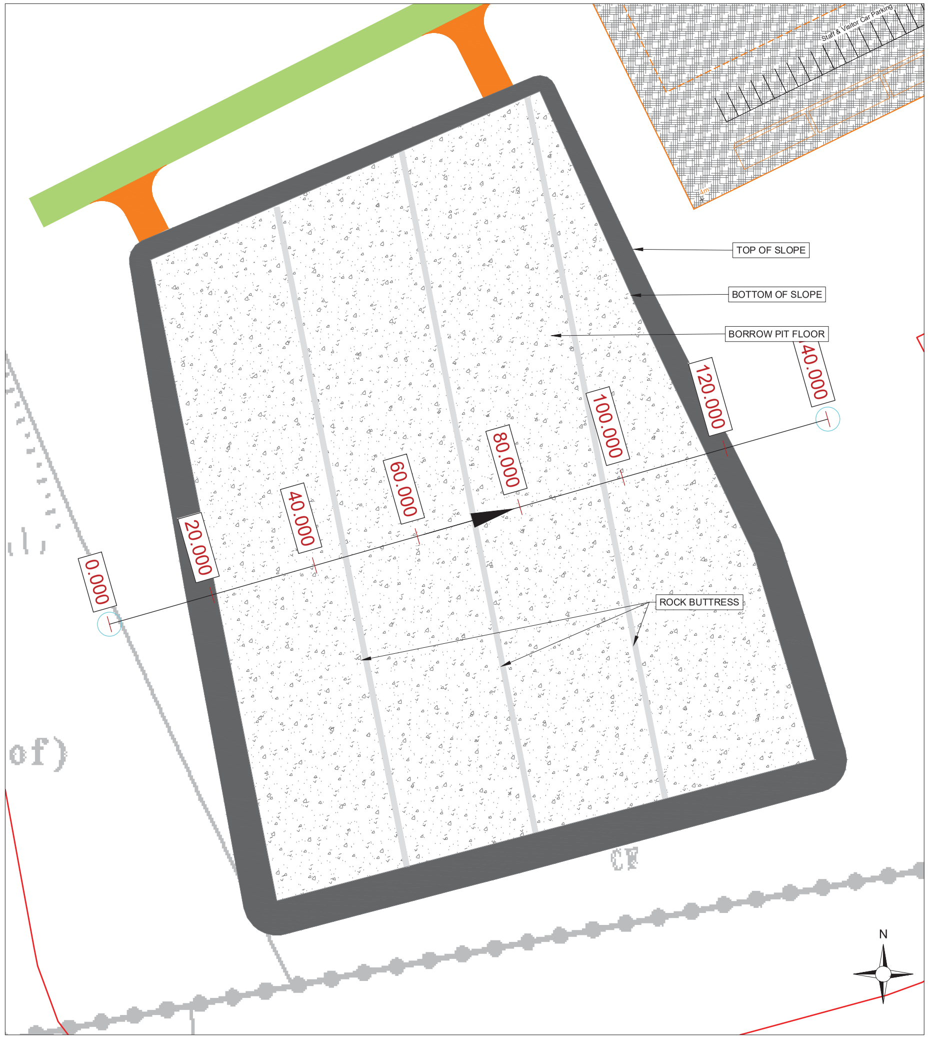
The borrow pit location is shown on Figure 4.1 and on the detailed site layout drawings included as Appendix 4-1 to this EIAR. Figure 4.7 below shows detailed sections through the proposed borrow pit. Prior to the extraction of any rock, it is proposed that overburden will be stripped from the surface of the borrow pit area by mechanical excavator. This overburden material will be stockpiled locally and will form a berm around the perimeter of the borrow pit which will partially screen the borrow pit from view. When the processing and stockpiling of crushed stone is moved to a location within the excavation area, the berm will be completed across the original processing and stockpiling area. The berm will then be seeded with agricultural grass seed mixture to assist in establishing vegetation in this area.

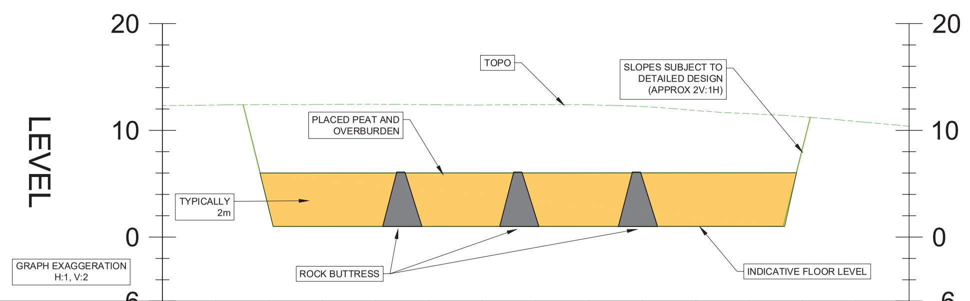
During and post-construction, the extraction area of the borrow pit will have to be permanently secured and a stock-proof fence will be erected around the borrow pit to prevent access to these areas. Appropriate health and safety signage will also be erected on this fencing and at locations around the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

The rock within the proposed borrow pit footprint will be removed by either breaking or blasting depending on its excavatability, which will be determined from a ground investigation carried out at the proposed borrow pit. Blasting will only be carried out after an appropriate method of notifying local residents has been submitted to and agreed with the Planning Authority. To generate the necessary volume of hardcore materials, the borrow pit would be excavated to an average approximate depth of up to 10 metres over the full area of the borrow pit.

Figure 4.7 shows a typical excavation profile for the borrow pit. Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions. An interceptor drain will also be installed upslope of the borrow pit, where necessary. This drain will divert any surface water away from the borrow pit and hence, prevent water from ponding and lodging on the re-instated borrow pit area.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using surplus excavated peat and spoil. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat and spoil to be placed safely. It is proposed to place peat to approximately 5m deep across the base of the borrow pit. It may be necessary to construct cells/rock buttresses or leave upstands of intact bedrock within the borrow pit to help contain the reinstated peat and overburden. This will allow for the safe placement and grading of the materials using dumper trucks and excavators. The typical layouts of the borrow pit is presented in Appendix 4.1.





CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000
EXISTING LEVELS	12.317	12.372	12.421	12.430	12.451	12.407	12.372	12.417	12.392	12.230	11.859	11.561	11.274	10.840	10.381

Figure 4-7

DRAWING TITLE:
Borrow Pit Layout & Sections

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 31
SCALE: 1:500 @ A1	DATE: 22.11.2021

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4.3.4 Peat and Spoil Management Plan

4.3.4.1 Quantities

The quantity of peat and other subsoils, requiring management on the site has been calculated, as presented in Table 4.2 below.

Table 4.2 Peat and overburden volumes requiring management/storage

Infrastructure Item	Excavated volume (m^3)		
	Peat *	Non-peat *	
		Overburden **	Rock **
Floated access roads	0	-	-
Founded access roads	11,059	-	-
Turbine foundations	7,576	6,013†	-
Crane hardstands	50,523	-	-
Compound North hardstand	0	-	-
Compound South hardstand	0	-	-
Substation hardstand	0	-	-
Met mast hardstand	1,968	-	-
Borrow Pit	0	0	144,000
Total Volume for Proposed Development	**71,127**	**6,013**	**144,000**

** The volume of peat versus non-peat material excavated has been estimated using the average peat depth calculated across the site to define the basal surface of the peat.*

*** The breakdown of the constituents of the non-peat materials excavated (i.e. the ratio of overburden to rock) is based on observations of rock and overburden exposures made during the site reconnaissance and desk study.*

† Assuming overburden thickness of 3m.

4.3.4.2 Temporary Peat Repositories

Selected areas, within the site of the proposed development, have been chosen as temporary peat repository areas. These areas have been chosen based on their generally level topography and their ground conditions. The earthen overburden material will be excavated and used to create individual cells that will be formed of containing mounds, a maximum of 1.5m in height. If there is no suitable earthen overburden present within the chosen area then an imported granular fill material will be used to construct the containing mounds.

A temporary ramped incline will be constructed at one point around the perimeter of each cell, where trucks will reverse up to tip the excavated peat into the cell. Surrounding each repository area will be temporary accommodation tracks from which a long-reach excavator will spread the excess peat evenly within the cell. Each peat repository cell will be developed and filled on a once-off basis in a matter of days, and therefore, the long-reach excavator will only be working around the perimeter of each cell for a very limited period. Where necessary, to avoid heavy disturbance of the areas around each cell while the excavator is spreading material within the cell, bog mats will be used to line the accommodation track.

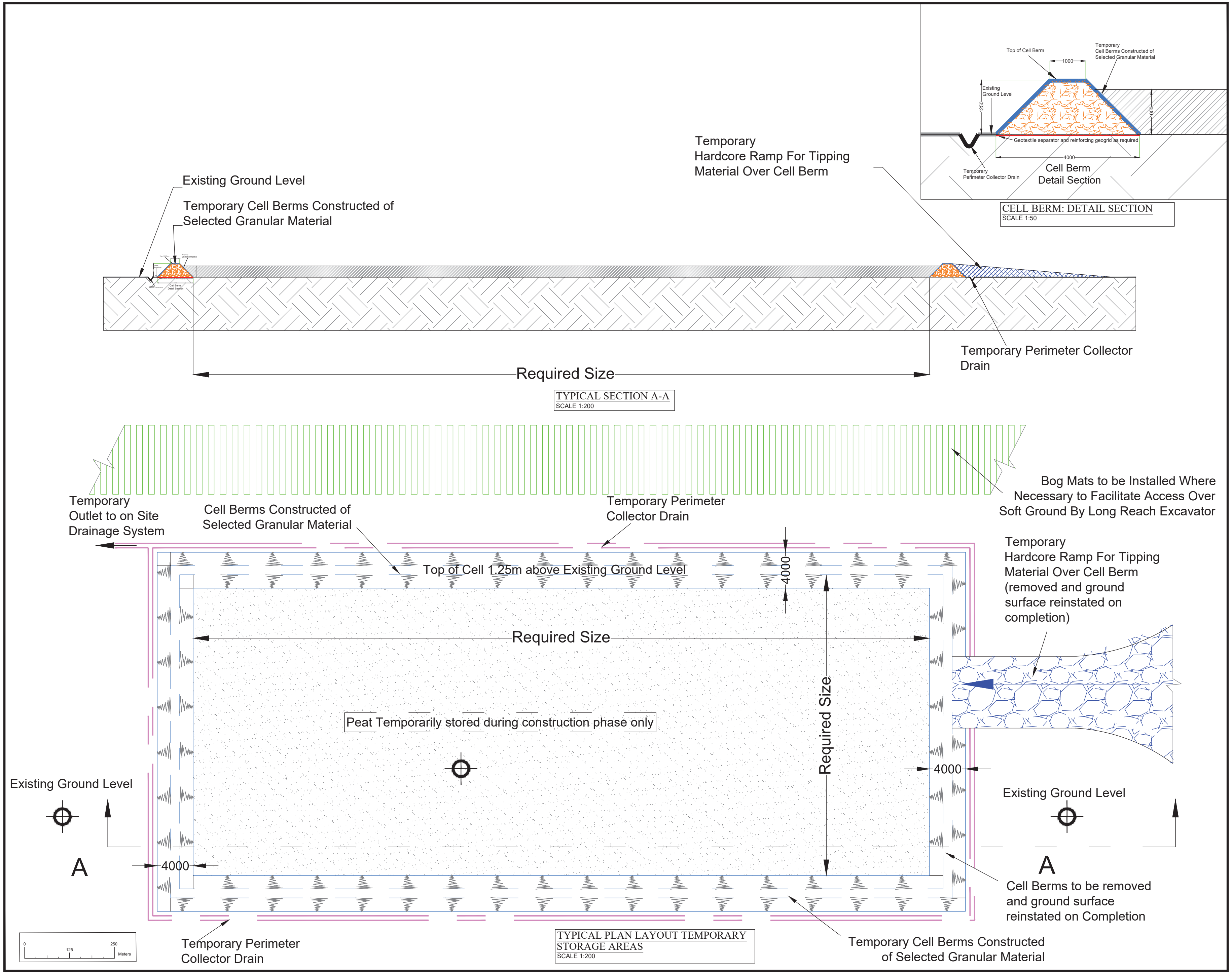
Plate 4.4 Bog mat being laid in position by excavator

Plate 4.5 Bog mat protecting ground by excavator.

The locations of proposed peat repositories are shown on Figure 4.1 and a generic layout and section drawing of the peat repository area design is illustrated on Figure 4.8. Minor adjustments to the locations of the proposed peat repository areas may occur as the construction of the site develops. These adjustments would be at the discretion of the site engineer.

Peat and other overburden excavated from the footprint of the proposed development during the course of the construction phase will be transported to the peat repository areas for temporary storage until such time as sufficient storage capacity has been generated in the proposed on-site borrow pit. Excavators will load the peat and overburden directly into dump trucks, which will be used to transport the material to the repository areas.

The material will be backfilled into the area within the peat storage cells, and the use of a long-reach excavator will ensure it is spread evenly over all areas, up to a maximum depth of 1.3 metres. The peat repository areas were chosen as the repository sites for surplus peat because of their flat topography and low ecological value. The habitats in this area are not designated for protection.



NOTES:

1. THIS DRAWING IS FOR PLANNING AND ENVIRONMENTAL IMPACT ASSESSMENT PURPOSES AND SHOULD NOT BE USED AS DETAILED DESIGN OR FOR CONSTRUCTION DRAWINGS.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

Figure 4.8

REV: FI-00	DATE: 06/10/21	DRAWN BY: CJM	CHECKED BY: LB
DESCRIPTION:	ISSUED FOR INFORMATION		

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ISSUED AS: FOR INFORMATION

CLIENT: MKO

PROJECT TITLE: BALLYNAGARE WIND FARM

DRAWING No: 20260-GDG-ZZ-XX-SK-C-0251

Revision: -FI-00

DRAWING TITLE: TEMPORARY PEAT STORAGE AREAS -TYPICAL DETAILS

SCALE: 1:200	SHEET SIZE: A1	DATE: 6/10/21
DRAWN BY: CJM	CHECKED BY: L.B	APPROVED BY: L.B.

4.3.4.3 Placement of Peat in Borrow Pit

The following particular recommendations/best practice guidelines for the placement of peat & spoil in the borrow pit should be considered and taken into account during construction.

- Peat shall be separated and stored by type, namely the acrotelmic and catotelmic layers.
  - Acrotelm (top about 0.3 to 0.4m of peat) is generally required for landscaping and shall be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping shall be undertaken before the main excavations.
  - Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage the growth of plants and vegetation.
  - All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the designated areas.
- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit areas.
- Silting ponds may be required at the lower side/outfall location of the borrow pit.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pit may be required.
- Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pit in a way which will allow the excavated peat & spoil to be placed safely.
- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

4.3.4.4 Placement of Peat & Spoil alongside Access Roads

In some areas of the proposed development site it is possible and environmentally sustainable to place excavated materials close to the excavation areas, in particular roads and around turbine areas. The following recommendations/best practice guidelines for the placement of peat and spoil alongside the access roads will be taken into account during the construction of the proposed development:

The following particular recommendations/best practice guidelines for the placement of peat & spoil alongside the founded roads should be considered and taken into account during construction.

- Peat and spoil shall be side-cast along founded roads only where it can be placed in a stable formation i.e. where the topography and ground conditions allow.
- Peat and spoil shall only be cast to safe heights and slope angles, considering the topography and the ground conditions. This height shall generally be up to 1m, and the slopes shall be not greater than 1 (v): 2 or 3 (h) unless a site-specific assessment during detailed design indicates a greater height and angle is safe.
- The placement of excavated peat & spoil is to be avoided without first establishing the adequacy of the ground to support the load. The placement of peat & spoil within such areas will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.
- Where there is any doubt as to the stability of the ground then no material shall be placed on to the surface.
- Where practical, it should be ensured that the surface of the placed peat & spoil is shaped to allow efficient run-off of surface water. Where possible, shaping of the surface of the placed peat and spoil should be carried out as placement of peat &

spoil progresses. This will reduce the likelihood of debris run-off and ensure stability of the placed peat & spoil.

- Finished/shaped side slopes in the placed peat & spoil shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat & spoil are encountered then slacker slopes will be required.
- Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the placed peat & spoil within these placement areas.
- Movement monitoring instrumentation may be required adjacent to the access road where peat has been placed. The locations where monitoring is required will be identified prior to construction works commencing on site.
- Supervision by a geotechnical engineer or appropriately competent person is recommended for the works.
- An interceptor drain should be installed upslope of the designated peat placement areas to divert any surface water away from these areas. This will help ensure stability of the placed peat and reduce the likelihood of debris run-off.
- All the above mentioned general guidelines and requirements should be confirmed by the designer prior to construction.

4.3.4.5 Peat Management

The volume of the borrow pit will be sufficient to accommodate all overburden and subsoil material generated during the course of the construction phase, as indicated in Table 4.2.

Water within the peat repository area will be filtered through the granular fill material that makes up the containment cells, and collected in collector drains surrounding the peat repository cells, as described in further detail below in Section 4.6.

Some overburden and peat will be stored temporarily adjacent to proposed works areas for reinstatement works after the main construction activities have been completed. For example, the working area required around each turbine foundation will have to be backfilled on completion of the turbine foundation. Similarly, the proposed roadways will have to be graded back to the level of the adjacent ground. In both these and other cases, the necessary volumes of overburden will be stored adjacent to the works areas, for reuse in reinstatement. All temporary storage areas will be assessed by an ecologist, geotechnical engineer and hydrologist prior to being used to temporarily store overburden destined for future reuse. This proposed use of temporary storage areas is considered more sustainable than hauling the material to the nearest borrow pit and transporting it back from there again to where it is needed for the reinstatement works. The stored material will be surrounded by silt fences to ensure sediment-laden run-off does not occur. Any excess mounded peat in temporary storage for long periods will be digger-bucket sealed and covered with polyethylene sheets or reseeded at the earliest opportunity.

4.3.5 Electricity Substation

It is proposed to construct an electricity substation within the site, adjacent to a proposed access road, as shown in Figure 4.1. The layout and elevations of the proposed substation are shown on Figure 4.9. The construction and electrical components of the electricity substation will be to ESB specifications. Further details regarding the connection between the proposed site substation and the national electricity grid are provided in Section 4.3.8 of this EIAR chapter. The proposed electricity substation compound measures approximately 50 metres in length by 25 metres in width and will include one wind farm control buildings and the electrical substation components necessary to consolidate the electrical energy generated by each wind turbine, and export that electricity from the wind farm site.

4.3.6 Wind Farm Control Building

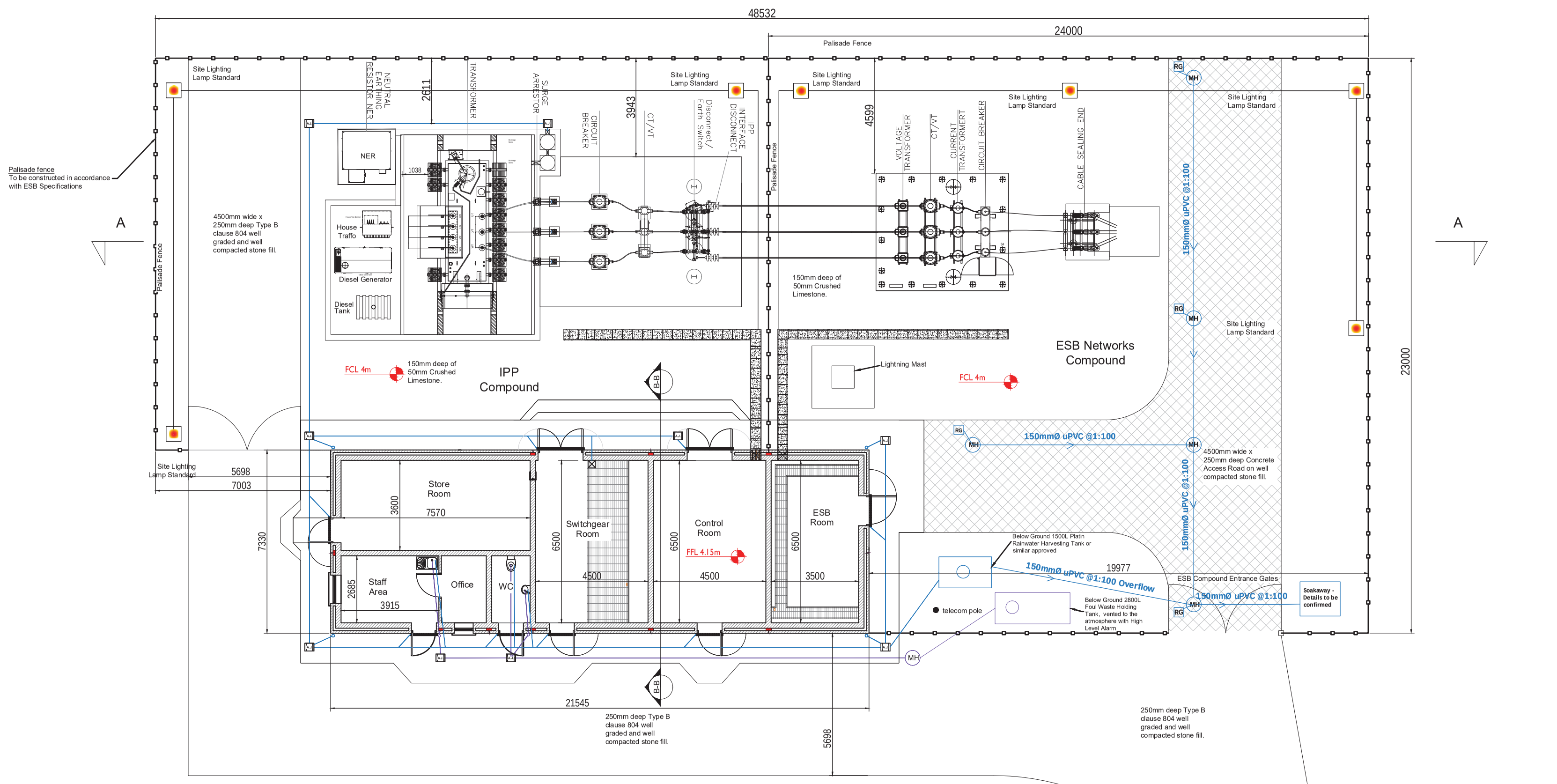
A wind farm control building will be located within the substation compound. The control building will measure 21.5metres by 7.3 metres and 6 metres in height, will be located in the western half of the substation compound. Layout and elevation drawings of the control building are included in Figure 4.10.

The wind farm control building will include staff welfare facilities for the staff that will work on the proposed development during the operational phase of the project. Toilet facilities will be installed with a low-flush cistern and low-flow wash basin. Due to the specific nature of the proposed development there will be a very small water requirement for occasional toilet flushing and hand washing and therefore the water requirement of the proposed development does not necessitate a potable source. It is proposed to harvest rainwater from the roofs of the buildings, and if necessary, bottled water will be supplied for drinking.

It is proposed to manage wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank, with all wastewater being tankered off site by permitted waste collector to wastewater treatment plants. It is not proposed to treat wastewater on-site, and therefore the EPA's 2009 'Code of Practice: Wastewater Treatment and Disposal Systems Serving Single Houses (p.e. 10)' does not apply. Similarly, the EPA's 1999 manual on 'Treatment Systems for Small Communities, Business, Leisure Centres and Hotels' also does not apply, as it too deals with scenarios where it is proposed to treat wastewater on-site.

Such a proposal for managing the wastewater arising on site has become almost standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment would be challenging, and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal.

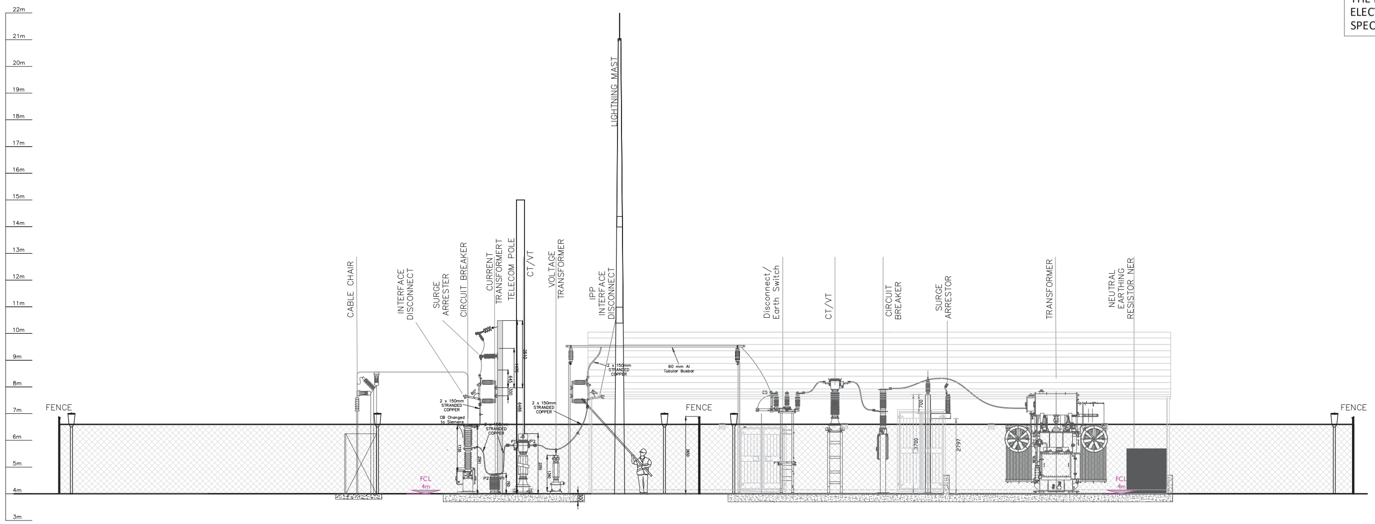
The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the sites turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007 (as amended), will be employed to transport wastewater away from the site to a licensed facility.



Substation Compound Layout

SCALE 1:100

PLEASE NOTE THAT THE SUBSTATION LAYOUT AND SUBSTATION COMPONENTS ILLUSTRATED ON THIS DRAWING ARE INDICATIVE ONLY. THE FULL SPECIFICATION AND DETAIL WILL BE DETERMINED FROM THE ELECTRICAL EQUIPMENT SUPPLIER AND ESB FUNCTIONAL SPECIFICATION.



Section A-A Through Substation Compound

SCALE 1:100

tli GROUP

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PROJECT

Ballynagare Wind Farm
38kV Substation

CLIENT

EMPower

CONSULTANTS

NOTES: -

- Configuration of substation equipment and infrastructure is subject to detailed design and ESB design approval.
- The proposed substation layout should be used for planning purposes only.
- This drawing is to be read in conjunction with relevant drawings, specifications and reports.
- Dimensions are in millimeters, unless noted otherwise.
- Drawings are not to be scaled use figured dimensions only.

LEGEND: -

- Surface water drainage shown thus
- Foul drainage shown thus
- Lamp Standard shown thus
- Proposed Levels Shown thus (Planning)
- Proposed Levels Shown thus (Elevation and Sections)
- Concrete Access Road shown thus

Figure 4.9

ISSUE/REVISION

I/R	DATE	DESCRIPTION
P00	27.08.21	Issued for Planning

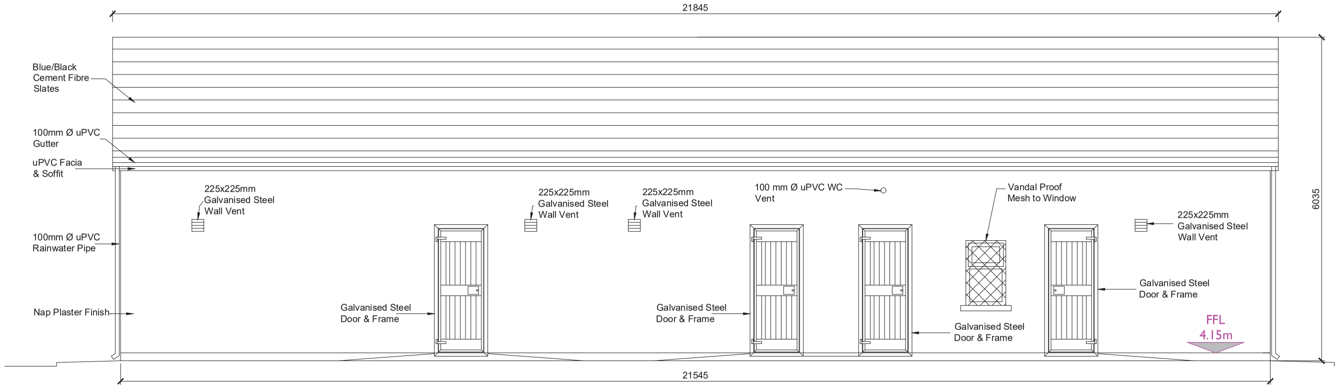
PROJECT NUMBER
05-801

SHEET TITLE
38kV Substation Compound Layout & Section

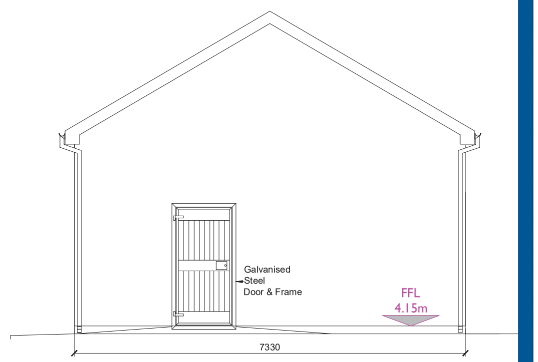
SHEET NUMBER
05801-DR-103

ISO A1 594mm x 841mm

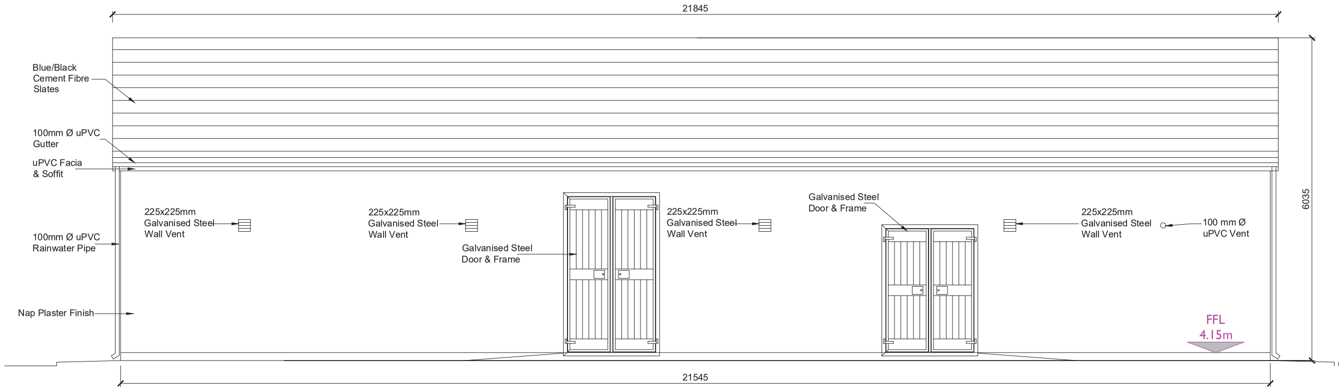
Project Management Initials: Designer: JC Checked: SK Approved: RG



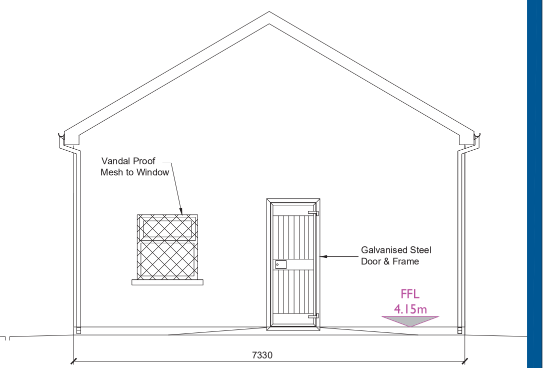
Front Elevation-East
SCALE 1:50



Side Elevation-North
SCALE 1:50



Rear Elevation-West
SCALE 1:50



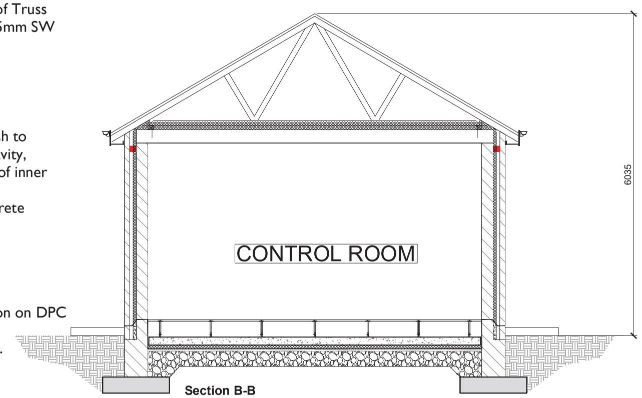
Side Elevation-South
SCALE 1:50

Roof Construction:
Roof on,
treated SW Roof Battens on,
selected Breather Membrane on
selected SW Prefabricated Roof Truss
system fixed to treated 100x75mm SW
Wallplate.
Plasterboard internal ceiling.

Cavity Wall:
Flat Sand / Cement Plaster finish to
100mm Outer Leaf, 100mm Cavity,
215mm Inner Leaf. Inside face of inner
leaf to remain fair-faced.
Cavity wall supported on concrete
strip foundation.

Floor:
Raised Access Floor on
150mm Reinforced Concrete
Floor Slab on Selected Insulation on DPC
on Sand Blinding all supported
off Well Compacted Hardcore.

NOTE : Control Building surfaces need to be non - combustible



Section B-B
SCALE 1:50

tli GROUP

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PROJECT
Ballynagare Wind Farm
38kV Substation

CLIENT
EMPower

CONSULTANTS

NOTES: -
- Substation building is subject to detailed design and ESB design approval and should be used for planning purposes only.
- The proposed substation layout should be used for planning purposes only.
- This drawing is to be read in conjunction with relevant drawings, specifications and reports.
- Dimensions are in millimeters, unless noted otherwise.
- Drawings are not to be scaled use figured dimensions only.

LEGEND: -
Proposed Levels Shown thus (Elevation and Sections) FCL 54.60m

Figure 4.10
ISSUE/REVISION

P00	27.08.21	Issued for Planning
I/R	DATE	DESCRIPTION

PROJECT NUMBER
05-801

SHEET TITLE
38kV Substation Building Elevations

SHEET NUMBER
05801-DR-104

ISO A1 594mm x 841mm

Project Management Initials: Designer: JC Checked: SK Approved: RG

4.3.7 Site Cabling

Each turbine will be connected to the on-site electricity substation via an underground 38kV (kilovolt) electricity cable. Fibre-optic cables will also connect each wind turbine to the wind farm control building at the onsite substation compound. The electricity and fibre-optic cables running from the turbines to the onsite substation compound will be run in trenches that will be approximately 1.3 metres in depth and 0.6 metres in width, along the sides of roadways. The route of the cable ducts will generally follow the access track to each turbine location and are visible on the site layout drawings included as Appendix 4-1 to this report. The position of the internal site cable trench relative to the roadways is shown in section in Figure 4-5 and Figure 4-6 above. Figure 4-11 below shows two variations of a typical cable trench, one for off-road trenches (to be installed on areas of soft ground that will not be trafficked) and one for on-road trenches (to be used where trenches run along or under a roadway).

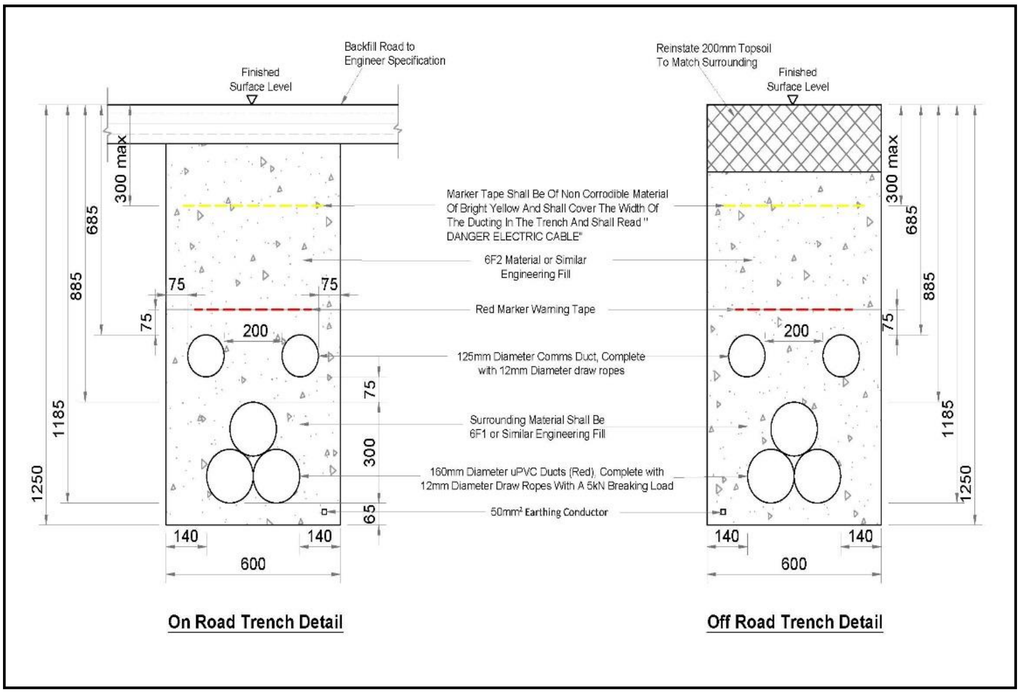


Figure 4.11 Typical Onsite Cable trench cross-section detail

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

4.3.8 Grid Connection Cabling

A 38kV connection between the proposed development and the national electricity grid will be necessary to export electricity from the proposed development. The proposed underground cable connection will originate at the proposed onsite substation and connect to the existing 110kV Clahane switching station. The route will follow the proposed site roads to the proposed site entrance and turn south along a local road to the R557. The grid connection route will then turn east onto the R557 in the townland of Monument. The grid connection route follows the public road network southeast to the Clahane 110kV substation. The connection route is illustrated in Figure 4-12.

For the purposes of the grid connection design for this planning application, it is assumed that the potential maximum export capacity of the proposed wind farm will be 42MW.

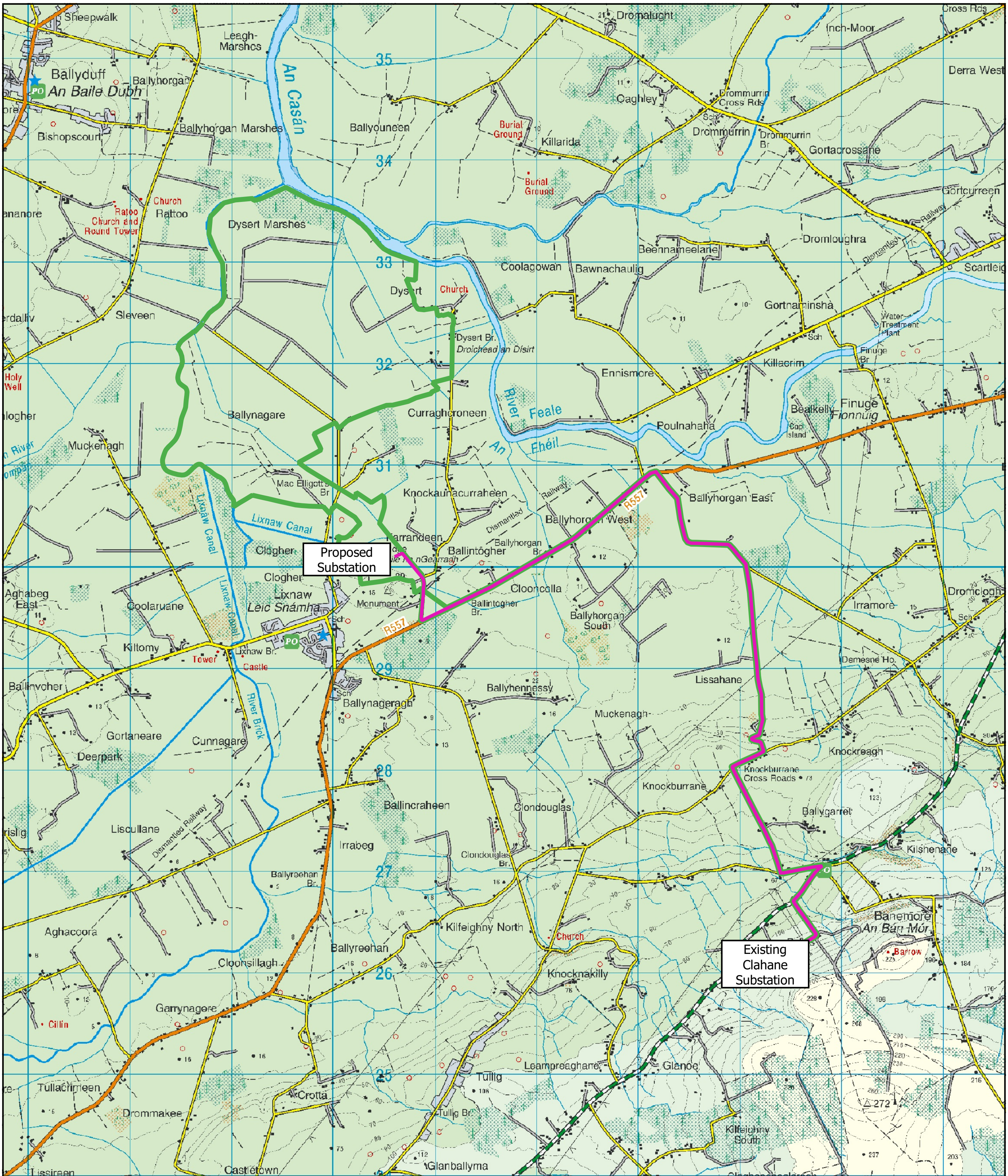
The proposed 38kV grid connection cable trench cross sections is shown in Figures 4-13. Further details in relation to the grid connection for the proposed development is outlined in Section 4.8.9 below.

4.3.8.1 Grid Connection Cable Route

The proposed grid connection cable route will commence from the proposed Ballynagare substation and connect to the existing 110kV Clahane switching station. The route will follow the proposed site roads to the proposed site entrance and turn south along a local road to the R557. The grid route travels east along the R557 for 2.7km where it heads south east along the tertiary road for 1.5km. It then travels south for 2km crossing under the Tralee-Tarbert 1 110kV and Tralee-Tarbert 2 110kV lines. It then turns west along the L1027 road for 0.35km where it then continues south for 1.1km. It then joins the L6074 road for 0.4km to Banemore Cross where it joins the N69. It then travels 0.45km south west along the N69 to the entrance of the existing Clahane 110kV substation which is approx. 550m from the N69 road. All works and construction machinery will operate within the curtilage of the public road. The total length of the proposed underground grid connection route is approximately 13.8 kilometres. The proposed grid connection cable will pass through 11 townlands, all of which are listed in Table 4.3 below. A map of the proposed grid connection cable route is shown in Figure 4.12.

Table 4.3 Townlands through which the cable route traverses

Townland Name
Knockaunacurraheen
Ballintogher,
Ballynageragh
Clooncolla
Ballyhorgan West
Ballyhorgan East
Lissahane
Knockburrane
Ballygarret
Banemore
Pallas



Map Legend

- EIAR Study Area
- Proposed 38kV Grid Connection

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Drawing Title	Grid Connection Route
Project Title	Ballynagare Wind Farm
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 4.12
Scale: 1:50000	Date: 30.09.21

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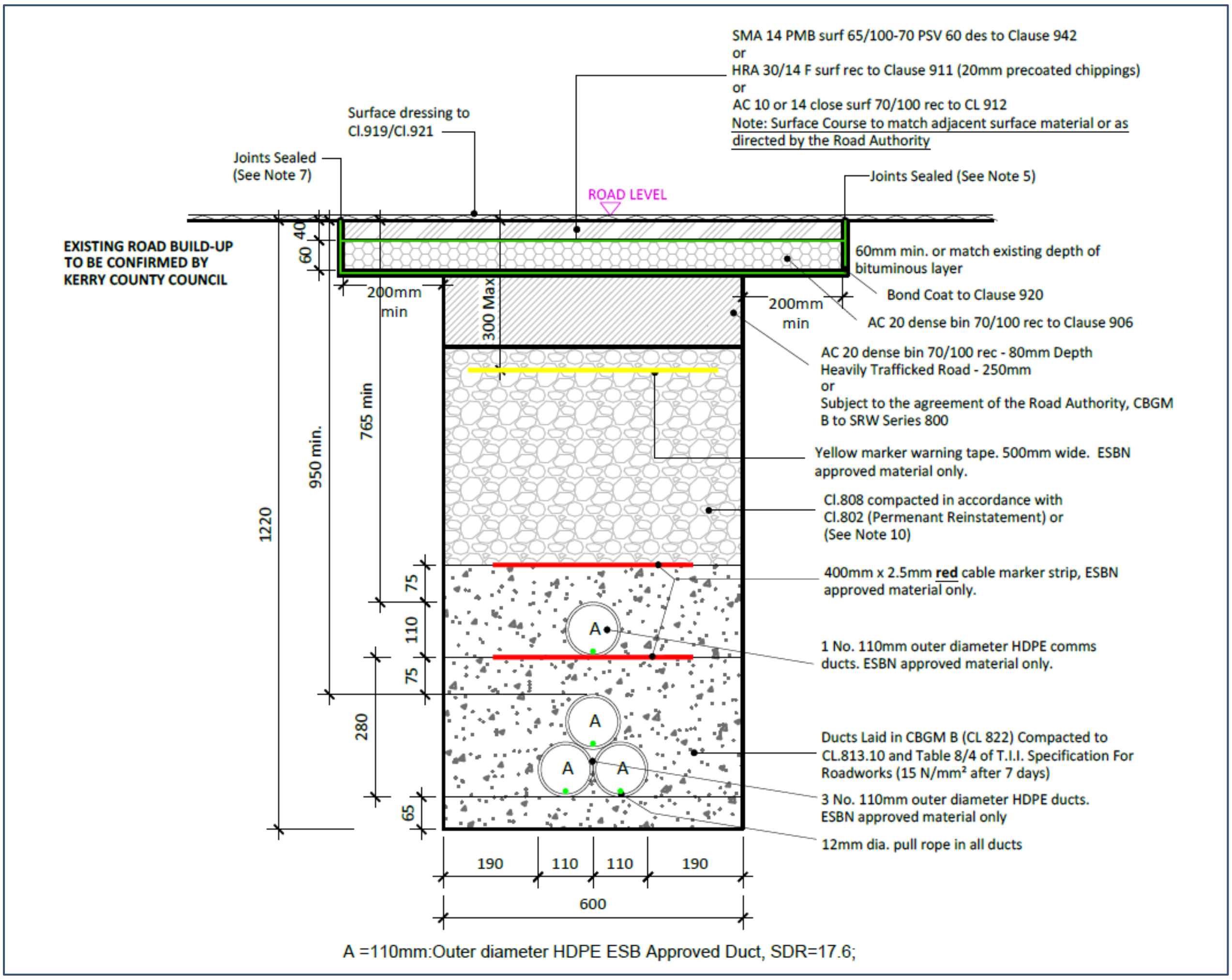


Figure 4.13 Proposed Grid Connection Cable Trench

4.3.9 Meteorological Mast

One permanent meteorological (met) mast is proposed as part of the proposed development. The met mast will be equipped with wind monitoring equipment at various heights. The mast will be located E88469 N131002 as shown on the site layout drawing in Figure 4-1. The mast will be a slender structure, 110 metres in height. The mast will either be a free-standing structure or could be supported by guyed wires radiating out 51 metres in three directions from the tower. The mast will be constructed on a hard standing area sufficiently large to accommodate the crane that will be used to erect the mast, adjacent to an existing track. The two variations of proposed met mast are shown in Figures 4.14 and 4.15. Electrical equipment at the base of the proposed met mast will be raised to an elevation of 3.75m OD to ensure that they are above the theoretical 1,000 year flood level.

4.3.10 Temporary Construction Compounds

A temporary construction compound measuring approximately 50 metres by 85 metres and 4,250m^2 in area is proposed for the southern section of the site, adjacent to the proposed access road. The location of the proposed construction compound is shown on the site layout drawing in Figure 4-1.

The construction compound will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors. The layout of this construction compound is shown on Figure 4-16. Construction materials and turbine components will be brought directly to the proposed turbine locations following their delivery to the site.

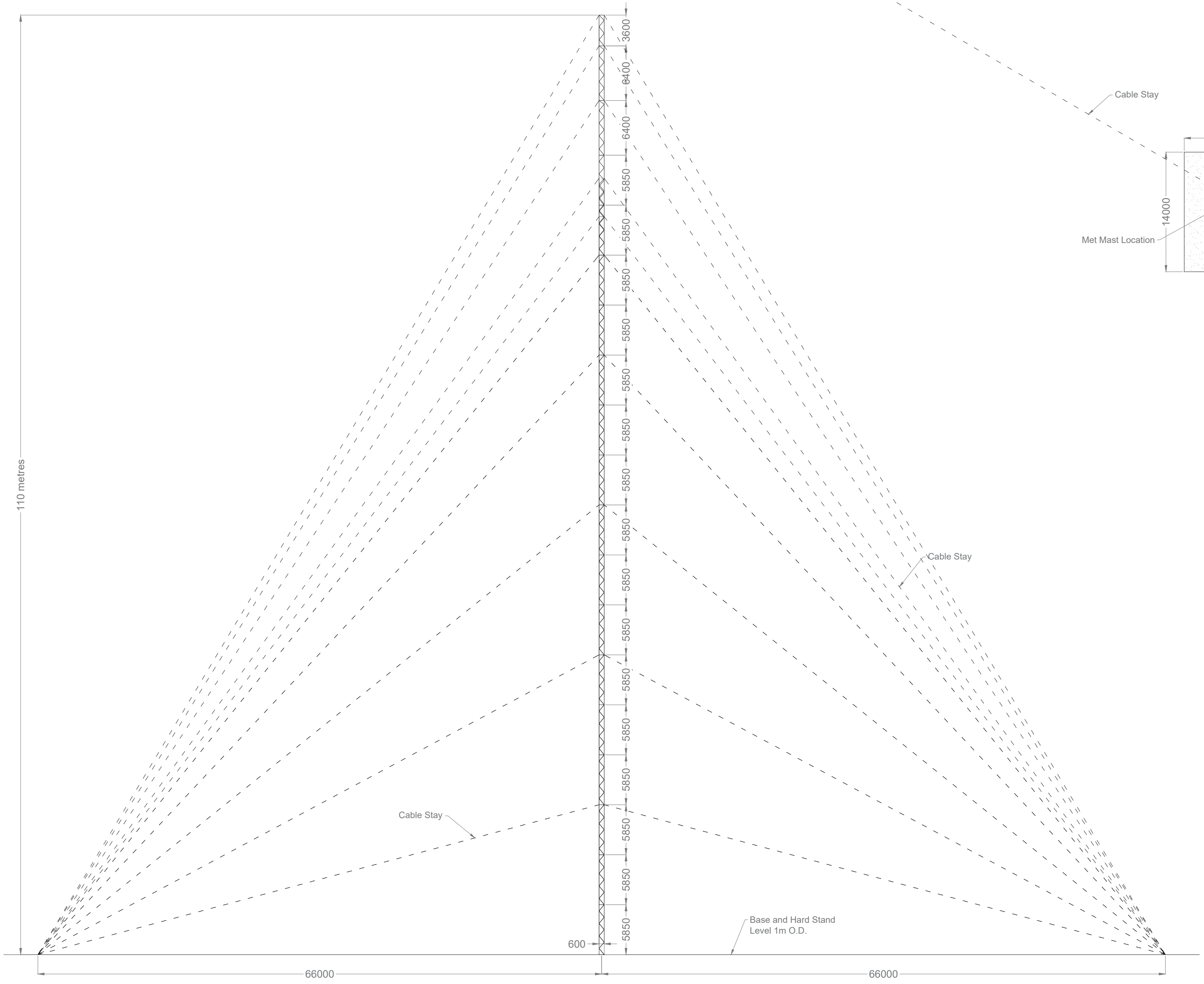
Temporary port-a-loo toilets located within a staff portacabin will be used during the construction phase. Wastewater from staff toilets will be directed to a sealed storage tank, with all wastewater being tankered off site by a permitted waste collector to wastewater treatment plants.

Once the proposed wind farm has been commissioned, this construction compound will be removed. The area will be reinstated with previously excavated spoil and will either be reseeded or left to revegetate naturally.

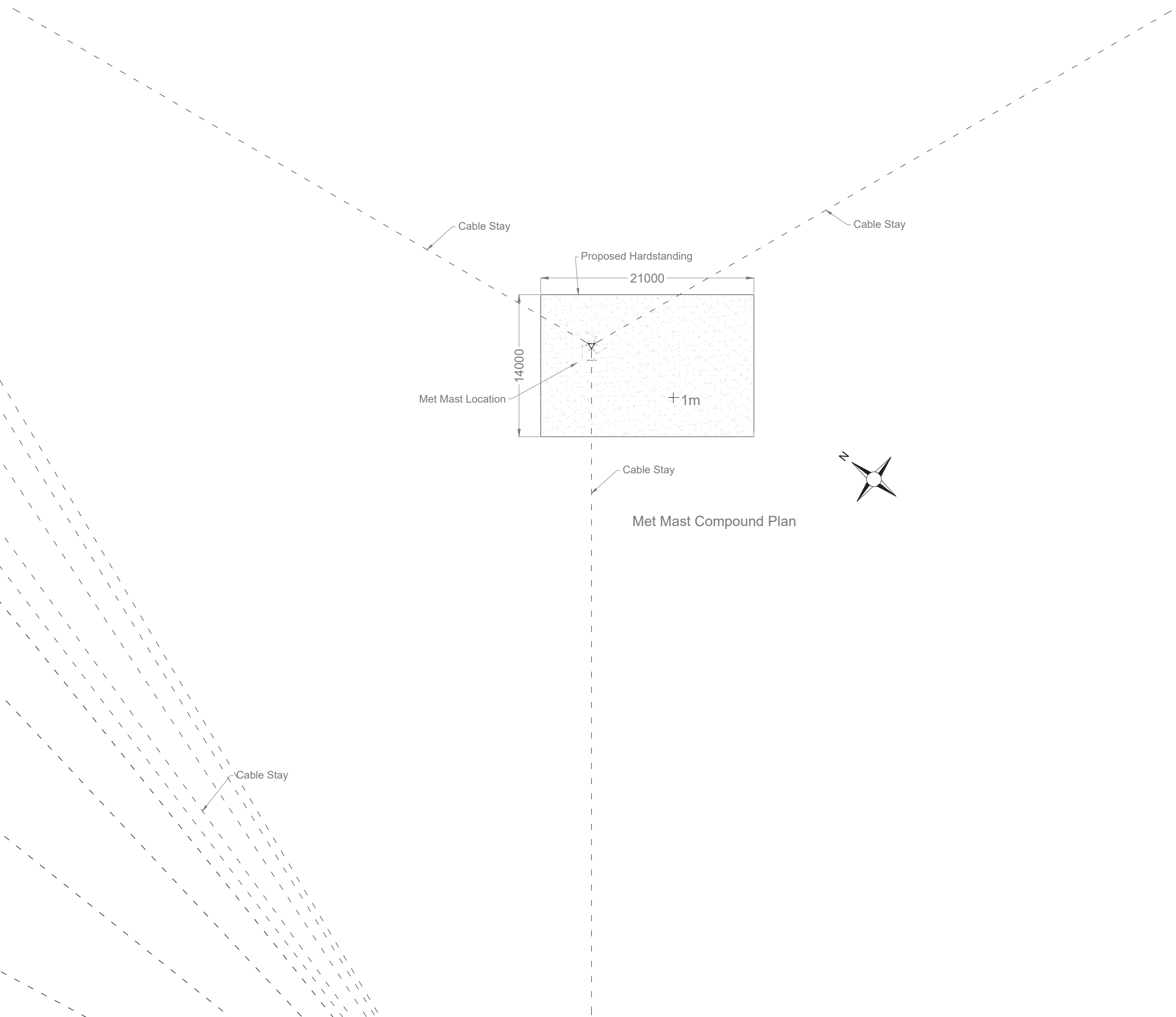
There will be a second temporary construction compound located adjacent to a proposed access road approximately 75m north of Turbine No. 3 in the west of the site. This temporary compound will measure approximately 4,250m^2 in area. This temporary construction compound will include staff facilities and a temporary port-a-loo and is also shown in Figure 4.1. The layout of this construction compound is shown in Figure 4-17. Once the proposed wind farm has been commissioned, this construction compound will be removed. The area will be reinstated with previously excavated peat and spoil and either be reseeded or left to revegetate naturally.

Drawing Notes

1. Met mast on site will either be guyed met mast or free standing met mast depending on site conditions. Both options shown only one will be used.



Met Mast Elevation



Met Mast Compound Plan

Figure 4-14

DRAWING TITLE: **Met Mast - Option 1 - Guyed Mast**

PROJECT TITLE: **Ballynagare Wind Farm, Co. Kerry**

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 34
SCALE: 1:500 @ A3	DATE: 22.11.2021

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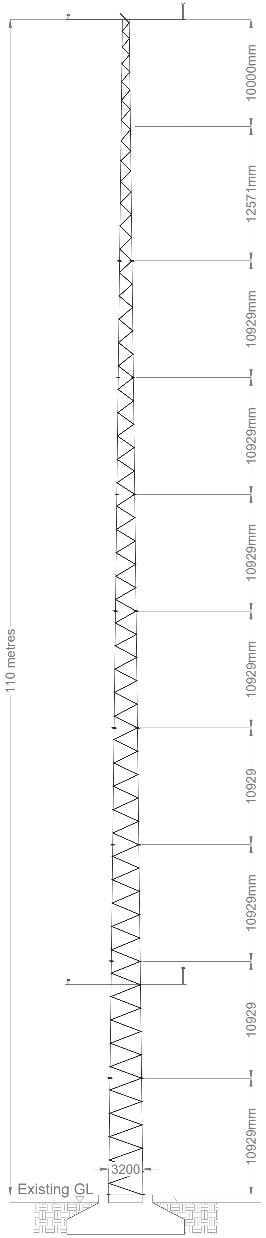
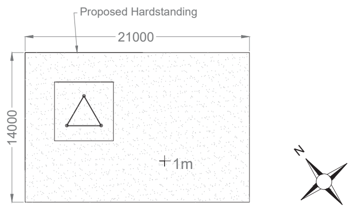
Website: www.mkoireland.ie

Drawing Notes

1. Met mast on site will either be guyed met mast or free standing met mast depending on site conditions. Both options shown only one will be used.





Met Mast Compound Plan

Figure 4-15

DRAWING TITLE: **Met Mast - Option 2 - Free Standing Mast**	
PROJECT TITLE: **Ballynagare Wind Farm, Co. Kerry**	
DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 35**
SCALE: **1:500 @ A3**	DATE: **22.11.2021**

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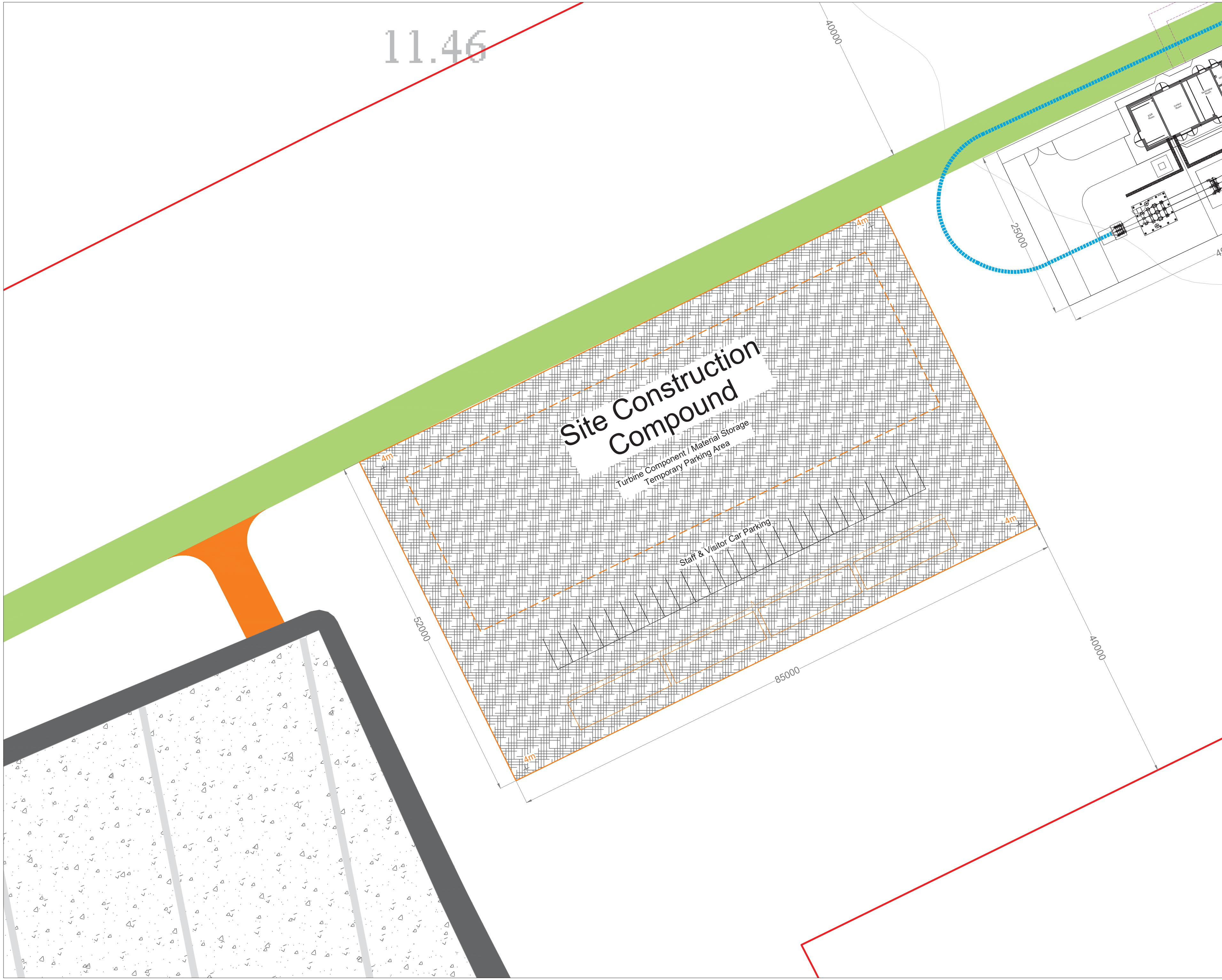

Project Design Drawing Notes

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Existing Road to be Upgraded
- Proposed Road
- Electrical Cable Trench
- Grid Connection Route
- Borrow Pit

N

Figure 4-16

DRAWING TITLE:

Temporary Construction Compound 1

PROJECT TITLE:

Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 28
SCALE: 1:500 @ A3	DATE: 22.11.2021

OS SHEET No.: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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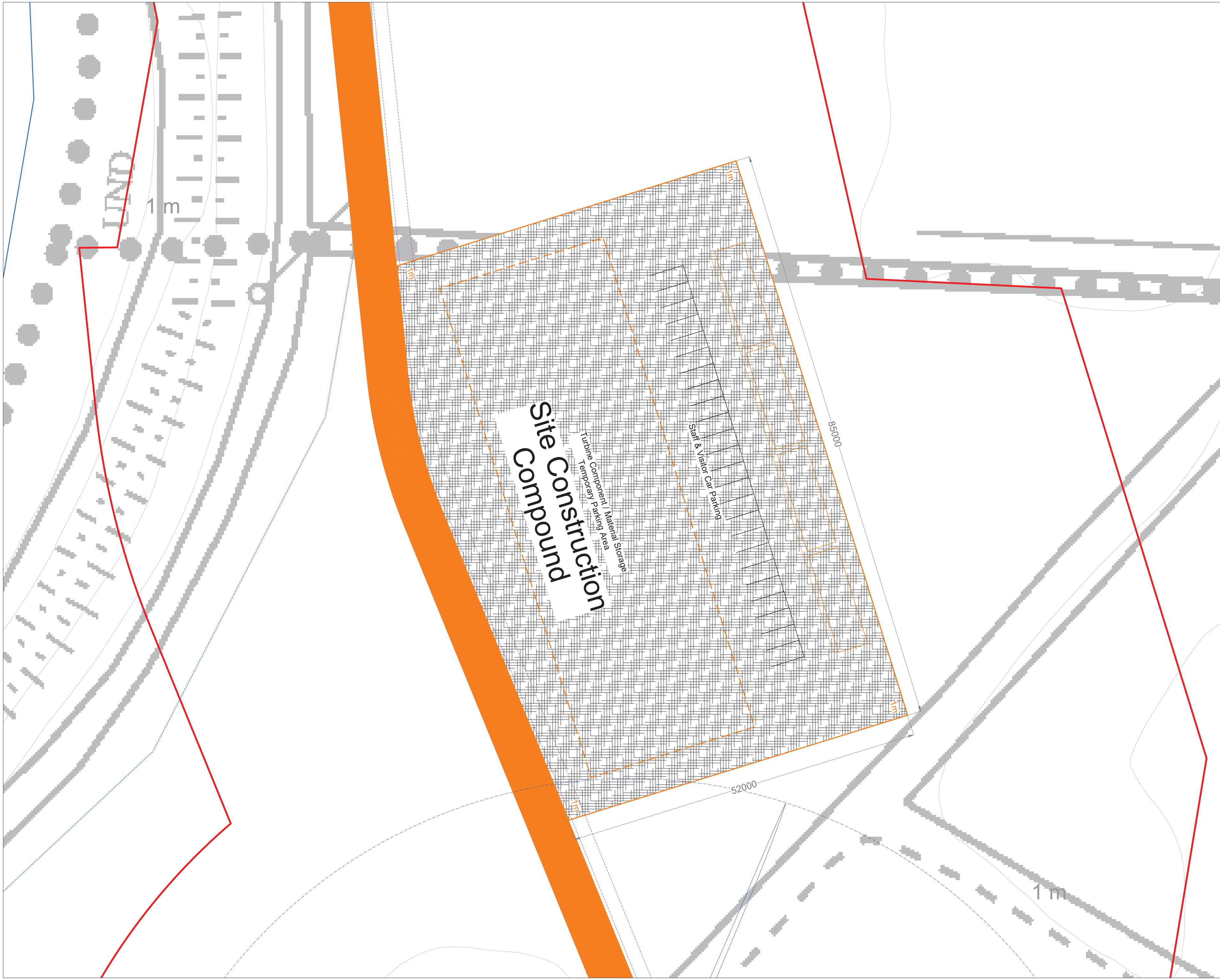

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7. Layout plans show 170m Turbine rotor diameter as per turbine drawing.
8. Final levels may vary depending on local ground conditions.

Drawing Legend

- Planning Application Boundary
- Proposed Road
- Electrical Cable Trench
- River/Stream
- River/Stream 50m Buffer
- Turbine Sweep Area

N

Figure 4-17

DRAWING TITLE:
Temporary Construction Compound 2

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: **Joseph O Brien**	CHECKED BY: **Thomas Blackwell**
PROJECT No.: **200512**	DRAWING No.: **200512 - 29**
SCALE: **1:500 @ A3**	DATE: **22.11.2021**

OS SHEET No.: 5151, 5152, 5153, 5213, 5214, 5215, 5275, 5276, 5277, 5335, 5336, 5337

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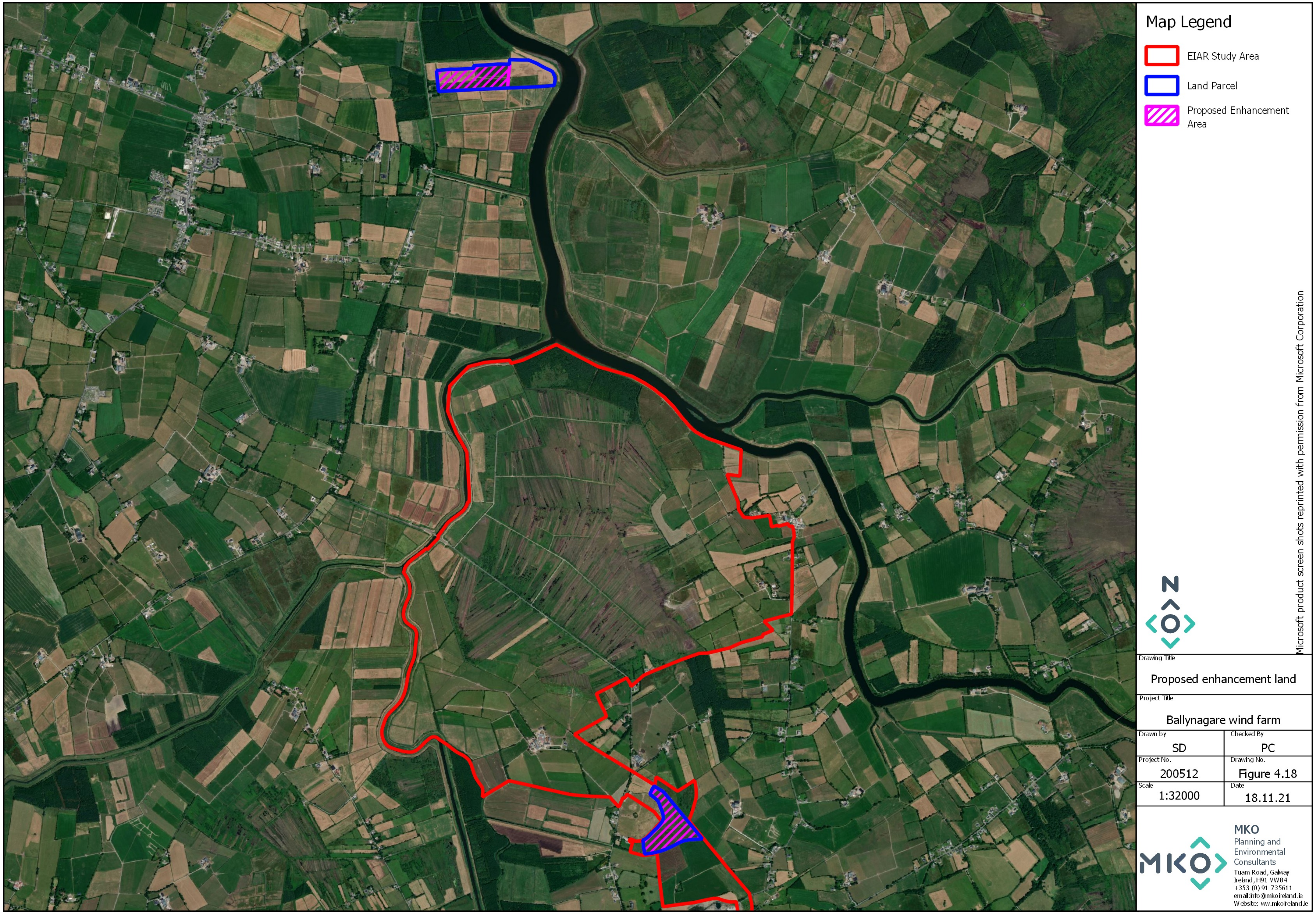
4.3.11 Associated Works

4.3.11.1 Whooper Swan Enhancement Lands

The proposed development is located adjacent to a non-designated but nationally important area for whooper swan in Ballyouneen, Co. Kerry. Nationally important numbers of whooper swan were observed roosting and foraging on improved agricultural farmland in Ballyouneen during two winter seasons of bird survey in October 2019-March 2020 and October 2020-March 2021. In addition, flocks of up to 57 whooper swan (regionally important) considered to be associated with the nationally important population at Ballyouneen were observed foraging in the south-west area of the proposed development.

The potential for effects on whooper swan at the wind farm site is assessed in full in Chapter 7 of this EIAR. The proposed development is not expected to impact the foraging and roosting grounds at Ballyouneen. However, due to the presence of smaller foraging flocks in the south-west of the wind farm site, it is proposed to identify and manage 15.76ha of currently unused and suboptimal habitat in the area to enhance its foraging value for the Ballyouneen whooper swan population. This enhancement land and adjoining lands (totalling 21.02ha) will be managed for foraging whooper swan for the lifetime of the proposed development. A detailed Whooper Swan Enhancement Plan is included as Appendix 7-7 to this EIAR. The location of the proposed whooper swan enhancement lands are shown in Figure 4.18.



Map Legend
EIAR Study Area
Land Parcel
Proposed Enhancement Area
Microsoft product screen shots reprinted with permission from Microsoft Corporation
N
Drawing Title
Proposed enhancement land
Project Title
Ballynagare wind farm
Drawn by
SD
Checked By
PC
Project No.
200512
Drawing No.
Figure 4.18
Scale
1:32000
Date
18.11.21
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4.3.12 Site Activities

4.3.12.1 Environmental Management

All proposed activities on the site of the proposed development will be provided for in an environmental management plan. A Construction and Environmental Management Plan (CEMP) has been prepared for the proposed development, and is included in Appendix 4-2 of this EIAR. The CEMP includes details of drainage, peat and overburden management and waste management. The CEMP will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in this EIAR, and will set out the monitoring and inspections procedures and frequencies. The environmental management plan will also make provision for a suitably qualified individual such as an environmental clerk of works who will oversee the site works, and provide on-site advice on the mitigation measures necessary to ensure the project proceeds as intended in this EIAR.

It is intended that the CEMP would be updated prior to the commencement of the development, to include all mitigation measures, conditions and or alterations to the EIAR and application documents that may emerge during the course of the planning process and would be submitted to the Planning Authority for written approval. The CEMP will also require updating by the selected contractor in order to identify, assess and satisfy the contract performance criteria as set out by the various stakeholders. The CEMP due to its structure and nature will also require constant updating and revision throughout the construction period as set out below. Therefore, this is a working document and will be developed further prior to and during construction.

4.3.12.2 Peat Management

Peat and other overburden material as described and quantified in Section 4.3.4 above, will be excavated from where they are found, and transported either directly to the borrow pit for permanent storage, or to one of the temporary peat repository areas as described in Section 4.3.4 for storage until such time as sufficient capacity has been developed within the borrow pit. Excavators will load the peat and overburden directly into dump trucks, which will be used to transport the material to the repository area. Some side casting of peat and other materials at the edges of areas where they are excavated from may occur at appropriate locations decided by the site geotechnical engineer.

4.3.12.3 Refuelling

Wherever possible, vehicles will be refuelled off-site. This will be the case for regular, road-going vehicles. However, for construction machinery that will be based on-site continuously, a limited amount of fuel will have to be stored on site.

On-site refuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations.

4.3.12.4 Concrete Deliveries

Only ready-mixed concrete will be used during the construction phase, with all concrete being delivered from local batching plants in sealed concrete delivery trucks. The use of ready-mixed concrete deliveries will eliminate any potential environmental risks of on-site batching. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be washed out fully at the batching plant, where facilities are already in place.

The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a temporary lined impermeable containment area, or a Siltbuster-type concrete wash unit (http://www.siltbuster.com/sheets/RCW.pdf) or equivalent. This type of Siltbuster unit catches the solid concrete and filters and holds wash liquid for pH adjustment and further solids separation. The residual liquids and solids can be disposed of off-site at an appropriate waste facility. Where temporary lined impermeable containment areas are used, such containment areas are typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plates 4.7 and 4.8 below.

Plate 4.6 Concrete washout area

Plate 4.7 Concrete washout area

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

Due to the volume of concrete required for each turbine foundations, and the requirement for the concrete pours to be continuous, deliveries are often carried out outside normal working hours in order to limit the traffic impact on other road users, particularly peak period school and work commuter traffic. Such activities are limited to the day of turbine foundation concrete pours, which are complete in a single day per turbine.

The risks of pollution arising from concrete deliveries will be further reduced by the following:

- Concrete trucks will not be washed out on the site, but will be directed back to their batching plant for washout.
- Site roads will be constructed to a high standard to allow transport of the turbine components around the site, and hence, concrete delivery trucks will be able to access all areas where the concrete will be needed. No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport. All concrete used in the construction of turbine bases will be pumped directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be pumped from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.
- The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.
- Clearly visible signage will be placed in prominent locations close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site.

4.3.12.5 Concrete Pouring

Because of the scale of the main concrete pours that will be required to construct the proposed wind farm, the main pours will be planned days or weeks in advance. Special procedures will be adopted in advance of and during all concrete pours to minimise the risk of pollution. These may include:

- Using weather forecasting to assist in planning large concrete pours, and avoiding large pours where prolonged periods of heavy rain is forecast.
- Restricting concrete pumps and machine buckets from slewing over watercourses while placing concrete.
- Ensuring that excavations are sufficiently dewatered before concreting begins and that dewatering continues while concrete sets.
- Ensuring that covers are available for freshly placed concrete to avoid the surface washing away in heavy rain.
- Disposing of surplus concrete after completion of a pour in agreed suitable locations away from any watercourse or sensitive habitats.

4.3.12.6 Dust Suppression

In periods of extended dry weather, dust suppression may be necessary along haul roads and around the borrow pit area to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system, and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.

4.3.12.7 Vehicle Washing

Wheels or vehicle underbodies are often washed before leaving sites to prevent the build-up of mud on public (and site) roads. It is not anticipated that vehicle or wheel washing will be required as part of the construction phase of the proposed development because site roads will be already formed using on-site materials before other road-going trucks begin to make regular or frequent deliveries to the site (e.g. with steel or concrete). The site roads will be well finished with compacted hardcore, and so the public road-going vehicles will not be travelling over soft or muddy ground where they might pick up mud or dirt.

A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development.

4.3.12.8 Waste Management

The CEMP, Appendix 4-2 of this EIAR, includes a waste management plan (WMP) which outlines the best practice procedures during the demolition, excavation and construction phases of the project. The WMP outlines the methods of waste prevention and minimisation by recycling, recovery and reuse at each stage of construction of the proposed development. Disposal of waste will be seen as a last resort.

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

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

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

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

4.4 Access & Transportation

4.4.1 Site Entrances

There are seven proposed site entrances into the site from the local roads in the area. The site will be accessed from the R557 via the local road (L6055) travelling north from the R557 in the townland of Monument to the east of Lixnaw. Initially the site is accessed via a new site entrance by turning northwest off this local road. It is from this new entrance that the borrow pit, construction compound, and substation are accessed. The proposed layout of this site entrance is shown on Figures 4.19.

The main site entrance link road continues northwest and crosses the existing Clogher Road from Lixnaw to Ballyduff to the north of the village of Lixnaw. The second and third site proposed site entrances are on either side of this local. These site entrances facilitate the crossing of the local road and will provide access to Turbines 5, 6, and 7. The proposed layout of these site entrances is shown on Figures 4.20. Once the construction phase is complete it is intended that the third site entrance will become the main entrance for the wind farm.

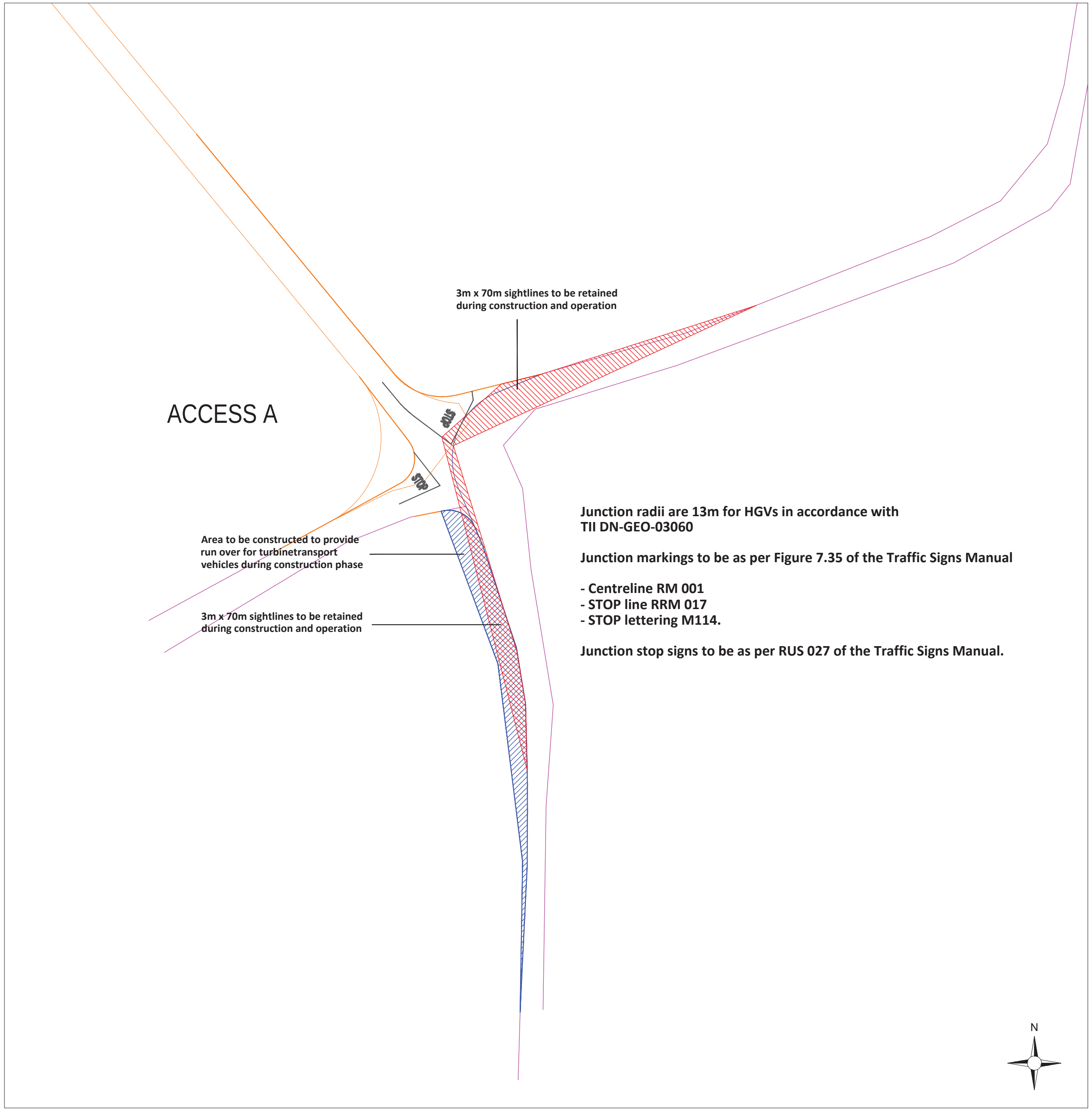
The fourth and fifth proposed site entrances are located on either side of the existing Lixnaw to Ballyduff road that bisects the centre of the site. These site entrances provide access to Turbine 4 and all associated works areas. The proposed layout of these site entrances is shown on Figures 4.21.

The sixth and seventh proposed site entrances are in the western portion of the site and are also located on either side of the either side of the existing Lixnaw to Ballyduff road that bisects the centre of the site. These site entrances will provide access to Turbines 1, 2, and 3 and all associated works areas. The proposed layout of these site entrances is shown on Figures 4.22

The location of these entrances is shown on the site layout drawing in Figure 4.1. The proposed layout of the site entrances is shown on Figures 4.19 to 4.22.

Drawing Legend

- Existing Road Edge
- Proposed New Road
- Transport Runover Area
- Sight Line

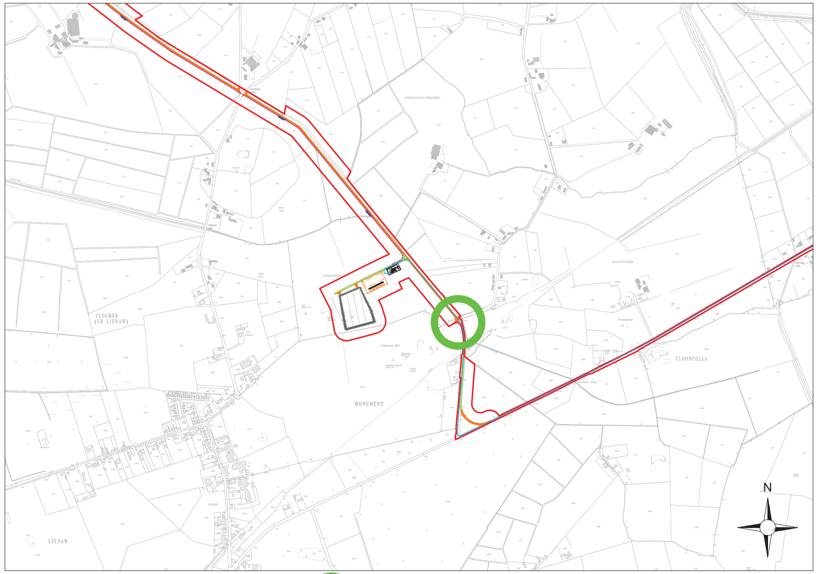


Junction radii are 13m for HGVs in accordance with TII DN-GEO-03060

Junction markings to be as per Figure 7.35 of the Traffic Signs Manual

- Centreline RM 001
- STOP line RRM 017
- STOP lettering M114.

Junction stop signs to be as per RUS 027 of the Traffic Signs Manual.



1:10,000 Location on Context Map

Figure 4.19

DRAWING TITLE:
Proposed Access Junction A

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No: 200512	DRAWING No: 200512 - 39
SCALE: 1:500 @ A1	DATE: 08.10.2021

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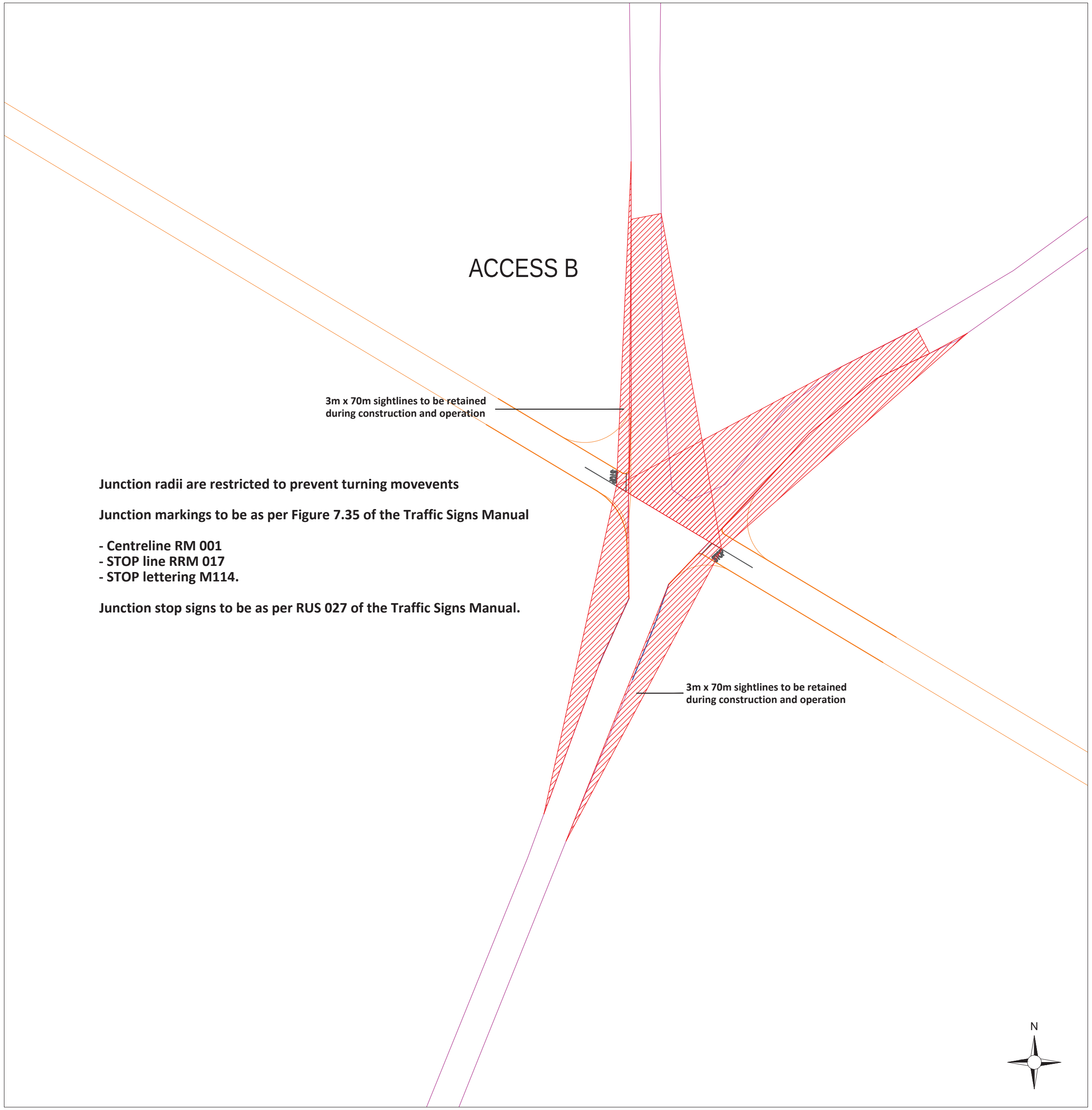
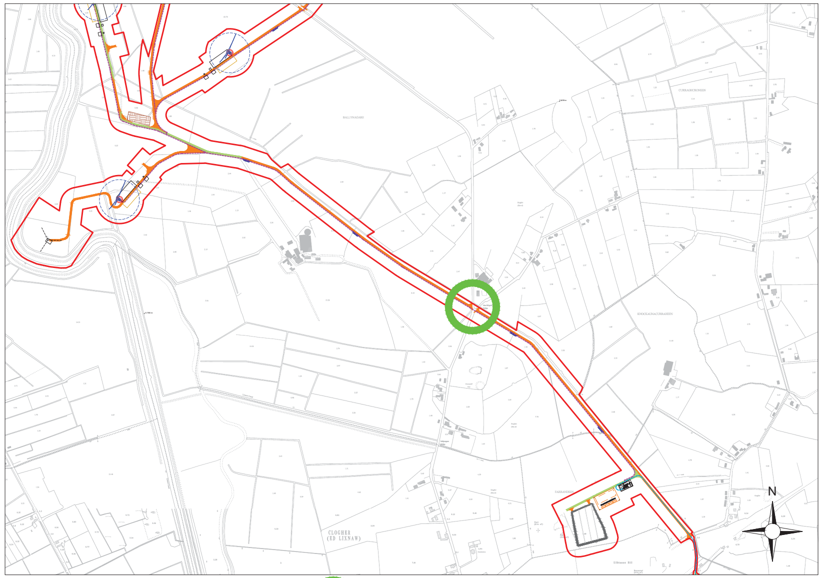
Drawing Legend

- Existing Road Edge
- Proposed New Road
- Sight Line





1:10,000 Location on Context Map

Figure 4.20

DRAWING TITLE:
Proposed Access Junction B

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 40
SCALE: 1:500 @ A1	DATE: 08.10.2021

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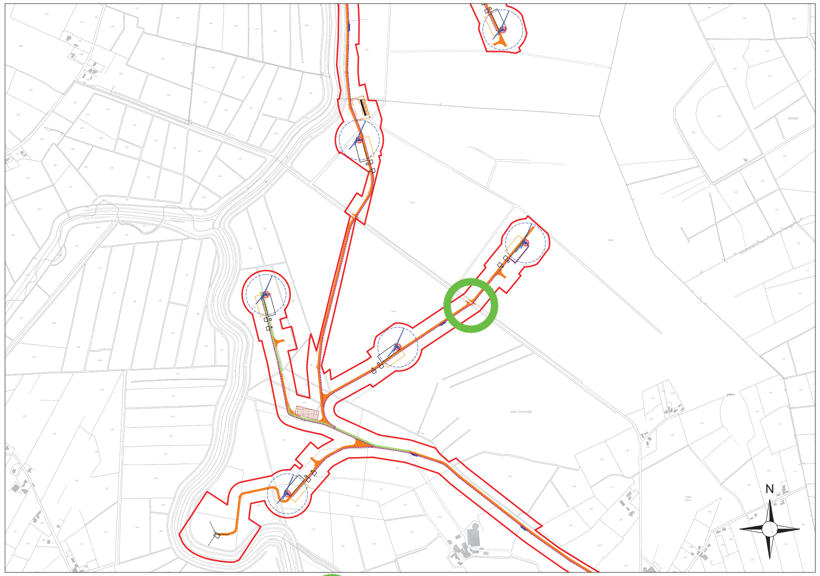
Drawing Legend

(pink line)	Existing Road Edge
(orange line)	Proposed New Road
(red hatching)	Sight Line



1:10,000 Location on Context Map

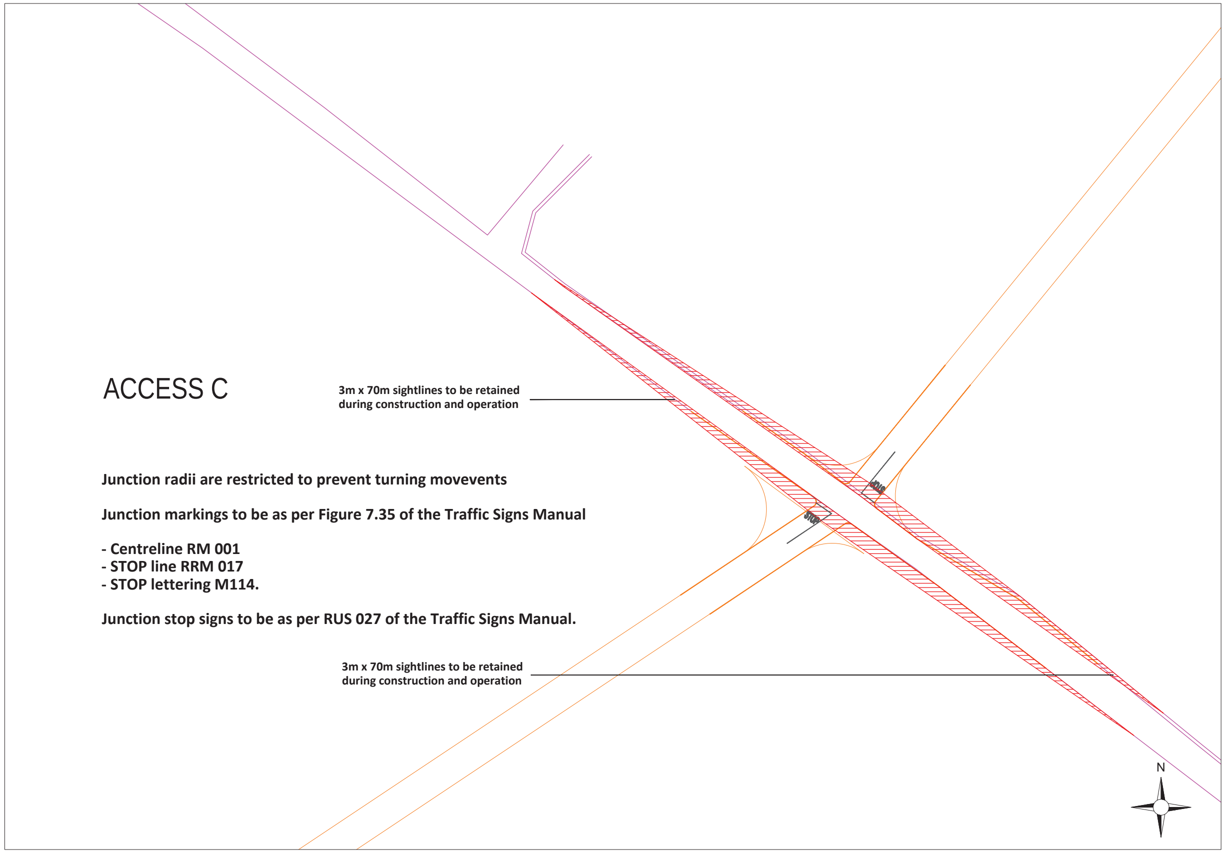


Figure 4.21

DRAWING TITLE:
Proposed Access Junction C

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 41
SCALE: 1:500 @ A1	DATE: 08.10.2021

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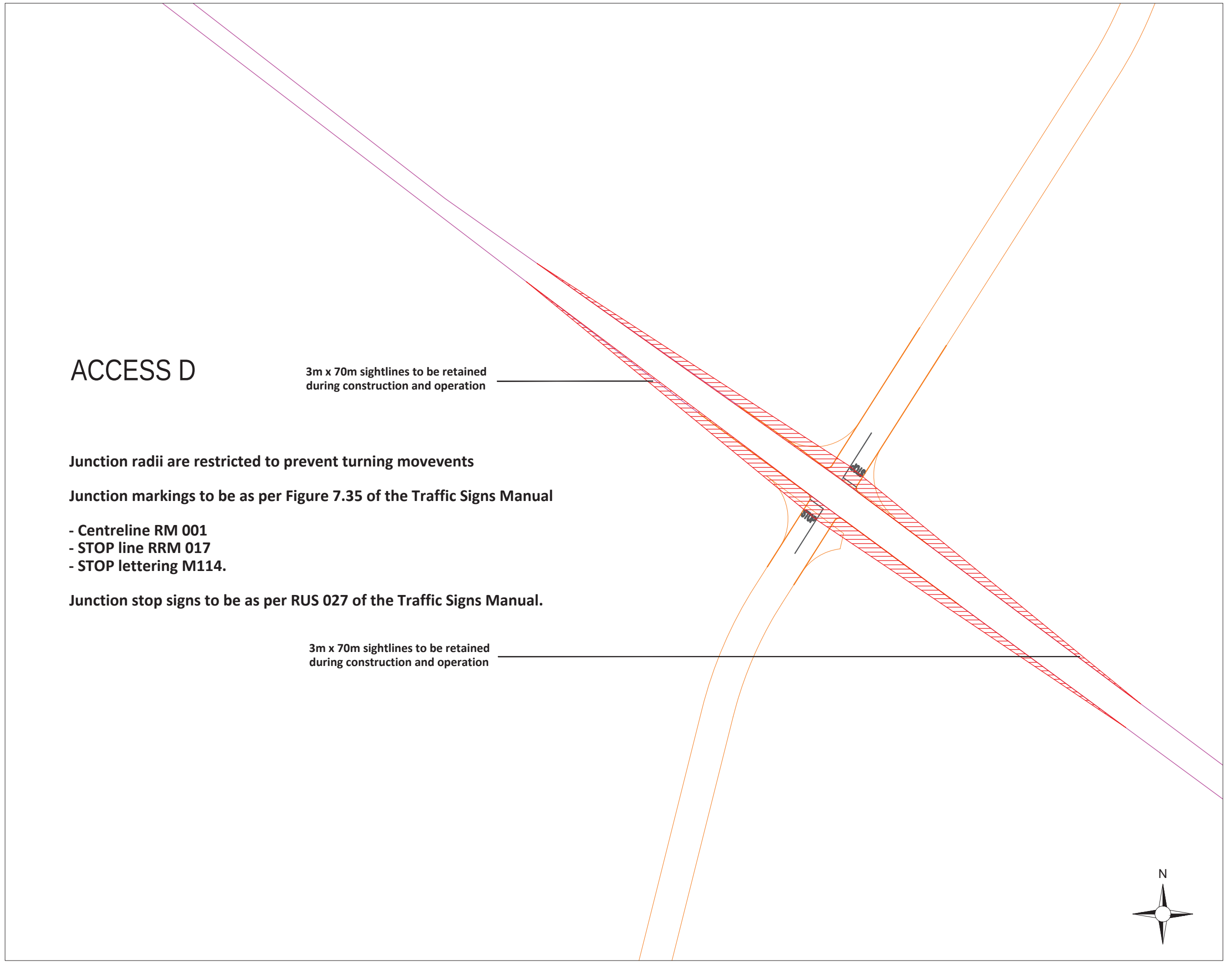
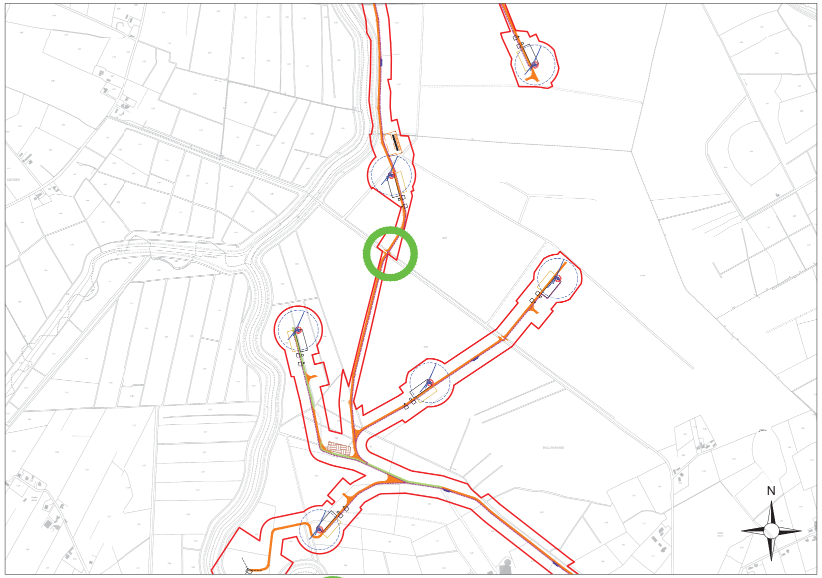
Drawing Legend

- Existing Road Edge
- Proposed New Road
- Sight Line





1:10,000 Location on Context Map

Figure 4.22

DRAWING TITLE:
Proposed Access Junction D

PROJECT TITLE:
Ballynagare Wind Farm, Co. Kerry

DRAWING BY: Joseph O Brien	CHECKED BY: Thomas Blackwell
PROJECT No.: 200512	DRAWING No.: 200512 - 42
SCALE: 1:500 @ A1	DATE: 08.10.2021

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4.4.2 Turbine and Construction Materials Transport Route

The proposed turbine transport route from the N69 National Secondary Road to the proposed development site is shown on Figure 4.23. From Foynes port, the turbines will be transported south on the N21 National Primary Road towards Newcastle West. The turbines will then travel west on the N21 towards Tralee and turn right at the roundabout before Tralee and on to the N69 traveling north east. The turbines will continue north east on the N69 and then turn left on to the local road at Mountcoal cross before travelling northwest to the R557. The turbines will then turn left onto the R557 and continue northwest towards the proposed development site.

Construction materials such as concrete and steel will follow the same transport route as the wind turbines from both north and south of the N69 to the proposed development site.

All deliveries of turbine components and other construction materials to the site will only be by way of the proposed transport route outlined in Figure 4.23. No other public road route will be used as part of the construction phase of the proposed development for the transport of materials. The number of construction vehicles that will be generated during the construction phase of the proposed development are outlined as part of the traffic and transport assessment in Chapter 14 of this EIAR.

4.4.3 Required Works along Transport Route

Works such as road widening are sometimes required along proposed turbine transport routes to accommodate the large vehicles used to transport turbine components to wind farm sites. The proposed transport route for the proposed development has been the subject of a route assessment to determine if any widening works are required along its length. Required works along the transport route are minor and are all located within the existing road corridor. Full details of the assessment are included as part of the traffic impact assessment set out in Chapter 14, Section 14.1 of this EIAR.

4.4.3.1 Construction of Temporary Junction Accommodation Works

The construction methodology of the temporary junction accommodation works along the turbine delivery route will be as outlined below:

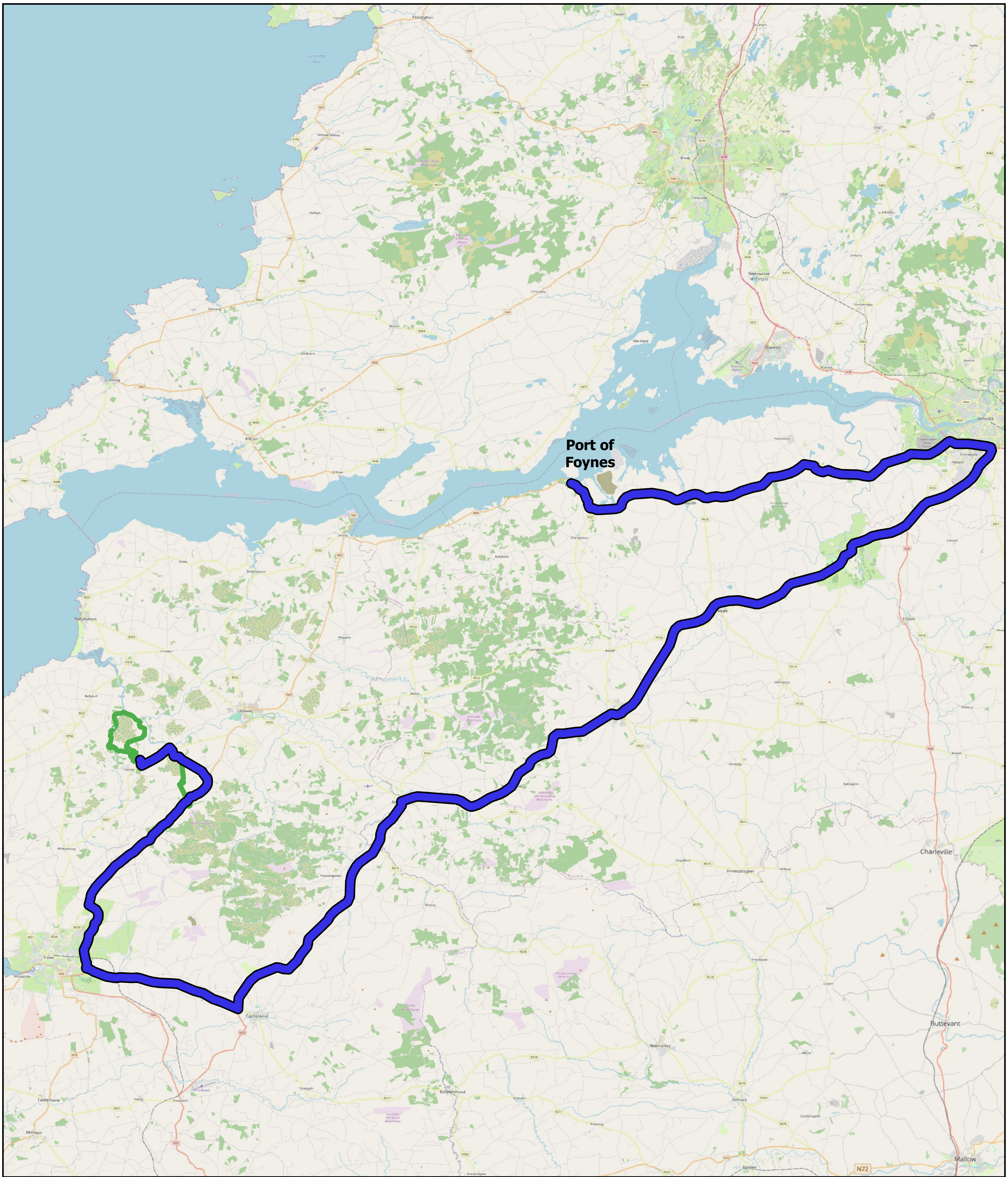
- Overburden within the required areas for the junction accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- Any excess excavated overburden will be removed from the works area to the on-site peat management areas or a licenced tip or, if suitable, stockpiled and reused for backfilling where appropriate.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation.
- The competent stratum will be overlain with granular fill sourced from local quarries.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The temporary junction accommodation works along the turbine delivery route will only be used by the turbine delivery/abnormal load vehicles and other vehicles associated with the delivery process.
- The temporary junction accommodation works location along the turbine delivery route, when not in use, will be cordoned off from the public road, using bollards, where the temporary removal of kerbing, barriers and fencing has occurred.
- Upon completion of the turbine delivery phase of the proposed wind farm the temporary junction accommodation works location along the turbine delivery route will revert back to its existing condition prior to the commencement of the temporary junction accommodation works (i.e. kerbing, barriers and fencing will be replaced.)

Leaving the granular fill and final surface running layer in place within the accommodation areas will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase). Should this be required the boundary treatments will again be temporarily removed and managed as set out above.

4.4.4 Traffic Management

A turbine with a blade length of 73.65 metres has been used in assessing the traffic impact of the proposed development. The blade transporter for such a turbine blade would have a total length of approximately 79 metres, including the blade which overhangs the back of the vehicle. The total length of the tower transporter is 46.6 metres with the axles located at the front and rear of the load with no overhang. The vehicles used to transport the nacelles will be similar to the tower transporter. All other vehicles requiring access to the site will be smaller than the design test vehicles. The turbine delivery vehicles have been modelled accurately in the Autotrack assessments for the site, as detailed in Chapter 14 of this EIAR.

The need to transport a wind turbine blade on the public roads is not an everyday occurrence in the vicinity of the site of the proposed development. However, the procedures for transporting abnormal size loads on the country's roads are well established. While every operation to transport abnormal loads is different and requires careful consideration and planning, escort vehicles, traffic management plans, drive tests, road marshals and convoy escorts from the Garda Traffic Corps are all measures that are regularly employed to gets unusual loads from origin to destination. With over 1,800MW of wind farms already built and operating in Ireland, transport challenges are something the wind energy industry and specialist transport sector has become particularly adept in finding solutions to.



Map Legend

EIAR Study Area

Proposed Turbine Delivery R

Microsoft product screen shots reprinted with permission from Microsoft Corporation

Drawing Title	
Turbine Delivery Route	
Project Title	
Ballynagare Wind Farm	
Drawn By TB	Checked By MW
Project No. 200512	Drawing No. Figure 4.23
Scale 1:400000	Date 13.10.2021

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A preliminary traffic management plan has been prepared as part of the traffic impact assessment set out in Section 14.1 of this EIAR. Prior to the construction of the proposed development, a detailed traffic management plan will be prepared by the haulage company and submitted to Kerry County Council for approval. The plan will include:

- A delivery schedule.
- Details of temporary works or any other minor alteration identified.
- A dry run of the route using vehicles with similar dimensions.

The deliveries of turbine components to the site will be made in convoys of three to four vehicles at a time, and mostly at night when roads are quietest. Convoys will be accompanied by escorts at the front and rear operating a "stop and go" system. Although the turbine delivery vehicles are large, they will not prevent other road users or emergency vehicles passing, should the need arise. The delivery escort vehicles will ensure the turbine transport is carried out in a safe and efficient manner with minimal delay or inconvenience for other road users.

It is not anticipated that any section of the local road network will be closed during transport of turbines, although there will be some delays to local traffic at pinch points. During these periods it may be necessary to operate local diversions for through traffic. All deliveries comprising abnormally large loads will be made outside the normal peak traffic periods to avoid disruption to work and school-related traffic.

Prior to the Traffic Management Plan being finalised, a full dry run of the transport operation along the proposed route will be completed using vehicles with attachments to simulate the dimensions of the wind turbine transportation vehicles. This dry run will inform the final traffic management plan. All turbine deliveries will be provided for in a transport management plan which will have to be prepared in advance of the construction stage, when the exact transport arrangements are known, delivery dates confirmed and escort proposals in place. Such a transport management plan is typically submitted to the Planning Authority for agreement in advance of any abnormal loads using the local roads, and will provide for all necessary safety measures, including a convoy and Garda escort as required, off-peak turning/reversing movements and any necessary safety controls.

4.5 Community Gain Proposal

Ballynagare Wind Farm has the potential to bring significant positive benefit to the local community. The project will create sustainable local employment, it will contribute annual rates to the local authority, and it will provide opportunity for local community investment in the project in line with the new Renewable Energy Support Scheme. As with all wind farm projects which EMPower develop, a community benefit fund will be put in place for the duration of the RESS (15 years) to provide direct funding to those areas surrounding the project.

4.5.1 Renewable Energy Support Scheme

The Renewable Energy Support Scheme (RESS) Terms and Conditions, published by the Department of Communications, Climate Action and Environment on in February 2020, make some high-level provisions for how this type of benefit fund will work. Any project which wants to export electricity to the national grid must abide by these broad principles. These include the following:

1. *a minimum of €1,000 shall be paid to each household located within a distance of a 1 kilometre radius from the Project;*
2. *a minimum of 40% of the funds shall be paid to not-for-profit community enterprises whose primary focus or aim is the promotion of initiatives towards the delivery of the*

UN Sustainable Development Goals, in particular Goals 4, 7, 11 and 13, including education, energy efficiency, sustainable energy and climate action initiatives;

3. *a maximum of 10% of the funds may be spent on administration. This is to ensure successful outcomes and good governance of the Community Benefit Fund.*
4. *the balance of the funds shall be spent on initiatives successful in the annual application process, as proposed by clubs and societies and similar not-for-profit entities, and in respect of Onshore Wind RESS 1 Projects, on "near neighbour payments" for households located outside a distance of 1 kilometre from the Project but within a distance of 2 kilometres from such Project.*

4.5.2 Community Benefit Fund

Ballynagare 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). Assuming an average capacity factor of 35%, and a capacity of 42 MW, the community benefit fund would amount to an average of €257,544 per annum. The actual fund will vary around the average from year to year, depending on wind conditions.

Onsite wind measurements suggest that Ballynagare will be capable of achieving an above average capacity factor, and therefore a larger community fund. If this project is constructed as currently designed, we estimate that a total of approximately €3.1 million will be available in the local area for community funding over the first 15 years of the project. The above figure is indicative only and will be dependent on the generation capacity of the wind farm which is influenced by a number of factors including:

1. *Number of wind turbines.*
2. *Capacity and availability of energy production of those turbines.*
3. *Quantity of wind.*

4.5.2.1 Administration of the Benefit Fund

The Community Benefit Fund belongs to the local community. The premise of the fund is that it should be used to bring about significant, positive change in the local area. To make this happen, our first task will be to form a benefit fund development working group that clearly represents both the close neighbours to the project as well as nearby communities. This group will then work on designing the governance and structure of a community entity that would administer the Community Benefit Fund. Ballynagare Wind Farm Ltd. aim to commence this work in summer 2022.

4.6 Site Drainage

4.6.1 Introduction

The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development. The proposed development's drainage design has therefore been proposed specifically with the intention of having no negative impact on the water quality of the site and nearby or adjacent rivers and watercourses, and consequently no impact on downstream catchments and ecological ecosystems. No routes of any natural drainage features will be altered as part of the proposed development and only three new watercourse crossings are proposed as part of the proposed development. Turbine locations and associated roadways were originally selected to avoid natural watercourses, and existing roads are to be used wherever possible. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. All discharges from the proposed works areas will be made over vegetation filters at a minimum of 50 metres distance from natural watercourses. Buffer zones around the existing natural drainage features have informed, wherever possible, the layout of the proposed development. Where there is infrastructure proposed within 50 metres of a natural watercourse, stringent drainage measures will be put in place to ensure the protection of the water quality of the natural watercourse.

4.6.2 Existing Drainage Features

The routes of any natural drainage features will not be altered as part of the proposed development. Turbine locations have been selected to avoid natural watercourses. The proposed development has also been designed to only require three new watercourse crossings. Some new or extended culverts may be required under existing roadways to manage drainage waters, and these will be sufficiently sized to accommodate peak flows from storm events.

There will be no direct discharges to natural watercourses. All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at a minimum of 50 metres distance from natural watercourses, or directly into artificial drainage ditches but only after silt traps, check dams and/or stilling ponds have been added to these drainage ditches. Buffer zones around the existing natural drainage features have informed the layout of the proposed development, and are indicated on the drainage design drawings.

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

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

4.6.3 Drainage Design Principles

The key principles of drainage design that will be implemented and adhered to as part of the Proposed Development are as follows:

- Keep clean water clean by intercepting it where possible, upgradient of works areas, and divert it around the works areas for discharge as diffuse overland flow or for rewetting of land.
- Collect potentially silt-laden runoff from works areas via downgradient collector drains and manage via series of avoidance, source, in-line, treatment and outfall controls prior to controlled diffuse release as overland flow or for rewetting of land.
- No direct hydraulic connectivity from construction areas to watercourses, or drains connecting to watercourses.
- Where possible, maintain 50-metre watercourse buffer zones for the wind turbines.
- No alteration of natural watercourses.
- Maintain the existing hydrology of the site.
- Blocking of existing manmade forestry drainage as appropriate.
- Daily inspection and recording of surface water management system by on-site clerk of works and immediate remedial measures to be carried out as required and works temporarily ceased if a retained stormwater/sediment load is identified to have the potential to migrate from the site.
- Use of siltbuster if required.

Drainage water from any works areas of the site of the proposed development will not be directed to any natural watercourses within the site. Two distinct methods will be employed to manage drainage water within the site. The first method involves keeping clean water clean by avoiding disturbance to natural drainage features, minimising any works in or around artificial drainage features, and diverting clean surface water flow around excavations and construction areas. The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, to allow attenuation and settlement prior to controlled diffuse release.

The drainage design is intended to maximise erosion control, which is more effective than having to control sediment during high rainfall. Such a system also requires less maintenance. The area of exposed ground will be minimised. The drainage measures will prevent runoff from entering the works areas of the site from adjacent ground, to minimise the volume of sediment-laden water that has to be managed. Discoloured run-off from any construction area will be isolated from natural clean run-off.

A schematic line drawing of the proposed drainage design is presented in Figure 4.24 below.

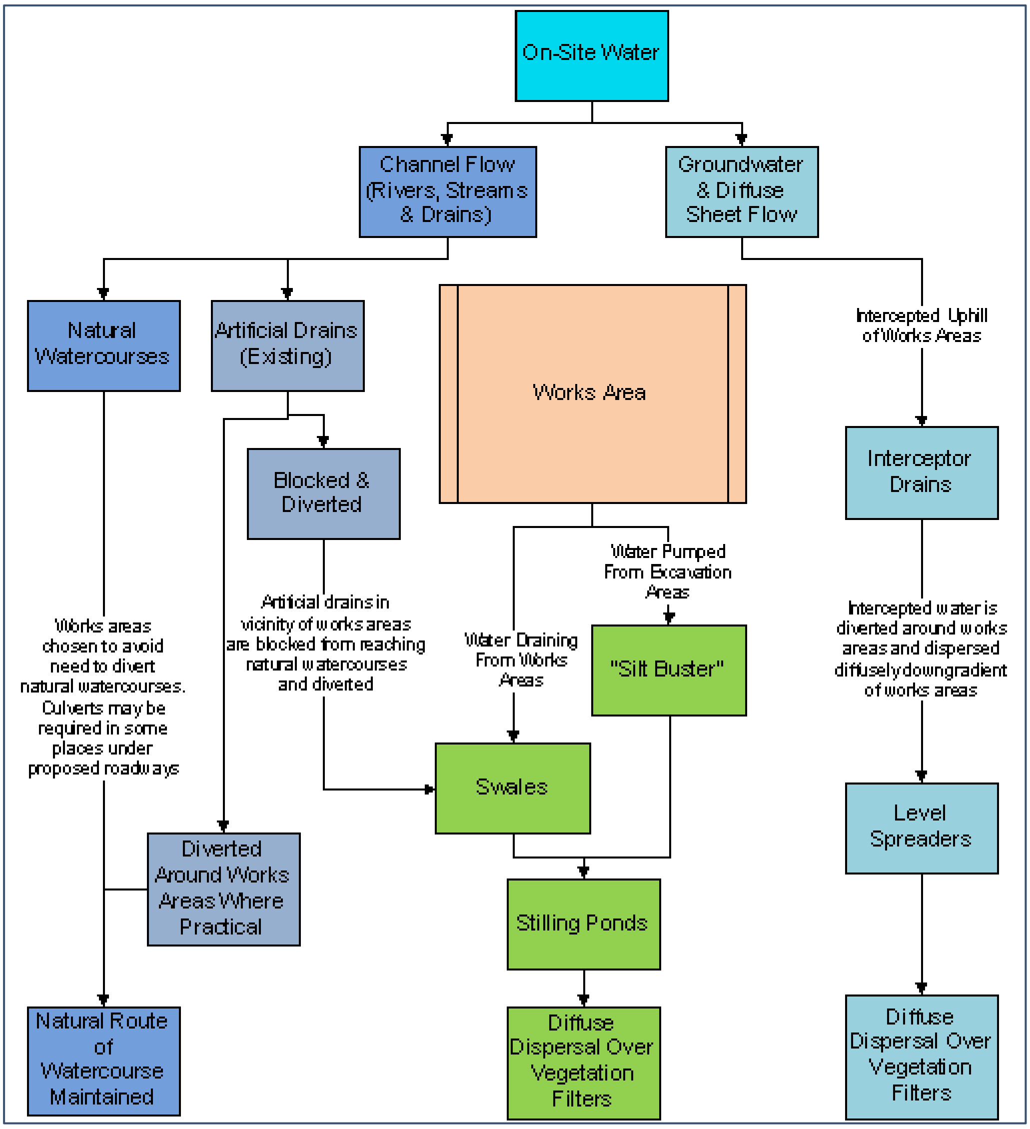


Figure 4.24 Proposed Development Drainage Process Flow

4.6.4 Drainage Design

A drainage design for the proposed development, incorporating all principles and measures outlined in this drainage design description, has been prepared, and is included in Appendix 4-4 to this EIAR. The drainage design employs the various measures further described below and is cognisant of the following guidance documents:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind Farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) 2006: Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006); and,
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2006.

4.6.4.1 Interceptor Drains

Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site where it might otherwise have come into contact with exposed surfaces and picked up silt and sediment. The drains will be used to divert upslope runoff around the works area to a location where it can be redistributed over the ground surface as sheet flow. This will minimise the volume of potentially silty runoff to be managed within the construction area.

The interceptor drains will be installed in advance of any main construction works commencing. The material excavated to make the drain will be compacted on the downslope edge of the drain to form a diversion dike. On completion of the construction phase works, it is envisaged that the majority of the interceptor drains could be removed. At that stage, there will be no open excavations or large areas of exposed ground that are likely to give rise to large volumes of potentially silt-laden run off. Any areas in which works were carried out to construct roads, turbine bases or hardstands, will have been built up with large grade hardcore, which even when compacted in place, will retain sufficient void space to allow water infiltrate the subsurface of these constructed areas. It is not anticipated that roadways or other installed site infrastructure will intercept ground-conveyed surface water runoff to any significant extent that would result in scouring or over-topping or spill over. Where the drains are to be removed, they will be backfilled with the material from the diversion dike. Interceptor drains may have to be retained in certain locations, for example where roadways are to be installed on slopes, to prevent the roadways acting of conduits for water that might infiltrate the roadway sub-base. In these cases, interceptor drains would be maintained in localised areas along the roadway with culverts under the roadway, which would allow the intercepted water to be discharged to vegetation filters downgradient of the roadway. Similarly, in localised hollows where water is likely to be funnelled at greater concentrations than on broader slopes, interceptor drains and culverts may be left in situ following construction. Figure 4.25 shows an illustrative drawing of an interceptor drain.

The velocity of flow in the interceptor will be controlled by check dams (see Section 4.6.5.3 below), which will be installed at regular intervals along the drains to ensure flow in the channel is non-erosive. On steeper sections where erosion risks are greater, a geotextile membrane will be added to the channel.

Interceptor drains will be installed horizontally across slopes to run in parallel with the natural contour line of the slope. Intercepted water will travel along the interceptor drains to areas downgradient of works areas, where the drain will terminate at a level spreader (see Section 4.6.5.4 below). Across the entire length of the interceptor drains, the design elevation of the water surface along the route of the drains will not be lower than the design elevation of the water surface in the outlet at the level spreader.

4.6.4.2 Swales

Drainage swales are shallow drains that will be used to intercept and collect run off from construction areas of the site during the construction phase. Drainage swales will remain in place to collect runoff from roads and hardstanding areas of the proposed development during the operational phase. A swale is an excavated drainage channel located along the downgradient perimeter of construction areas, used to collect and carry any sediment-laden runoff to a sediment-trapping facility and stabilised outlet. Swales are proven to be most effective when a dike is installed on the downhill side. They are similar in design to interceptor drains and collector drains described above. Figure 4.25 shows an illustrative example of a drainage swale.

Drainage swales will be installed downgradient of any works areas to collect surface flow runoff where it might have come into contact with exposed surfaces and picked up silt and sediment. Swales will intercept the potentially silt-laden water from the excavations and construction areas of the site and prevent it reaching natural watercourses.

Drainage swales will be installed in advance of any main construction works commencing. The material excavated to make the swale will be compacted on the downslope edge of the drain to form a diversion dike.

4.6.4.3 Check Dams

The velocity of flow in the interceptor drains and drainage swales, particularly on sloped sections of the channel, will be controlled by check dams, which will be installed at regular intervals along the drains to ensure flow in the swale is non-erosive. Check dams will also be installed in some existing artificial drainage channels that will receive waters from works areas of the site.

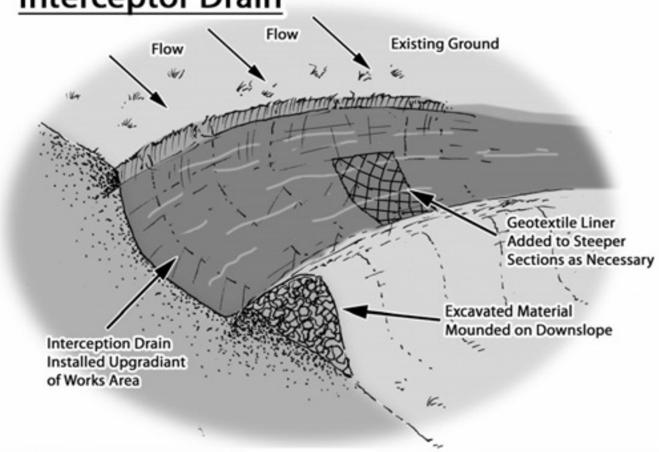
Check dams will restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. Check dams may also be installed in some of the existing artificial drainage channels on the site, downstream of where drainage swales connect in.

The proposed check dams will be made up of straw bales or stone, or a combination of both depending on the size of the drainage swale it is being installed in. Where straw bales are to be used, they will be secured to the bottom of the drainage swale with stakes. Clean 4-6 inch stone will be built up on either side and over the straw bale to a maximum height of 600mm over the bottom of the interceptor drain. In smaller channels, a stone check dam will be installed and pressed down into place in the bottom of the drainage swale with the bucket of an excavator.

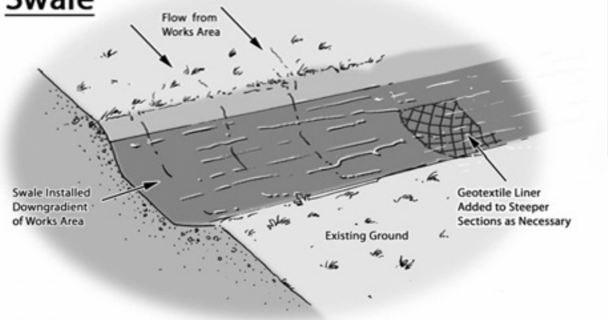
The check dams will be installed at regular intervals along the interceptor drains to ensure the bottom elevation of the upper check dam is at the same level as the top elevation of the next down-gradient check dam in the drain. The centre of the check dam will be approximately 150mm lower than the edges to allow excess water to overtop the dam in flood conditions rather than cause upstream flooding or scouring around the dams.

Drainage Design Measures

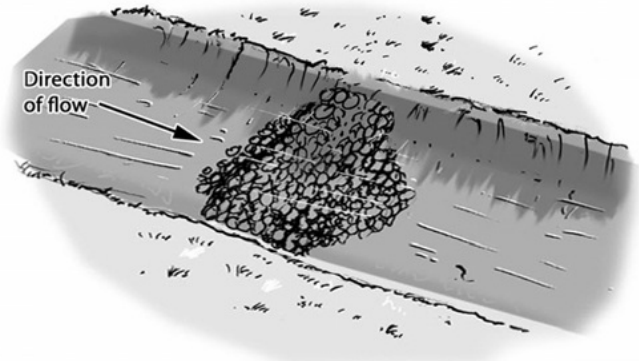
Interceptor Drain



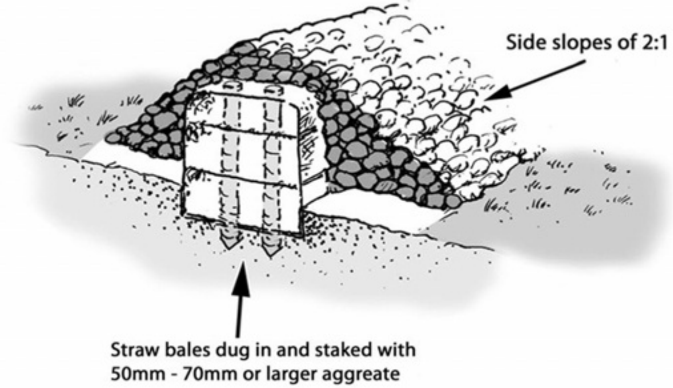
Swale



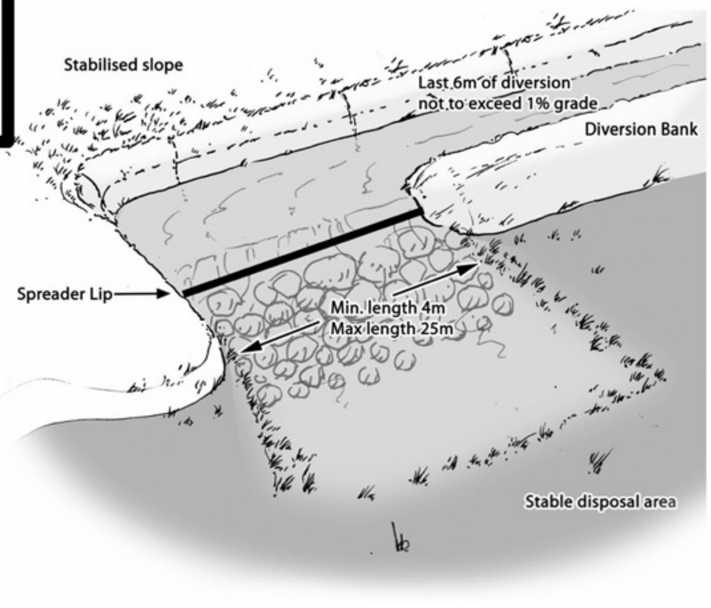
Check Dam (Stone Dam in Drain)



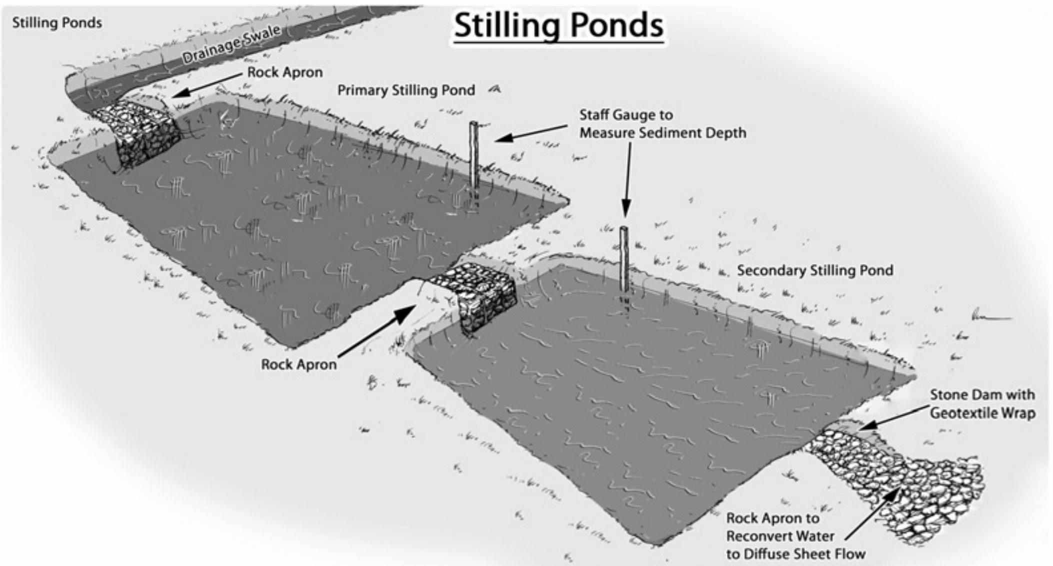
Check Dam
(Straw Bale & Stone Dam - Cross Section)



Level Spreader



Stilling Ponds



MKO	Drawing Title: Drainage Design Illustations	Drawing No.: Figure 4.25		Scale: NTS	
	Project Title: Ballynagare Wind Farm			Date: 13.10.2021	
	Drawn By: JO'B	Checked By: TB		Project No.: 200512	

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Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place at the end of the construction phase to limit erosive linear flow in the drainage swales during extreme rainfall events.

Check dams are designed to reduce velocity and control erosion and are not specifically designed or intended to trap sediment, although sediment is likely to build up. If necessary, any excess sediment build up behind the dams will be removed. For this reason, check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

4.6.4.4 Level Spreaders

A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.

The water carried in interceptor drains will not have come in contact with works areas of the site, and therefore should be free of silt and sediment. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be reconcentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. Figure 4.25 shows an illustrative example of a level spreader.

The slope in the channel leading into the spreader will be less than or equal to 1%. The slope downgradient of the spreader onto which the water will dissipate will have a grade of less than 6%. The availability of slopes with a grade of 6% or less will determine the locations of level spreaders.

The spreader lip over which the water will spill will be made of a concrete kerb, wooden board, pipe, or other similar piece of material that can create a level edge similar in effect to a weir. The spreader will be level across the top and bottom to prevent channelised flow leaving the spreader or ponding occurring behind the spreader. The top of the spreader lip will be 150mm above the ground behind it. The length of the spreader will be a minimum of four metres and a maximum length of 25 metres, with the actual length of each spreader to be determined by the size of the contributing catchment, slope and ground conditions.

Clean four-inch stone can be placed on the outside of the spreader lip, and pressed into the ground mechanically to further dissipate the flow leaving the level spreader over a larger area.

4.6.4.5 Vegetation Filters

Vegetation filters are the existing vegetated areas of land that will be used to accept surface water runoff from upgradient areas. The selection of suitable areas to use as vegetation filters will be determined by the size of the contributing catchment, slope and ground conditions.

Vegetation filters will carry outflow from the level spreaders as overland sheet flow, removing any suspended solids and discharging to the groundwater system by diffuse infiltration.

Vegetation filters will not be used in isolation for waters that are likely to have higher silt loadings. In such cases, silt-bearing water will already have passed through stilling ponds prior to diffuse discharge to the vegetation filters via a level spreader.

4.6.4.6 Stilling Ponds (Settlement Ponds)

Stilling ponds will be used to attenuate runoff from works areas of the site during the construction phase, and will remain in place to handle runoff from roads and hardstanding areas of the proposed development during the operational phase. The purpose of the stilling ponds is to intercept runoff potentially laden with sediment and to reduce the amount of sediment leaving the disturbed area by reducing runoff velocity. Reducing runoff velocity will allow larger particles to settle out in the stilling ponds, before the run-off water is redistributed as diffuse sheet flow in filter strips downgradient of any works areas.

Stilling ponds will be excavated/constructed at each required location as two separate ponds in sequence, a primary pond and a secondary pond. The points at which water enters and exits the stilling ponds will be stabilised with rock aprons, which will trap sediment, dissipate the energy of the water flowing through the stilling pond system, and prevent erosion. The primary stilling pond will reduce the velocity of flows to less than 0.5 metres per second to allow settlement of silt to occur. Water will then pass from the primary pond to the secondary pond via another rock apron. The secondary stilling pond will reduce the velocity of flows to less than 0.3 metres per second. Water will flow out of the secondary stilling pond through a stone dam, partially wrapped in geo-textile membrane, which will control flow velocities and trap any sediment that has not settled out. Figure 4.25 shows an illustrative example of a stilling pond system.

Water will flow by gravity through the stilling pond system. The stilling ponds will be sized according to the size of the area they will be receiving water from, but will be sufficiently large to accommodate peak flows storm events. The stilling ponds will be dimensioned so that the length to width ratio will be greater than 2:1, where the length is the distance between the inlet and the outlet. Where ground conditions allow, stilling ponds will be constructed in a wedge shape, with the inlet located at the narrow end of the wedge. Each stilling pond will be a minimum of 1-1.5 metres in depth. Deeper ponds will be used to minimise the excavation area needed for the required volume.

The embankment that forms the sloped sides of the stilling ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the stilling ponds area.

Stilling ponds will be located towards the end of swales, close to where the water will be reconverted to diffuse sheet flow. Upon exiting the stilling pond system, water will be immediately reconverted to diffuse flow via a fan-shaped rock apron if there is adequate space and ground conditions allow. Otherwise, a swale will be used to carry water exiting the stilling pond system to a level spreader to reconvert the flow to diffuse sheet flow.

A water level indicator such as a staff gauge will be installed in each stilling pond with marks to identify when sediment is at 10% of the stilling pond capacity. Sediment will be cleaned out of the stilling pond when it exceeds 10% of pond capacity. Stilling ponds will be inspected weekly and following rainfall events i.e after events of >25mm rainfall in any 24-hour period. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

4.6.4.7 Siltbuster

A “siltbuster” or similar equivalent piece of equipment will be available to filter any water pumped out of excavation areas if necessary, prior to its discharge to stilling ponds or swales.

Siltbusters are mobile silt traps that can remove fine particles from water using a proven technology and hydraulic design in a rugged unit. The mobile units are specifically designed for use on construction sites.

The unit stills the incoming water/solids mix and routes it upwards between a set of inclined plates for separation. Fine particles settle onto the plates and slide down to the base for collection, whilst treated water flows to an outlet weir after passing below a scum board to retain any floating material. The inclined plates dramatically increase the effective settling area of the unit giving it a very small footprint on site and making it highly mobile. Figure 4.26 below shows an illustrative diagram of the Siltbuster.

The Siltbuster units are now considered best practice for the management of dirty water pumped from construction sites. The UK Environment Agency and the Scottish Environmental Protection Agency have all recommended/specified the use of Siltbuster units on construction projects.

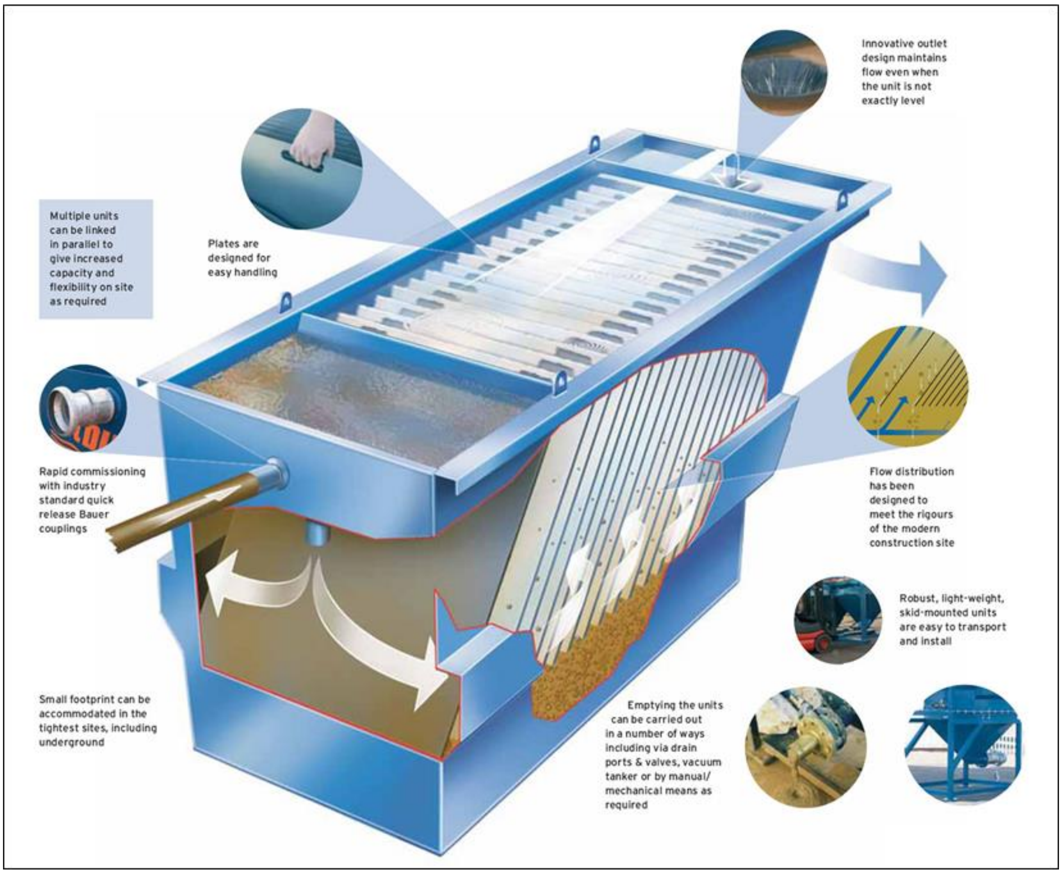


Figure 4.26 Siltbuster

4.6.4.8 Culverts

All new proposed culverts and proposed culvert upgrades will be suitably sized for the expected peak flows in the watercourse.

Some culverts may be installed to manage drainage waters from works areas of the proposed development, particularly where the waters have to be taken from one side of an existing roadway to the other for discharge. The size of culverts will be influenced by the depth of the track or road sub-base. In some cases, two or more smaller diameter culverts may be used where this depth is limited, though this will be avoided as they will have a higher associated risk of blockage than a single, larger pipe. In all cases, culverts will be oversized to allow mammals to pass through the culvert.

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

All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.

4.6.4.9 Silt Fences

Silt fences will be installed as an additional water protection measure around existing watercourses in certain locations, particularly where works are proposed within the 50-metre buffer zone from natural watercourses, which is inevitable where existing roads in proximity to watercourses are to be upgraded as part of the proposed development. These areas include around existing culverts, around the headwaters of watercourses, and the proposed locations are indicated on the detailed drainage design drawings included in Appendix 4-4.

Silt fences will be installed as single, double or a series of triple silt fences, depending on the space available and the anticipated sediment loading. The silt fence designs follow the technical guidance document 'Control of Water Pollution from Linear Construction Projects' published by CIRIA (Ciria, No. C648, 1996). Up to three silt fences may be deployed in series..

The Stage 1 (Coarse) silt fence will consist of a geotextile fabric such as Terram 1000 attached by staples to fixed stakes. The Terram sheets will be folded in an L shape with one metre extending horizontally in towards the works area. This horizontal section will be buried at a distance of approximately 150mm beneath a clean stone surface. Terram 1000 is a permeable fabric through which water can pass, but through which sediment particles cannot. It does however, impede water flow and can lead to the backing up of water and sediment, which reduce its effectiveness.

The Stage 2 (Medium) silt fence will consist of straw bales, embedded 100mm into the soil/ground and fixed in place with stakes. A geotextile fabric will be pegged and stapled to the straw bales and stakes.

The Stage 3 (Fine) silt fence will be similar to the Stage 1 fence, with the addition of a course sand and/or fine gravel at the base of the geotextile.

In the case of all three types of fence, the geotextile fabric will be embedded at least 150mm below the ground surface.

In a small number of locations around the proposed site where space between the works areas and watercourses may be limited, silt fence designs will be combined to increase their effectiveness. For example, a straw bale silt fence (Stage 2) may be double wrapped with geotextile fabric (Stage 1) and course sand/fine gravel added on the upgradient side (Stage 3). The most suitable type, number or combination of silt fences will be determined on a location specific basis for the various parts of the site. Although they may be indicated in the drainage designs shown in Appendix 4-4 to be just a single line, silt fences may be installed in series on the ground.

Site fences will be inspected regularly to ensure water is continuing to flow through the Terram, and the fence is not coming under strain from water backing up behind it.

4.6.5 Borrow Pit Drainage

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

Run off from the single outlet point will be diverted via a drainage swale to a series of settlement ponds and onwards to a level spreader, which will convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The management of surface runoff from the borrow pit area by converting it to diffuse sheet flow removes the risk of contamination of surface water drains and removes the requirement for silt traps leading from this particular area.

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

4.6.6 Peat Repository Area Drainage

The containment bund that makes up the peat storage cells will be constructed with granular fill material, either sourced on site or imported to site if necessary. Water will be able to filter out through the containment cell bund, and will be collected in a series of drainage channels to be installed around each cell, before being directed to the other drainage measure as outlined above.

4.6.7 Floating Road Drainage

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

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

4.6.8 Cable Trench Drainage

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

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

On steeper slopes, silt fences, as detailed in Section 4.6.5.9 of the EIAR will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

4.6.9 Site and Drainage Management

4.6.9.1 Preparative Site Drainage Management

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

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

4.6.9.2 Pre-emptive Site Drainage Management

The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular. Large excavations, large movements of overburden or large scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

4.6.9.3 Reactive Site Drainage Management

The final drainage design prepared for the proposed development prior to commencement of construction will have to provide for reactive management of drainage measures. The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the environmental clerk of works or supervising hydrologist on-site. The environmental clerk of works or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site. The drainage design may have to be modified on the ground as necessary, and the modifications will draw on the various features outlined above in whatever combinations are deemed to be most appropriate to the situation on the ground as a particular time.

In the event that works are giving rise to discharges of silt to watercourses, the environmental clerk of works or supervising hydrologist will stop all works in the immediate area around where the siltation is evident. The source of the siltation will be identified and additional drainage measures such as those outlined above will be installed in advance of works recommencing.

4.6.10 Drainage Maintenance

An inspection and maintenance plan for the drainage system onsite will be prepared in advance of commencement of any works. Regular inspections of all installed drainage features will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the environmental clerk of works or the supervising hydrologist.

If necessary, any excess sediment build up behind check dams will be removed. For this reason, check dams will be inspected and maintained weekly during the construction phase of the project to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.

Check dams will also be inspected weekly during the construction phase of the project and following rainfall events to ensure the structure of the dam is still effective in controlling flow. Any scouring around the edges of the check dams or overtopping of the dam in normal flow conditions will be rectified be reinforcement of the check dam.

Drainage swales will be regularly inspected for evidence of erosion along the length of the swale. If any evidence of erosion is detected, additional check dams will be installed to limit the velocity of flow in the channel and reduce the likelihood of erosion occurring in the future.

A water level indicator such as a simple staff gauge or level marker will be installed in each silt trap with marks to identify when sediment is at 50% of the trap's capacity. Sediment will be cleaned out of the silt trap when it exceeds 50% of trap capacity. Silt traps will be inspected weekly during the construction phase of the project and following rainfall events. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows.

The frequency of drainage system inspections will be reduced following completion of the construction phase of the project. Weekly inspections during the construction phase will be reduced to monthly, bi-monthly and eventually quarterly inspections during the operational phase. The frequency will be increased or decreased depending on the effectiveness of the measures in place and the amount of remedial action required in any given period.

4.7 Construction Management

4.7.1 Construction Timing

It is estimated that the construction phase will take approximately 24 months from starting on site to the commissioning of the electrical system.

4.7.2 Construction Sequencing

The construction phase can be broken down into three main phases, 1) civil engineering works - 18 months, 2) electrical works - 9 months, and 3) turbine erection and commissioning - 6 months. The main task items under each of the three phases are outlined below. The three phases can be undertaken concurrently

Civil Engineering Works

- Install meteorological mast.
- Clear and hardcore area for temporary site offices. Install same.
- Construct bunded area for oil tanks.
- Construct new site roads and hard-standings and crane pads.
- Construct drainage ditches, culverts etc. integral to road construction.
- Excavate for turbine bases. Store soil locally for backfilling and re-use. Place blinding concrete to turbine bases. Fix reinforcing steel and anchorage system for tower section. Construct shuttering. Fix any ducts etc. to be cast in. Pour concrete bases. Cure concrete. Remove shutters after 1-2 days.

Electrical Works

- Construct bases/plinths for transformer.
- Excavate trenches for site cables, lay cables and backfill. Provide ducts at road crossings.
- Erect transformers at compound.
- Erect fencing at transformer compound.

Turbine Erection and Commissioning

- Erect towers, nacelles and blades.
- Backfill tower foundations and cover with previously stored topsoil.
- Complete electrical installation.
- Grid connection.
- Commission and test turbines.
- Complete site works, reinstate site.
- Remove temporary site offices. Provide any gates, landscaping, signs etc. which may be required.

All relevant Site Health & Safety procedures, in accordance with the relevant Health and Safety Legislation and guidance (listed in Section 5.9.2.1 of this EIAR), including the preparation of the Health & Safety Plan, erection of the relevant and appropriate signage on site, inductions and toolbox talks will take place prior to and throughout the construction phase of the proposed development. Further details of on-site health, safety and welfare are included in Chapter 5 of this EIAR.

The phasing and scheduling of the main construction task items are outlined in Figure 4.27 below, where 1st September 2025 has been selected as an arbitrary start date for construction activities.

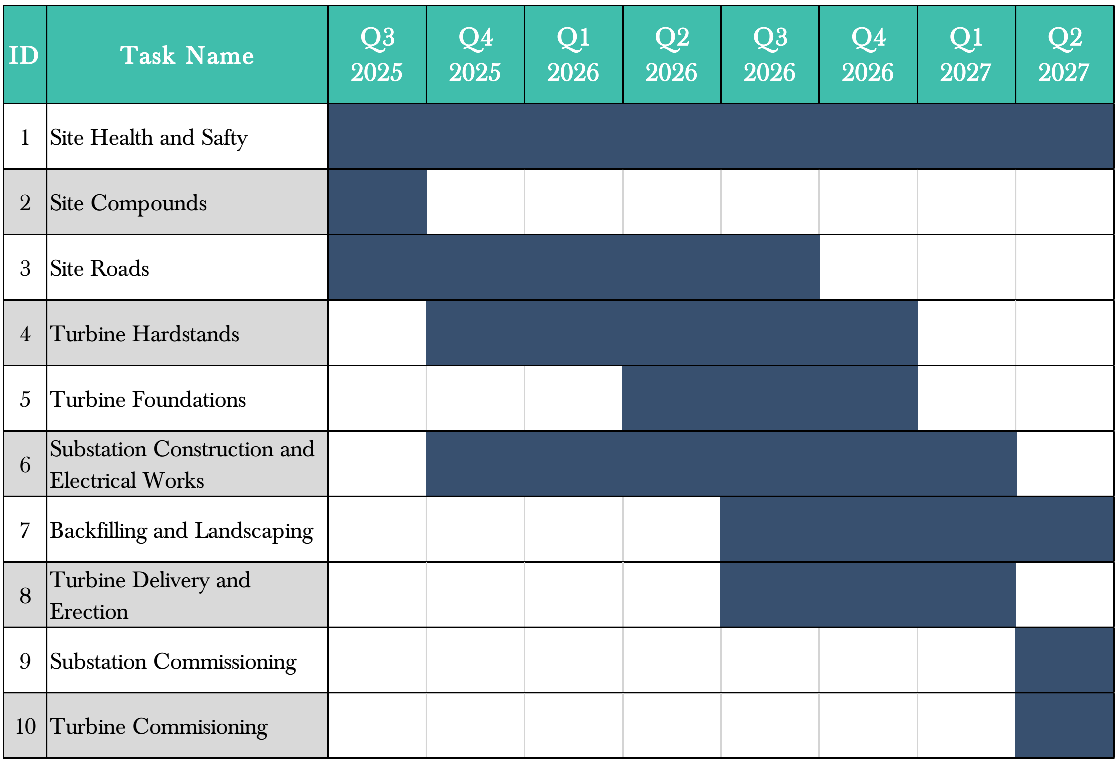


Figure 4.27 Indicative Construction Schedule

4.7.3 Construction Phase Monitoring & Oversight

The requirement for a Construction Environmental Management Plan (CEMP) to be prepared in advance of any construction works commencing on any wind farm site and submitted for agreement to the Planning Authority is now well-established. The proposed procedures for the implementation of the mitigation measures outlined in such an EMP and their effectiveness and completion is typically audited by way of an Environmental Management Plan (EMP) Audit Report. The EMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation, all conditions attached to the grant of planning permission and any further mitigation measures proposed during the detailed design stage, and allows them to be audited on a systematic and regular basis. The first assessment is a simply Yes/No question, has the mitigation measure been employed on-site or not? Following confirmation that the mitigation measure has been implemented, the effectiveness of the mitigation measures has to be the subject of regular review and audit during the full construction stage of the project. If some remedial actions are needed to improve the effectiveness of the mitigation measure, then these are notified to the site staff immediately during the audit site visit, and in writing by way of the circulation of the audit report. Depending on the importance and urgency of rectifying the issue, the construction site manager is given a timeframe by when the remedial works need to be completed.

The on-site construction staff will be responsible for implementing the mitigation measures specified in the EIAR and compiled in the Audit Report. Their implementation will be overseen by supervising hydrogeologists, environmental scientists, ecologists or geotechnical engineers, depending on who is best placed to advise on the implementation. The system of auditing referred to above ensures that the mitigation measures are maintained for the duration of the construction phase, and into the operational phase where necessary. The Audit Reports are usually submitted to the Planning Authority as a condition of planning and will be proposed as part of the Environmental Management Plan and Audit System that that is typically proposed to and agreed with the Planning Authority in advance of construction works commencing.

4.8 Construction Methodologies

4.8.1 Shallow Turbine Foundations

Each of the turbines to be erected on site will have a reinforced concrete base. Overburden will be stripped off the foundation area to a suitable formation using a 360° excavator with most being removed to the onsite borrow pit while some will be stored locally for later reuse in backfilling around the turbine foundation. A five metre wide working area will be required around each turbine base, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be surrounded by silt fences to ensure sediment-laden run-off does not occur.

The formation material will have to be approved by an engineer as meeting the turbine manufacturer's requirements. If the formation level is reached at a depth greater than the depth of the foundation, the ground level will have to be raised with clause 804 or similar hardcore material, compacted in 250 millimetres (mm) layers, with sufficient compacted effort (i.e. compacted with seven passes using 12 tonne roller). Drainage measures will be installed to protect the formation by forming an interceptor drain around the perimeter of the base which will outfall out at the lowest point level spreader or settlement pond.

An embankment approximately 600 mm high will be constructed around the perimeter of each turbine base and a fence will be erected to prevent construction traffic from driving into the excavated hole and to demarcate the working area. All necessary health and safety signage will be erected to warn of deep excavations etc. Access to and from excavated bases will be formed by excavating a pedestrian walkway to 1:12 grade.

There will be a minimum of 100 mm of blinding concrete laid on the formation material positioned using concrete skip and 360° excavator to protect ground formation and to give a safe working platform.

The anchor cage is delivered to site in 2 or more parts depending on the turbine type. A 360° excavator with suitable approved lifting equipment will be used to unload sections of the anchor cage and reinforcing steel. The anchor cage is positioned in the middle of the turbine base and is assembled accordingly. When the anchor cage is in final position it is checked and levelled by using an appropriate instrument. The anchor cage is positioned 250mm – 300mm from formation level by use of adjustable legs. Reinforcement bars are then placed around the anchor cage, first radial bars, then concentric bars, shear bars and finally the superior group of bars. Earthing material is attached during the steel foundation build up. The level of the anchor cage will be checked again prior to the concrete pour and during the concrete pour.

Formwork to concrete bases will be propped/supported sufficiently so as to prevent failure. Concrete for bases will be poured using a concrete pump. Each base will be poured in three stages. Stage 1 will see the concrete being poured and vibrated in the centre of the anchor cage to bring the concrete up to the required level inside the cage. Stage 2 will see the centre of the steel foundation being poured and vibrated to the required level. Stage 3 will see the remaining concrete being poured around the steel foundation to bring it up to the required finished level. After a period of time when the concrete has set sufficiently the top surface of the concrete surface is to be finished with a power float.

Once the base has sufficient curing time it will be backfilled with suitable fill up to existing ground level and finished with the original material that was excavated.

4.8.2 Piled Turbine Foundation

Due to the depth of peat at some turbine locations, it is anticipated that some turbine foundations may have to be piled. Piled foundations have been successfully proposed and used on other wind farm sites in Ireland. The construction methodology to be used for the piled foundation scenario is as follows:

- Using geogrid and imported stone as required, a temporary access ramp and temporary platform for a piling rig, shown in Plate 4.8, is to be constructed above the turbine base location.
- A piling rig is then to be mobilised on the piling rig platform.
- Piles are to be constructed to extend through the peat and silt layers and to penetrate the underlying rockhead by approximately 5 metres.
- Peat, silt and rock cored upwards during the piling process shall be removed to a suitable material storage location.
- Concrete delivery trucks and pumps feeding the pile construction will operate from the finished hardstand.
- On completion of the piles, (approx 14-20 per base) the piling rig will de-rig and remobilise at a separate base.
- A low ground bearing pressure tracked excavator will excavate peat at the foundation to 300mm below blinding level.
- Using geogrid as required and a cleaning layer of stone beneath the blinding layer, a layer of blinding will then be placed.
- Concrete within the piles is then to be broken down to blinding level, exposing the reinforcement steel within the piles onto which the reinforcement steel of the foundation is to be fixed.
- On completion of the steel cage, the foundation pour is to be completed as normal.
- Weathered rock removed either during the piling process or from other areas of the site is to be used as backfill over the foundation.

Plate 4.8 below shows an example of piling being undertaken on a wind farm in Co. Kerry, in that particular case to depths of 17 metres.

Plate 4.8 Piling Rig on a piling platform at a turbine foundation

4.8.3 Site Roads and Crane Pad Areas

Site roads will be constructed to each turbine base and at each base a crane hard standing will be constructed to the turbine manufacturer's specifications and the largest predicted area has been assessed in this EIAR. Tracked excavators will carry out excavation for roads with appropriate equipment attached. The excavations shall follow a logical route working away from the borrow pit locations. Excavated material will be transported back to the borrow pits in haul trucks. A two to three-metre-wide working area will be required around each hardstanding area, with the sides of the excavated areas sloped sufficiently to ensure that slippage does not occur. Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets and surrounded by silt fences to ensure sediment-laden run-off does not occur.

When the formation layer has been reached, stone from the on-site borrow pit shall be placed to form the road foundation. In the event of large clay deposits being encountered in sections of road, a geotextile layer will be required at sub-base level. The sub grade will be compacted with the use of a roller. The final wearing course will not be provided until all bases have been poured. This prevents damage to the wearing course due to stone and concrete trucks movements. The road will be upgraded prior to the arrival of the first turbine. All roads will be maintained for the duration of the operation of the proposed development.

4.8.4 Hardstand Areas in Deeper Peat

In areas of deeper peat, a sheet piled solution to construct turbine hardstands can also be employed. The construction methodology for the construction of sheet piled hardstands would be as follows;

- The proposed footprint of the hardstanding is to be set out on the ground.
- Existing surface water flows are to be diverted around the hardstanding and foundation footprint through new engineered drainage channels.
- The low point of the hardstanding is to be identified, and a drainage solution is to be identified from the proposed excavated level at this location, in order that the hardstanding does not act as a large sink for surface water once constructed (which would increase pore water pressures on the peat adjacent to the hardstanding).
- Suitable environmental protection measures/silt traps are to be placed along the proposed drainage solution from the hardstandings.
- Using a low ground bearing tracked excavator, sheet piles are to be pushed vertically through the peat into the underlying silt layer beneath the peat.
- The sheet piles are to be set into the ground at a distance outside of the set out hardstanding extents equal to the depth of the peat in that area (care shall be taken that any subsurface drainage solution, if used as part of point 2 above, is not damaged).
- The sheet piles are to extend into the silt layer a minimum of 3m or until refusal.
- The sheet piles are to be pushed into the silt layer, and not vibrated in as is sometimes the practice for inserting sheet piles at coffer dam locations. No vibration is to take place in the vicinity of the peat.
- The hardstanding is to be constructed by excavating and replacing on a cell by cell basis i.e. each 20m2 of surface area excavated to the silt layer must be backfilled with suitable stone prior to excavating an adjacent cell.
- The excavator must be working from either the existing floating road, or an existing backfilled cell at all times. The excavator may require the use of an extended arm to reach deeper pockets of peat.
- For the initial four cells in each hardstand, the excavator is to place excavated material into low ground bearing transport vehicles for removal to the peat storage areas. This is to avoid the loading of large volumes onto transport lorries sitting on the floating road location adjacent to open excavations.
- For the initial four cells in each hardstand, low ground bearing transport vehicles are to transport large boulders and coarse engineering fill for the build-up of that cell. It is only

when the first 4 cells are in place that transport lorries may be used for the transport of stone. This is to avoid concentrated loads from tipper trucks on the floating road adjacent to open excavations, and impact loads on the floating roads from the discharge of loads from these tipper trucks. Unloading of tipper trucks in the vicinity of these excavations is only permitted on and to an excavated and replaced cell.

- The excavator is to place excavated material into transport lorries for removal to the peat storage areas. Transport lorries are not to be filled above 75% capacity. Once permitted to do so as above, transport lorries will transport large stone material or boulders for the base of the hardstand to the hardstand area. The excavator will place the large boulders into the excavated cell and push them into place. Again, transport lorries are not to be filled above 75% capacity during stone deliveries to the hardstand area.
- Stone must be filled to a minimum of three metres above the silt layer prior to moving to the adjoining cell for excavation. Additional bracing of the sheet piles may also be incorporated as shown in Plate 4.9 and 4.10 below. The design for the actual bracing system to be used will be completed prior to construction.
- The final top metre of the hardstand may incorporate layers of geogrid. Compaction shall be carried out in layers of no more than 300mm.
- In order to avoid excessive amounts of fill, the final layer of the hardstand may be set below the top of the foundation level by as much as two metres. This will have the effect of reducing the footprint of the excavation also as the effective area of the hardstand is splayed at 45 degrees for load bearing. (For every metre above the silt layer that the hardstand rises, the footprint is widened by two metres).
- The ineffective areas of the excavated and replaced footprint are to be backfilled with peat such that heavy machinery will not be placed thereon.
- The sheet piles can then be removed for use on the next base in a similar fashion.
- Load spreading bogmats or light flatracks may be used to store some of the lighter components on areas adjacent to the piled foundations, to minimise the area that has to be piled. Such flatracks are shown below in Plate 4.11 prior to delivery to a wind farm where they have been used for the above purpose.

Plate 4.9 Sheet piling a hardstand in Cumbria, UK

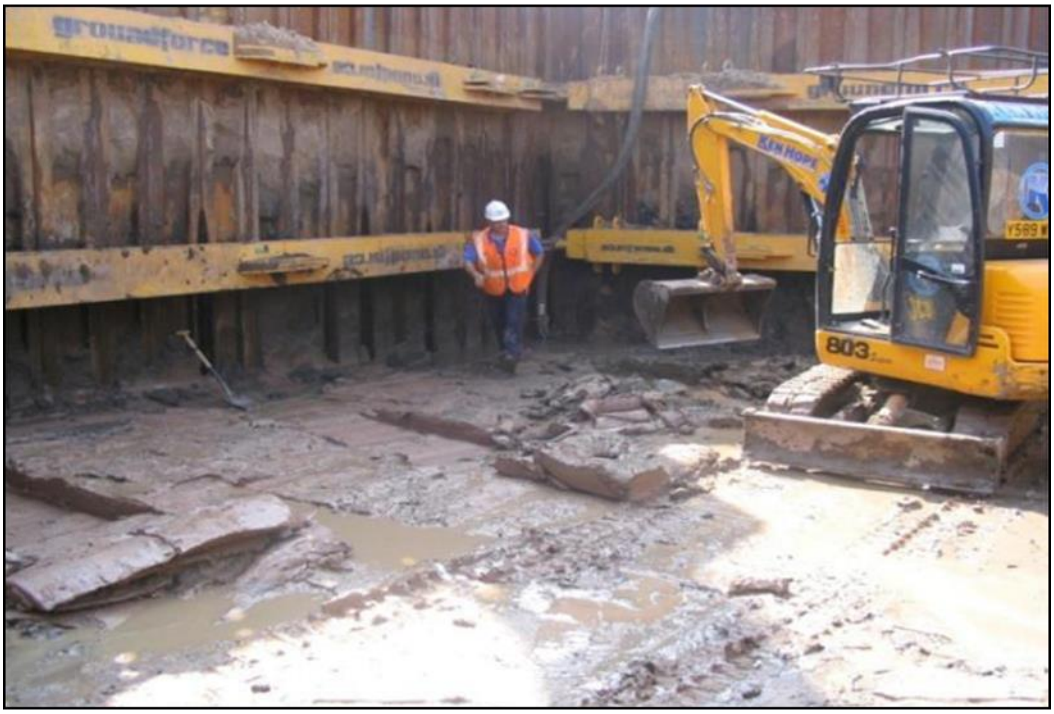


Plate 4.10 Sheet piling a hardstand in Cumbria, UK

Plate 4.11 Flatracks for spreading load at laydown areas

4.8.5 Floating Roads

In localised areas across the site, it may be necessary to construct some floating roads over peat. The floating road design will be used typically in areas with two metres of peat depth or greater. The most suitable type of road construction will be selected at the detailed design stage based on shear strength, slope, peat depth and factor of safety of the peat over which the road must traverse.

Floating roads minimise impact on the peat, particularly peat hydrology, and significantly reduce the volumes of peat requiring management as there is no excavation required and no peat arisings are generated.

The following methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability:

- Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than three metres.
- Floating road construction will be to the line and level requirements as per detailed engineering design.
- Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
- Construction of road to be in accordance with appropriate design from the designer.
- The typical make-up of the new floated access road is 500 to 750mm of selected granular fill with 2 no. layers of geogrid.
- Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.

- Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone on to the peat shall not be carried out.
- To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a ten metres length of constructed floating road.
- Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a ten metre length of constructed floating road.
- Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
- A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

4.8.6 Proposed Clear-span Watercourse Crossings

It is proposed to construct clear-span watercourse crossings along the wind farm access roads at 2 no. locations using either corrugated metal arches or pre-cast concrete clearspan bridges. The locations of these crossings are shown on the layout drawings included in Appendix 4-3 of this EIAR. The clearspan watercourse crossing methodologies presented below will ensure that no instream works are necessary.

The typical construction methodology for the installation of a pre-cast concrete clear-span bridge is presented below:

- The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures along the proposed road will be installed in advance of the works.
- The abutment will consist of concrete panels which will be installed on a concrete lean mix foundation to provide a suitable base. The base will be excavated to rock or competent ground with a mechanical excavator with the foundation formed in-situ using a semi-dry concrete lean mix. The base will be excavated along the stream bank with no instream works required.
- Access to the opposite side of the river for excavation and foundation installation will require the installation of pre-cast concrete slab across the river to provide temporary access for the excavator.
- All pre-cast concrete panels and slabs/beams will be installed using a crane which will be set up on the bank of the watercourse and will be lifted into place from the bank with no contact with the watercourse.
- A concrete deck will be poured over the beams/slabs which span across the river. This will be shuttered, sealed and water tested before concrete pouring can commence.

A typical design drawing of a pre-cast concrete, clear span crossing is shown in Figure 1.2 of Appendix 4-3.

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

4.8.7 Onsite Electricity Substation and Control Building

The onsite substation will be constructed by the following methodology:

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

4.8.8 Temporary Construction Compounds

The temporary construction compounds will be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs and associated settlement ponds will be installed around the perimeter;
- The compound platform will be established using a similar technique as the construction of the substation platform discussed above;
- A layer of geo-grid will be installed, and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;
- Areas within the compound will be constructed as site roads and used as vehicle hardstandings during deliveries and for parking;
- The compound will be fenced and secured with locked gates if necessary; and,
- Upon completion of the proposed development the temporary construction compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required.

4.8.9 Grid Connection Cable Trench

4.8.9.1 Excavation and Duct Installation

The following construction methodologies will be employed in relation to the grid connection cable route. A detailed construction methodology for the installation of the proposed 38kV grid connection is included as Appendix 4-6.

4.8.9.1.1 Parallel Road Excavations inroad & in Grass margin

- The area where excavations are planned will be surveyed and all existing services will be identified.
- All relevant bodies i.e. ESB, Eircom, Kerry County Council etc. will be contacted and all drawings for all existing services sought.
- A traffic management plan will be set up prior to any works commencing.
- A road opening licence will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- A rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks "Specification for the Installation of Ducts and Structures for Underground Power Cables and Communications Cables".
- All excavated material will either be removed to the on-site peat repository areas or to a licenced tip or, if suitable, stockpiled and reused for backfilling where appropriate. All excavated material not used for backfilling will be removed from site using trucks.
- The trench depth is specified at 1220mm and trench support will not be required, however where depths exceed 1250mm trench support will be installed or the trench sides will be benched or battered back where appropriate.
- Any ingress of ground water will be removed from the trench using submersible pumps.
- A silt filtration system will be used to prevent contamination of any watercourse.
- Once the trench has been excavated a base layer of 15 N CBM4 concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck directly into the trench.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure the trefoil ducts together (at 3 metre centres).
- Once the trefoil ducts have been installed couplers will be fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions the end of the trefoil ducts will be shimmed up off of the bed of the trench to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected.
- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The as built location of the ducting will be surveyed using a total station/GPS.
- 15 Newton CBM4 concrete will be carefully installed so as not to displace the ducting to the underside of the communications duct and compacted as per approved detail. See Plate 4.14.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the trefoil ducting.
- ESB marker board will be fitted above the trefoil ducting.
- The Communication duct will be fitted and kept to one side of the trench ensuring that the minimum cover is achieved and 15 Newton CBM4 concrete will be placed to the specified cover and compacted, see Plate 4.14.
- ESB red marker board will be installed and the remainder of trench will be backfilled in two compacted layers with approved material (lean mix concrete/clause 804).
- Yellow marker tape will be installed as per approved detail specifications, 300 mm maximum below finished road/ground level.
- Topsoil will be permanently reinstated where required or Clause 804 stone used to finish the trench on grass margins where appropriate to give a more trafficable surface.

Plate 4.12 Cable Trench and Conduit

Plate 4.13 Cable Trench and Conduit

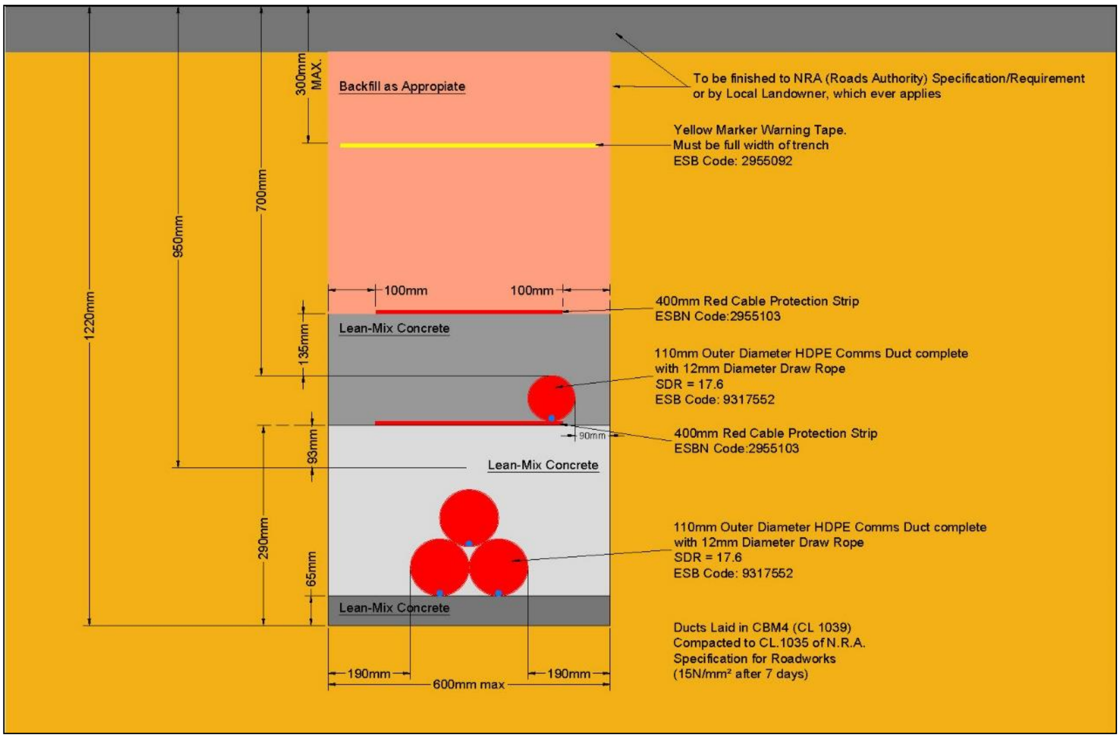


Plate 4.14 Trench layout single circuit (4-way) trefoil

4.8.9.1.2 Road Crossing

- A traffic management plan will be set up prior to any works commencing.
- The area where excavations are planned will be surveyed and all existing services will be identified.
- A road opening licence will be obtained where required and any conditions complied with.
- The road will be cut to the required width of trench using road saw.
- A truck will be used to remove excavated material from work area.
- A rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks manual for the ''Specification for the Installation of Ducts and Structures for Underground Power Cables and Communication Cables''.
- Trench support will be installed where required.
- All excavated material from road crossing will be removed off site to an approved tip or if suitable stored for reuse.
- A base layer of 15 Newton CBM4 concrete will be installed and compacted.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure trefoil ducts together (at 3 meter centres).
- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The ducting will then be surveyed for both level and grid location using a total station/GPS.
- 15 Newton CBM4 concrete will be carefully installed to the underside of the communications ducts and compacted.
- ESB marker board will then be placed at this level in the trench.
- Communication ducts will then be fitted and backfilled to the correct level with 15 Newton concrete and spacer boards to ensure correct cover is achieved.
- ESB marker board will be installed again at this level and the remainder of trench backfilled in two compacted layers of 15 Newton CBM4 concrete / Clause 804 material.
- Yellow marker tape will be installed at a maximum of 300 mm from the finished road level.
- The road surface will be temporarily reinstated with a blinding layer/cold mix tarmacadam.
- The road surface will then be permanently reinstated at a later date (2 – 3 weeks).

4.8.9.2 Existing Underground Services

Any underground services encountered along the cable routes will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations an additional layer of marker tape will be installed between the communications duct and top level yellow marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35N concrete surrounding the ESB ducts where adjacent services are within 600mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

4.8.9.3 Joint Bays

Joint bays are pre-cast concrete chambers where lengths of cable will be joined to form one continuous cable. They will be located at various points along the ducting route approximately every 700 - 750 meters. Where possible, joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction the joint bay locations will be completely fenced off and will be incorporated into the traffic management system. Once they have been constructed they will be backfilled temporarily until cables are being installed. Exact location of cable/joint bay in the road curtilage to be subject to ESB specifications and agreement with Kerry County Council.

4.8.9.4 Watercourse/Culvert Crossings

There are a total of 5 major watercourse and culvert crossings along the proposed grid connection route. The remaining crossings along the grid connection route are classified as minor culverts.

The construction methodology has been designed to eliminate the requirement for in-stream works. A general description of the various construction methods employed at watercourse/ culvert crossings are described in the following paragraphs below. A list of the stream crossings along the grid connection route and the proposed crossing method at each location are provided in Table 4.3 below.

The crossing methodologies to be employed at the other culvert crossings along the grid connection cable route, will be selected from the suite of watercourse crossing options outlined below, as appropriate, depending on culvert type, depth, size and local ground conditions.

The stream crossing locations are shown in Figure 4.28..

4.8.9.4.1 *Piped Culvert Crossings over Culvert– Option 1*

Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where sufficient cover exists above the culvert, the trench will be excavated above the culvert and the ducts will be installed in the trefoil arrangement passing over the sealed pipe where no contact will be made with the watercourse. This method of duct installation is further detailed in Figure 4.29.

4.8.9.4.2 *Piped Culvert Crossings under Culvert – Option 2*

Where the culvert consists of a socketed concrete or sealed plastic pipe where sufficient cover over the culvert does not exist to accommodate the cable trench, a trench will then be excavated beneath the culvert and cable ducts will be installed in the trefoil arrangement under the sealed pipe.

If these duct installation methods cannot be achieved or utilised, the ducts will be installed by alternative means as set out in the following sections. This method of duct installation is further detailed in Figure 4.30.

4.8.9.4.3 *Flatbed Formation over Culverts – Option 3*

Where cable ducts are to be installed over an existing culvert/bridge where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert or the depth that can be achieved in the deck of a bridge structure. The ducts will be laid in this trench in a flatbed formation over the existing culvert/bridge and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification.

After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench.

Where a bridge or culvert has insufficient deck cover to fully accommodate the required ducts, the ducts can be laid in a flatbed formation partially within the existing road make up. Where this option is to be employed, the ducts will also be encased in steel with a concrete surround as per Eirgrid and/or ESB Networks specifications. In order to achieve cover over these ducts and restore the carriageway of the road, it may be necessary to locally raise the pavement level to fully cover the ducts. The increase road level will be achieved by overlaying the existing pavement with a new wearing course as required. Any addition of a new pavement will be tied back into the existing road pavement at grade. After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench. This method of duct installation is further detailed in Figure 4.31.

The flatbed formation methodology will also be used at bridge structures where there is an existing footpath. The cables will be installed in the same flatbed arrangement where the existing footpath will be excavated to allow for the installation of the cables. The footpath will be reinstated after cable ducts have been installed. Where there is no existing footpath, it is proposed to install a footpath to encase the cable ducts after they have been laid in the flatbed formation.

4.8.9.4.4 *Horizontal Directional Drilling – Option 4*

In the event that none of the above methods are appropriate, directional drilling will be utilised.

The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, will be utilised for the horizontal directional drilling at watercourse/culvert crossings listed below. The launch and reception pits will be approximately 2m wide, 3m long and 1 m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ (environmentally friendly product (not toxic to aquatic organisms)) and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

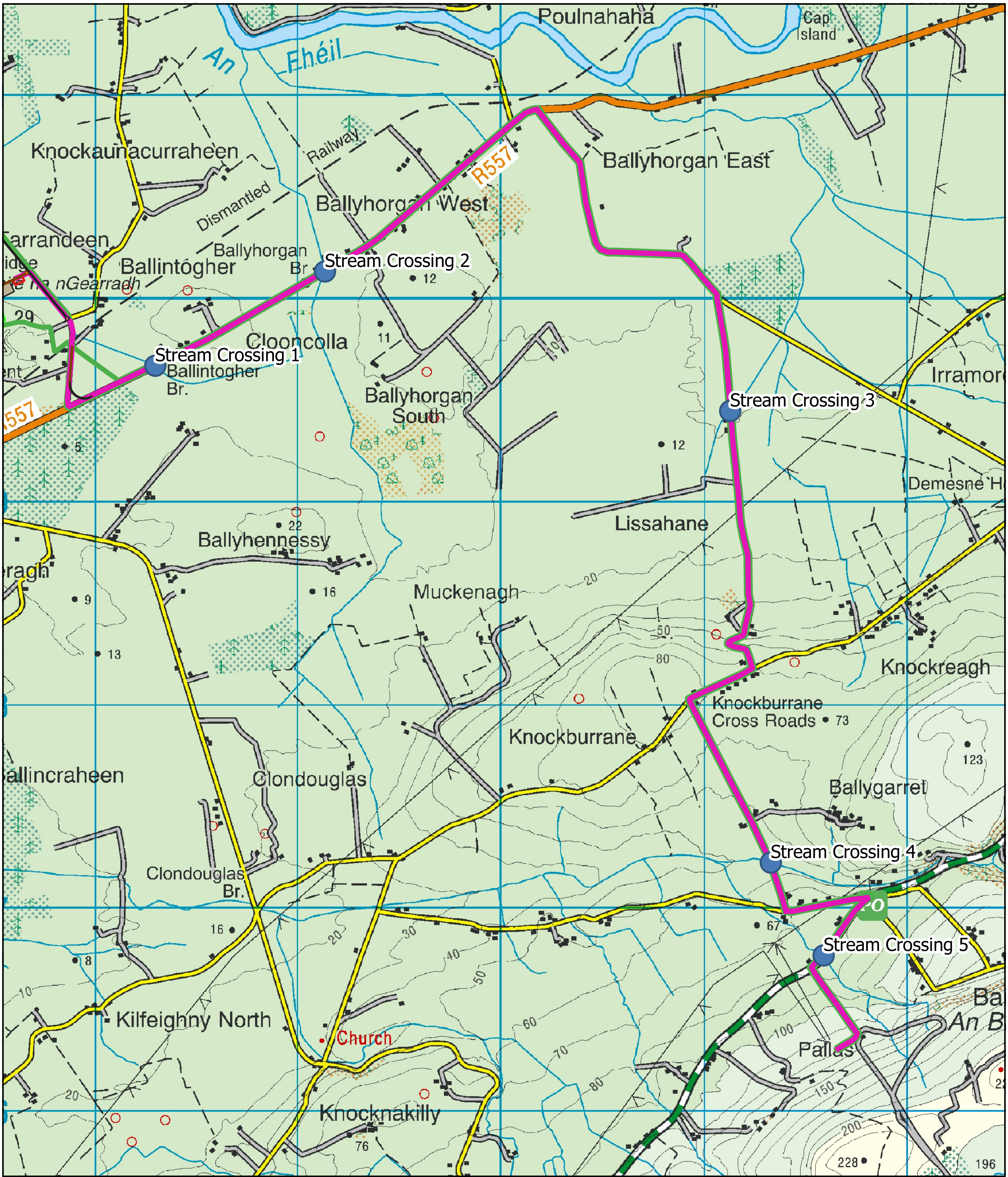
The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any adverse effects arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved licensed waste facility.

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Figure 4.32.

Table 4.4 Stream crossing methodology – Grid Route

Crossing no.	Type and size	Cover from road level to top of culvert/bridge	Maximum depth of trench from road level under watercourse	Description	Watercourse Crossing Option	Extent of In-stream Works
1	1500mm high stone singe arch bridge	200mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
2	1500mm high stone arch bridge	0 mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
3	500mm internal Ø concrete pipe	<200mm	n/a	Due to the lack of cover over the existing pipe, the cable will be installed under the existing pipe. No contact will be made with the watercourse during the works.	Option 2	None. No in-stream works required.
4	1500mm high stone arch bridge	290mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by	Option 4	None. No in-stream works required.

				means of directional drilling which will ensure that no contact will be made with the watercourse during the works.		
5	2000mm high stone arch bridge	350mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.



Map Legend

- EIAR Study Area
- Proposed 38kV Grid Connection
- Proposed Stream Crossings
- Proposed Substation

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Drawing Title	Grid Connection Stream Crossings
Project Title	Ballynagare Wind Farm
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 4.28
Scale: 1:25000	Date: 30.09.21

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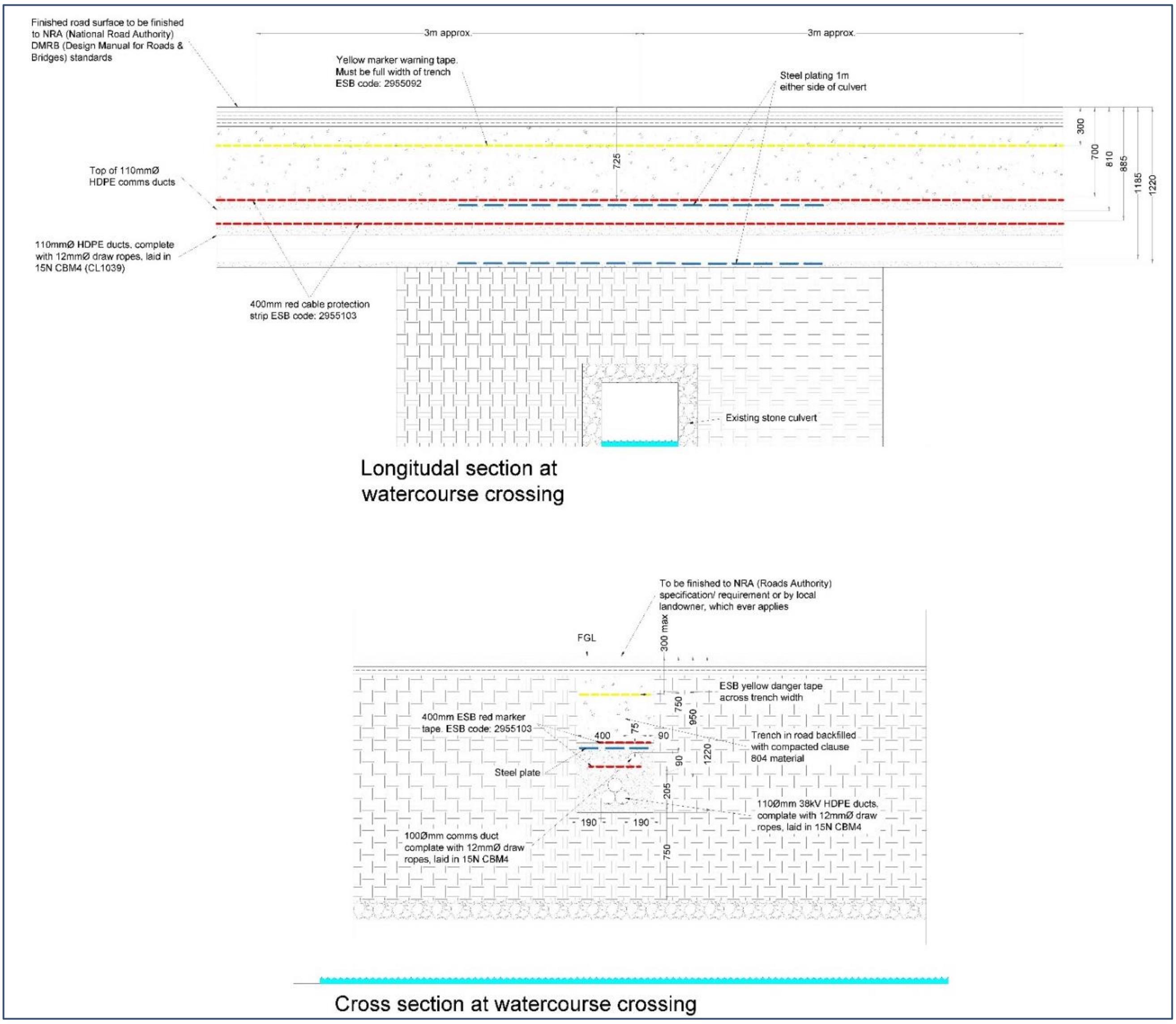

Figure 4.29 Culvert Crossing Option 1

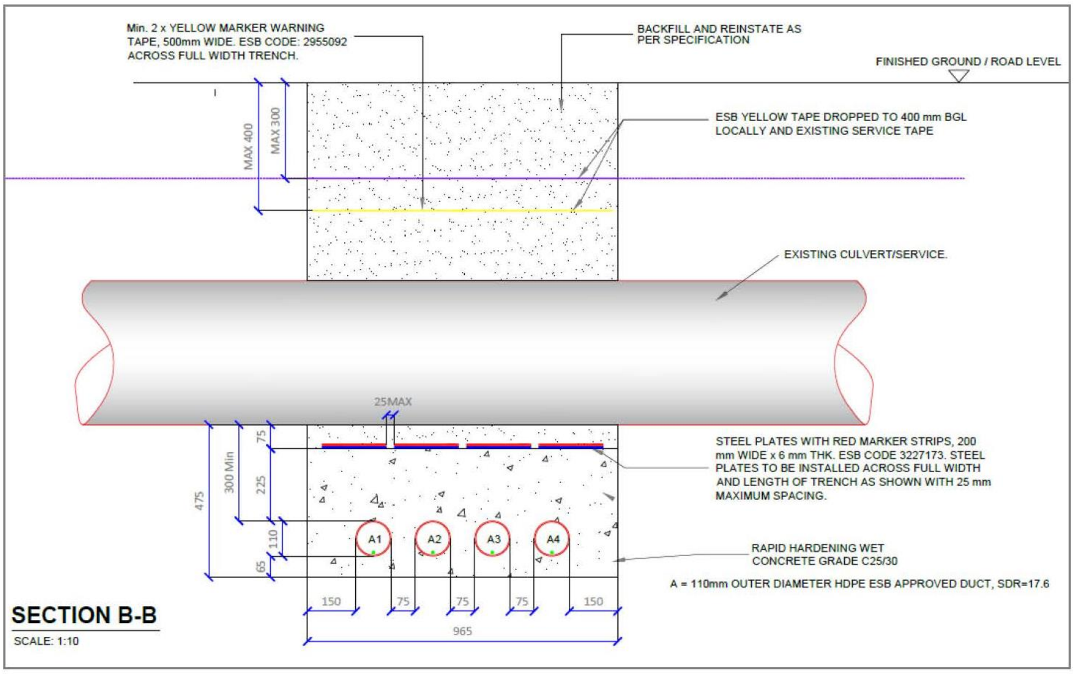

Figure 4.30 Culvert Crossing Option 2

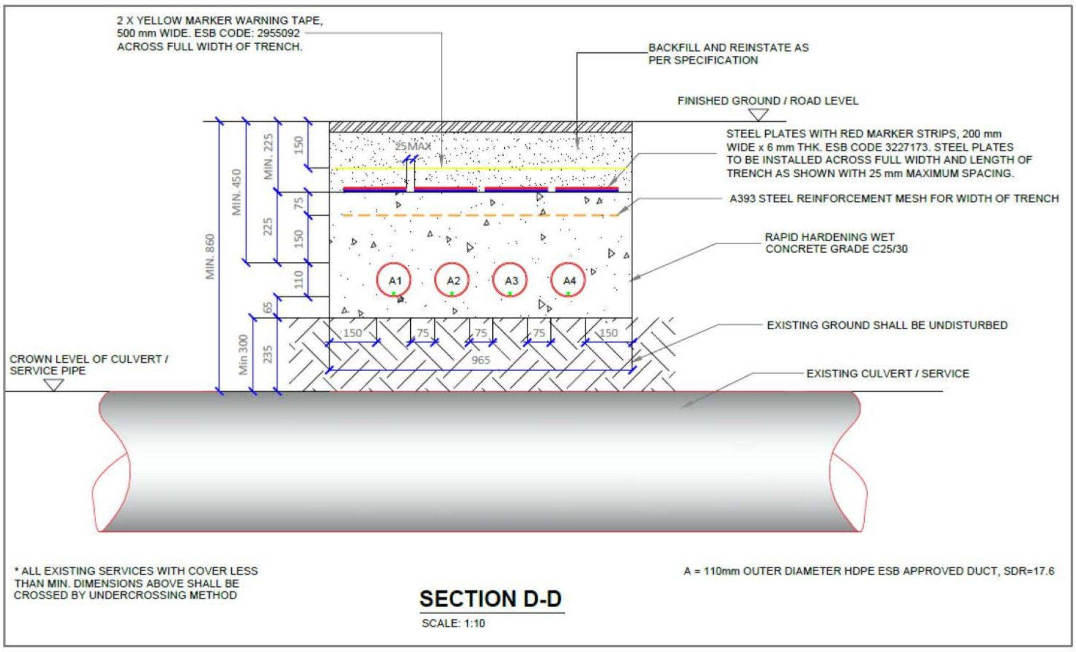

Figure 4.31 Culvert Crossing Option 3

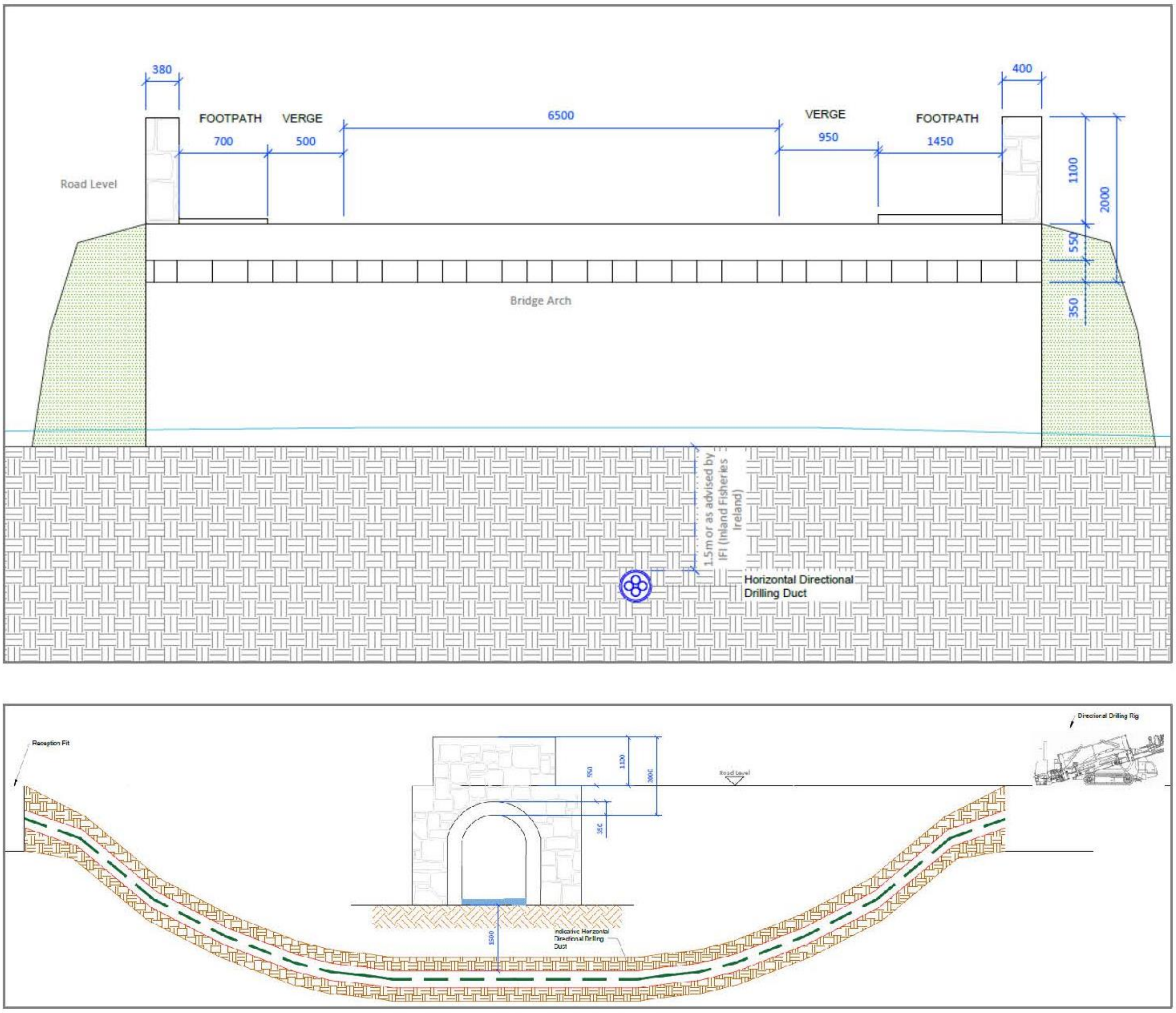

Figure 4.32 Culvert Crossing Option 4

4.8.9.5 General Precaution

Prior to any works commencing a dilapidation survey will be conducted of the entire route, photographing and noting any existing damage or defects to structure or road surfaces. A copy of this survey will be submitted to Kerry County Council prior to works commencing

Communication with the public, local residences and businesses as outlined in the CEMP along the route will be an important responsibility of the project supervisor. Keeping all affected parties up to date and informed both shortly prior and during the construction period at all times. Two to three weeks before any work commencing, reasonable efforts will be made to inform all affected parties of the oncoming works.

Signage will be erected in the weeks prior to any works commencing along and on adjacent roads to the proposed route notifying the public of the forthcoming construction. Contact details for the contractor and details of licence will also be posted along the proposed cable route during construction.

Every effort will be made to minimise the impact of the above works on local residences and traffic. Consideration will also be given to the agricultural community and works will be organised and sequenced so as not to inconvenience any such activities.

- All personnel will be inducted and made familiar with the method statements, risk assessments and traffic management plans involved.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate CSCS training.
- All personnel will have FÁS Safe Pass training
- Fire extinguishers and first aid supplies will be available in the work area.
- The road way will be maintained in clean condition at all times.
- Helmets, High Visibility clothing and safety footwear will be worn at all times.
- A competent foreman will be on site at all times.
- Excavations are back filled at the end of each working day.
- The trench will not be over crowded.
- Unauthorised access will be monitored and prevented.
- Pipe work will be lifted into position manually.
- Hand dig will be used to expose any services detected during the survey.

4.9 Operation

The proposed wind farm development is expected to have a lifespan of approximately 35 years. During this period, on a day-to-day basis the wind turbines will operate automatically, responding by means of anemometry equipment and control systems to changes in wind speed and direction.

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

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

4.10 Decommissioning

The wind turbines proposed as part of the proposed development are expected to have a lifespan of approximately 35 years. Following the end of their useful life, the wind turbines may be replaced with a new set of machines, subject to planning permission being obtained, or the site may be decommissioned fully, with the exception of the electricity substation.

Upon decommissioning of the proposed wind farm, the wind turbines would be disassembled in reverse order to how they were erected. All above ground turbine components would be separated and removed off-site for recycling. Turbine foundations would remain in place underground and would be covered with earth and reseeded as appropriate. Leaving the turbine foundations in-situ is considered a more environmentally prudent option, as to remove that volume of reinforced concrete from the ground could result in significant environment nuisances such as noise, dust and/or vibration. Site roadways could be in use for other purposes other than the operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site roads in situ for future use. If it were to be confirmed that the roads were not required in the future for any other useful purpose, they could be removed.

The on-site electricity substation will not be removed at the end of the useful life of the wind farm project, as permanent planning permission is being sought for this element of the proposed development. By the time the decommissioning of the project is to be considered, the on-site substation will likely form an integral part of the local electricity network, with a number of supply connections and possibly some additional generation connection. Therefore, the substation will have to be retained as a permanent structure and will not be demolished.

As noted in the Scottish Natural Heritage report (SNH) Research and Guidance on Restoration and Decommissioning of Onshore Wind Farms (SNH, 2013) reinstatement proposals for a wind farm are made approximately 30 years in advance, so within the lifespan of the wind farm, technological advances and preferred approaches to reinstatement are likely to change. According to the SNH guidance, it is therefore:

> *"best practice not to limit options too far in advance of actual decommissioning but to maintain informed flexibility until close to the end-of-life of the wind farm".*

APPENDIX 3

CEMP

Construction & Environmental Managemental Plan

Ballynagare Wind Farm

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1. INTRODUCTION

This Construction and Environmental Management Plan (CEMP) has been developed by MKO on behalf of Ballynagare Wind Farm Ltd. who intend to apply to Kerry County Council for planning permission to construct a renewable energy development and all associated infrastructure in the townlands of Ballynagare, Dysert Marshes, Dysert, Curraghcroneen, Farrandeen, Monument, and adjacent townlands in County Kerry.

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

Triggers for amendments to the CEMP will include:

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

This CEMP identifies the key planning and environmental considerations that must be adhered to and delivered during site construction and operation. The Contractor, as appointed by the Project Developer, will be required to implement all of the requirements set out in this CEMP. The CEMP may be updated and revised throughout the construction phase of the project, but all future iterations must meet or exceed the standards and requirements set out in this document and the Project Developer must be satisfied that all requirements set out in this document can and will be implemented in full by the appointed contractor.

The CEMP to be prepared by the appointed contractor will be a single, amalgamated document that can be used during the construction phase of the project, as a single consolidated point of reference relating to all construction, environmental and drainage requirements for the Planning Authority, developer and contractors alike. The CEMP may evolve over further iterations as the construction works progress, but at all times must meet or exceed the standards and requirements set out in this document. It will be the contractor's current version of the CEMP, which at any point in time, will guide the construction activities on site and the implementation of which will be audited by an Environmental Clerk of Works (ECoW).

1.1 Scope of the Construction and Environmental Management Plan

This report is presented as a guidance document for the construction phase of the proposed Ballynagare Wind Farm including connection to the national grid and junction accommodation works along the turbine delivery route. Where the term 'site' is used in the CEMP it refers to all works associated with the wind farm development including the grid connection, road junction and enabling works. The CEMP outlines clearly the mitigation measures and monitoring proposals that are required to be adhered to in order to complete the works in an appropriate manner.

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

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

Section 2 outlines the site and project details, detailing the targets and objectives of this plan along with providing an overview of anticipated construction methodologies that will be adopted throughout the project.

Section 3 sets out details of the environmental controls on site which looks at noise and dust controls. Site drainage measures, peat management and a waste management plan are also included in this section.

Section 4 sets out a fully detailed implementation plan for the environmental management of the project outlining the roles and responsibilities of the project team. A water quality monitoring plan is also included in this section.

Section 5 outlines the Emergency Response Plan to be adopted in the event of an emergency in terms of site health and safety and environmental protection.

Section 6 consists of a summary table of all mitigation proposals to be adhered to during the implementation of the project, categorised into three separate headings, 1) pre-commencement measures; 2) construction-phase measures and 3) operational-phase measures.

Section 7 consists of a summary table of all monitoring requirements and proposals to be adhered to during the implementation of the project, categorised into the following three separate headings; 1) Pre-commencement measures, 2) Construction-phase measures, and 3) Operational-phase measures.

Section 8 sets out an anticipated programme for the timing of the works.

Section 9 outlines the proposals for reviewing compliance with the provisions of this report.

2. SITE AND PROJECT DETAILS

2.1 Site Location and Description

The site of the proposed development is located in the townlands of Ballynagare, Dysert Marshes, Farrandeen, Monument, Knockaunacurraheen, Ballintogher, Ballnageragh, Clooncolla, Ballyhorgan West, Ballyhorgan East, Lissahane, Knockburrane, Ballygarret, Banemore, and Pallas, Co. Kerry. The proposed wind farm will comprise of the provision of a total of 7 no. wind turbines, with a maximum ground to top blade tip height of up to 170m, upgrading of existing and provision of new internal access roads. The proposed wind farm development will connect to the Nation Grid via a new grid connection to the existing Clahane substation via underground 38 kV cable.

The proposed development Study Area measures approximately 611 hectares . The Irish Grid Reference co-ordinates for the approximate centre of the site are (E89700, N132200). The town of Listowel is located approximately 9 km east of the proposed development site. The village of Lixnaw is located approximately 2 km south of the proposed development site.

Junction accommodation works will be required at 8 locations as further discussed in Section 2.3 below and Section 14 of the EIAR.

The proposed project layout is presented in Site Layout Drawings included with the application.

2.1.1 Description of the Development

During the construction phase of the project, civil works will include: excavation and construction of reinforced concrete turbine foundations; access road construction and widening of existing access roads; construction of a temporary compound; upgrading existing and installation of new watercourse crossings; construction of underground cabling; and, a permanent meteorological mast.

The design life of the project is expected to be 35 years.

The key components of the wind farm include the following:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
    - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
    - Hub height of 95m
    - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a height of 110 metres.
- Upgrade of existing roads and access junctions
- Provision of new site entrances, roads and hardstand areas
- 2 no. peat storage areas
- 2 no. construction compounds
- 1 no. borrow pit
- All site drainage works
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation

- Connection of the proposed 38kV on-site substation via underground cable in the public road to the entrance of the existing Clahane 110kV substation in the townland of Pallas
- All ancillary site and ground works, apparatus and signage

The proposed site layout showing individual elements of the development is shown in Figure 2-1 and Figure 2-2 and in the Site Layout Drawings.

2.1.1.1 Site Access

There are seven proposed site entrances into the site from the local roads in the area. The site will be accessed from the R557 via the local roadtravelling north from the R557 in the townland of Monument to the east of Lixnaw.. Initially the site is accessed via a new site entrance by turning northwest off this local road (and it is from this new entrance that substation site, southern construction compound, and borrow pit are accessed). The wind farm access road then crosses the existing Clogher Road from Lixnaw to Ballyduff to the north of the village of Lixnaw. The second and third site proposed site entrances are on the either side of this local road. These site entrances facilitate the crossing of the local road and will provide access to turbines 5, 6 and 7. Once the construction phase is complete it is intended that the third site entrance will become the main entrance for the wind farm.

The location of these entrances is shown on the site layout drawing in Figure 2-1. The proposed layout of the site entrances is shown on Figures 4-19 to 4-22 of the EIAR..

2.2 Targets and Objectives

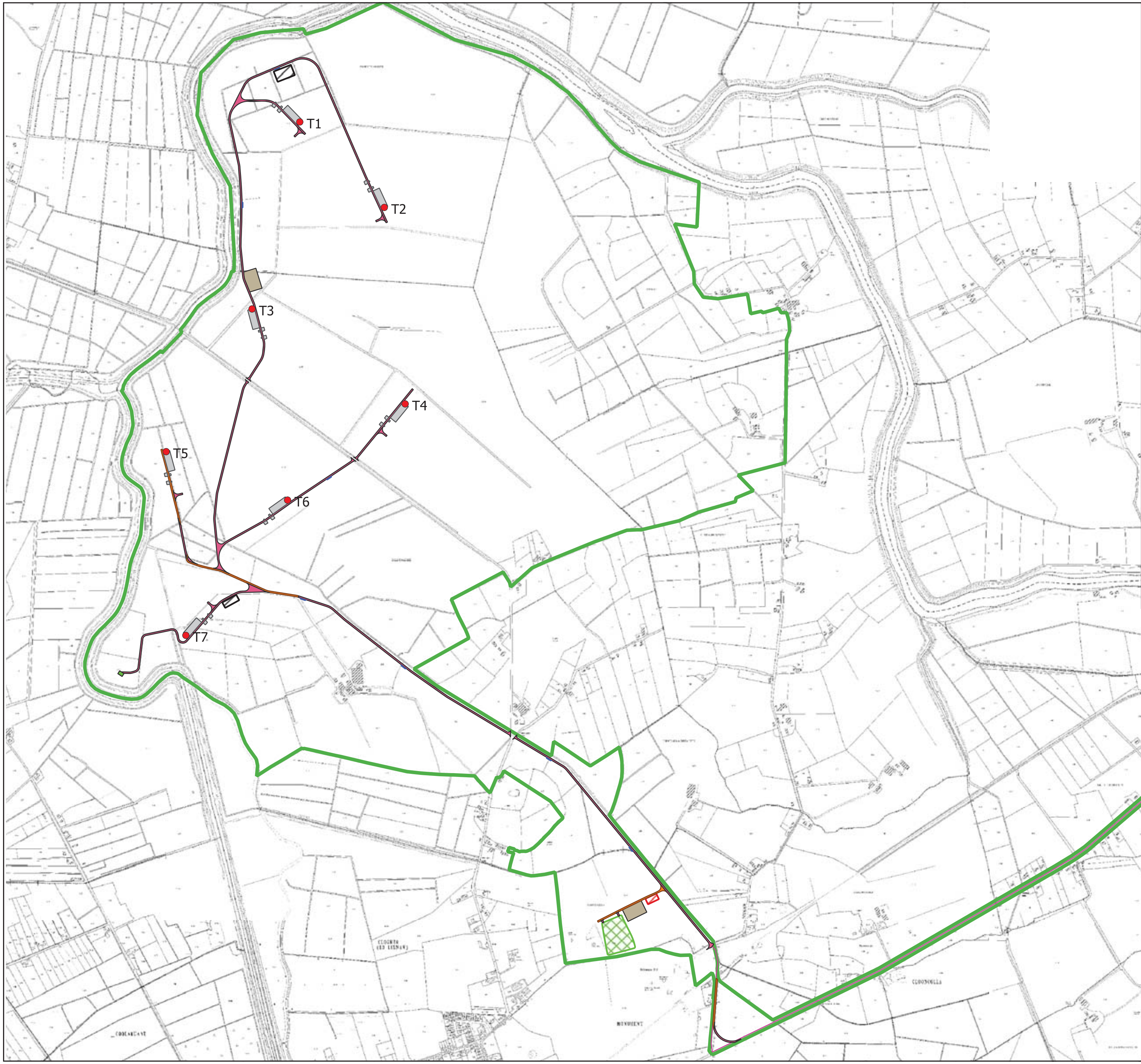
The following key targets and objectives will inform the final detailed design should the proposed development secure planning permission and proceed to the construction phase. This includes consideration of the buildability of the designs that emerge:

- Adopt a sustainable approach to construction and, ensure sustainable sources for materials supply where possible;
- Keeping all watercourses free from obstruction and debris;
- Avoidance of any pollution incident or near miss as a result of working around or close to existing watercourses and having emergency measures in place;
- Correct fuel storage and refuelling procedures to be followed;
- Air and noise pollution prevention to be implemented;
- Construction Methods and designs will be altered where it is found there is an adverse effect on the environment;
- Good waste management and house-keeping to be implemented;
- Using recycled materials if possible, e.g. excavated stone, soil and subsoil material;
- Avoidance of vandalism;
- Monitoring of the works and any adverse effects that it may have on the environment and,
- Provide adequate environmental training and awareness for all project personnel.

The key site objectives are as follows;

- Keep impact of construction to a minimum on the local environment, watercourses and wildlife;
- Comply with all relevant water quality legislation;
- Ensure construction works and activities are completed in accordance with mitigation and best practice approach presented in the Environmental Impact Assessment Report (EIAR) and associated planning documentation;
- Ensure construction works and activities are completed in accordance with any planning conditions for the development;

- Ensure construction works and activities have minimal impact/disturbance to local landowners and the local community;
- Ensure construction works and activities have minimal impact on the Natural Environment;



Map Legend

- EIAR Study Area Boundary
- Proposed Turbine Locations
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Turbine Foundation
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed New Roads
- Existing Roads for Upgrade
- Proposed Passing Bay
- Proposed Met Mast Location
- Proposed Temporary Peat Storage Areas
- Proposed 38kV Grid Connection

N

Drawing Title: Proposed Site Layout	
Project Title: Ballynagare Wind Farm	
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 2.1
Scale: 1:15000	Date: 2021.10.13

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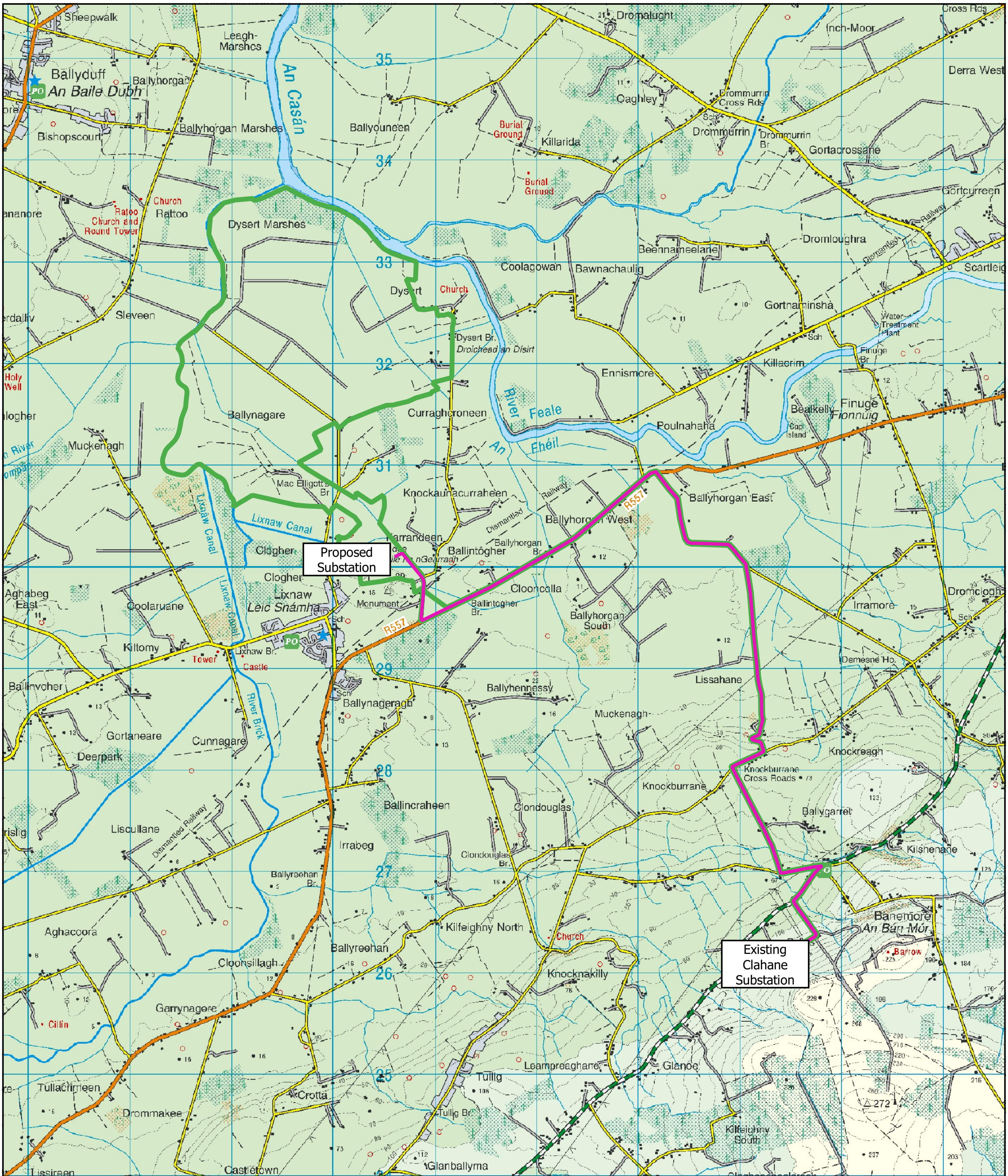

Map Legend

EIAR Study Area

Proposed 38kV Grid Connection

Drawing Title	Grid Connection Route
Project Title	Ballynagare Wind Farm
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 2.2
Scale: 1:50000	Date: 30.09.21

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2.3 Overview of the Proposed Construction Methodology

2.3.1 Introduction

An experienced main contractor will be appointed for the civil works for the construction phase of the Proposed Development. The main contractors will comply with this CEMP and any revisions made to this document throughout the construction phase. An overview of the anticipated Construction Methodologies is provided below.

2.3.2 Overview of Proposed Construction Methodology

The EIAR includes construction methodologies for various elements of work to be undertaken as part of the project. These construction methodologies are reproduced in the following sub-sections but will be superseded by an appointed contractor's construction method statements, which will form part of the CEMP. The contractor's construction method statements will be prepared to take account of the detailed engineering, geotechnical and detailed drainage design which will be prepared prior to commencement of construction and all requirements of this CEMP.

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

- Temporary Construction Compound;
- Borrow Pit;
- Drainage System;
- Upgrade of Existing Roads;
- New Site Access Roads;
- Turbine Foundations and Anemometry Mast Foundations;
- Crane Hardstands;
- Electricity Substation and Control Building;
- Temporary Peat Storage Areas
- Cable Trenching;
- Watercourse Crossings;
- Grid Connection;
- Turbine Delivery Route Accommodation Works; and,
- Site Reinstatement

2.3.2.1 Temporary Construction Compound

The proposed site temporary construction compound will be centrally located in the site, adjacent to the proposed substation, between proposed locations of turbines no. 5 and no. 7. The location of the construction compound is shown on the site layout drawings in Figure 2-1 The construction compound will consist of temporary site offices, staff facilities and car-parking areas for staff and visitors.

The compound will typically be constructed as follows:

- The area to be used as the compound will be marked out at the corners using ranging rods or timber posts. Drainage runs, and associated settlement ponds will be installed around the perimeter (refer to Section 3.2 below & EIAR Section 4.6);
- The compound will be established using a similar technique as the construction of the excavated site tracks as discussed below;
- Where required, a layer of geogrid will be installed, and compacted layers of well graded granular material will be spread and lightly compacted to provide a hard area for site offices and storage containers;

- Areas within the compound will be constructed as site roads and used as vehicle hard standings during deliveries and for parking;
- A bunded containment area will be provided within the compound for the storage of lubricants, oils and site generators etc.;
- If necessary the compound will be fenced and secured with locked gates, although fencing would only be utilised where significant risk of danger to third parties or vandalism is envisaged;
- Upon completion of the project the compound will be decommissioned by backfilling the area with the material arising during excavation, landscaping with topsoil as required;
- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used on site for toilet facilities. This will be maintained by the service contractor on a regular basis and will be removed from the site on completion of the construction phase; and,
- The water supply to the site will be from a temporary water storage tank which will be filled using a mobile water tank which will source water locally as required.

2.3.2.2 Borrow Pit

The proposed development will comprise one proposed borrow pit, to be located in the south of the site, south of turbines no. 4 and 5, as shown in Figure 2-1. The borrow pit will typically be excavated and backfilled as follows:

- The area to be used for the both borrow pit will be marked out at the corners using ranging rods or timber posts. Drainage runs, and associated settlement ponds will be installed around the perimeter;
- The initial borrow pit excavation will involve removal of peat (if present) and mineral soil to the top of bedrock. These materials will be stored temporarily or placed around the borrow pit to form berms to prevent surface water inflow to the borrow pit excavation;
- Interceptor drainage ditches will be excavated on all sides of the borrow pit to catch surface water runoff, and direct it to downstream re-distribution locations;
- The bedrock material will be extracted from the borrow pit and stockpiled or used as required;
- The use of material won from the borrow pit will be sequential with new road construction or turbine base formations;
- Temporary stockpiling of aggregates will be required to accommodate the cut and fill operations within the borrow pit, and the progression of access roads and turbine excavations;
- As the borrow pit excavation progress and become deeper, surface water and groundwater ingress will be removed via pumping to settlement ponds, and re-distribution locally across natural vegetated areas. Where required, additional specialist water treatment measures will be employed to ensure no deterioration in downstream water quality occurs;
- When extraction ceases within the borrow pit, the uphill face of the rock will be stepped, and deposits of soil will be placed which will assist in the re-vegetation of the rock face; and,
- The extraction area of the borrow pit will have to be permanently secured and a stock-proof fence will be erected around the borrow pit to prevent access to these areas as well as the installation of appropriate health and safety signage.

2.3.2.3 Drainage System

The early establishment of temporary drainage facilities will reduce the risk of pollution problems during construction. In addition, construction operations will adopt best working practices. The development of the site will need to be phased accordingly. The construction of the drainage will start from the downstream sections and progress upstream, connecting conveyance systems with other

drainage features as each development phase progresses. They will therefore need to be designed with sufficient flexibility to respond to an early phase of limited incoming flow during the construction phase.
Detailed measures to address surface water management based upon the design criteria and philosophy will be implemented. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated, and settlement ponds constructed to eliminate any suspended solids within surface water running off the site. Surface water management and drainage design is dealt with in Section 3.2 below and Section 4.6 of the EIAR.

2.3.2.4 Upgrade of Existing Roads

It is proposed to utilise the existing road network as much as possible with approximately 1.75 km of existing roadway requiring upgrade. These roads will require upgrading which will entail widening of the roadway to a total running width of approximately 6.0 m, with wider sections at corners and on the approaches to turbine locations, and the laying of a new surface dressing on the existing section of roadway where necessary. The road widening will generally be undertaken as follows:

- If it is considered that the current road formation level is adequate to support required bearing, then no upgrade or widening works will be completed;
- Otherwise, where required, the subsoil in the existing road verge will be excavated down to a suitable formation layer of rock and the spoil deposited in the peat reinstatement areas;
- Well-graded imported granular fill or material won from the borrow pits will be spread and compacted to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used. These layers of granular fill will be brought to the same level as the top of the existing paved surface;
- A layer of geo-grid will be installed directly onto the top of the granular fill layer and the existing road surface where required and a layer of finer well graded stone for the running surface will be laid on the geo-grid and compacted;
- Prior to any works commencing on the upgrade of existing roads, the requirement for additional roadside drainage will be considered by the Project Hydrologist in line with the proposals outlined in Section 4.1.4 below; and,
- Where road widening is required in an area where the peat depth is greater than 1.5 m, it will be necessary to complete the road upgrade using a floating road methodology as detailed in Section 2.3.2.5 that follows.

2.3.2.5 New Site Access Roads

New roadway will be required in areas where existing roads are not already present, or where existing sections are too steep or otherwise unsuitable for the required purpose in the case of the proposed development. Maximum use has been made of the existing machine tracks and fire breaks within areas of forestry to ensure that the felling area required to make way for proposed new site roads is kept to a minimum. There are approximately 5.39 km of new access roads to be constructed at the site. It is also proposed to construct 0.29 km of new farm track link roads between turbines no. 4 and no. 5.

In a number of areas across the site, floating roads will be required where peat depths exceed c1.5m. Floating roads will be constructed using either a lightweight construction methodology which includes the use of layers of brash and lumber either side of a geogrid membrane where required and capped with suitable stone material or the use of geogrid capped with a stone material

The new access roads will be constructed as follows:

- Establish alignment of the new site roads from the construction drawings and mark out the centre lines with ranging rods or timber posts;

- The road layout has been designed to avoid or limit the number of crossings of natural watercourses;
- Where existing culverts are to be upgraded or extended, the works will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland (IFI);
- The access tracks will be of single-track design with an overall width of 6 m. There will be some local widening on the bends, junctions and around turbine bases for the safe passage of large vehicles;
- The excavated road section will, where practicable have turf stripped over the area of the excavation and stored growing side up for reuse. This area will be oversized to facilitate the excavated subsoil material. The subsoil material will subsequently be capped with topsoil to form an earth bund around the peat reinstatement areas identified;
- All peat and overburden excavated will be used as part of the borrow pit restoration or in reinstatement areas. Topsoil will be temporarily stockpiled locally for reuse for landscaping the backfill placed above the foundations;
- The subsoil will be excavated down to a suitable formation layer of either firm clay or bedrock;
- Where floating roads are to be constructed, the subsoil will not be excavated but a layer of geo-grid or layers of brash and lumber will be laid directly on to the peat surface.
- For both excavated and floating roads, the road will be constructed using well-graded granular fill will be spread and compacted in layers to provide a homogeneous running surface. The thickness of layers and amount of compaction required will be decided by the Construction Manager based on the characteristics of the material and the compaction plant to be used;
- All new roadways will be constructed with a camber to aid drainage of surface water;
- Batters will generally be sloped to between 1:1 and 1:2 (depending on depth and type of material) and will be left as cut to re-vegetate naturally with local species. Design slopes will be informed by the Geotechnical Engineer;
- At bends or steep inclines from the roads, reflective snow poles will be erected to warn traffic on dark mornings and evenings that there is a turn in the road or a sharp incline beyond the site road; and
- All rock won from the borrow pit areas that are to be used in road construction on site will be tested in accordance with the relevant standard (*BS 812-111:1990 Testing aggregates. Methods for determination of ten percent fines value.*)

In addition, where floating roads are required, the following measures will be adopted as part of the construction methodology:

- Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than three metres.
- Floating road construction will be to the line and level requirements as per detailed engineering design.
- Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.
- Construction of road to be in accordance with appropriate design from the designer.
- The typical make-up of the new floated access road is 500 to 750mm of selected granular fill with 2 no. layers of geogrid.
- Following the detailed design of the floated access roads it may be deemed necessary to include pressure berms either side of the access road in some of the deeper peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road will reduce the likelihood of potential bearing failures beneath the access road.
- Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone on to the peat shall not be carried out.
- To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a ten metres length of constructed floating road.

- Where it is not possible to end-tip over a 10m length of constructed floating road then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a ten metre length of constructed floating road.
- Following end-tipping a suitable bull-dozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.
- A final surface layer shall be placed over the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

2.3.2.6 Turbine and Anemometry Mast Foundations

The wind turbines and anemometry mast foundations will be a reinforced concrete base designed to the appropriate standards (*BS EN 1992-1-1:2004+A1:2014 Eurocode 2: Design of Concrete Structures*). Foundation loads will be provided by wind turbine and mast supplier, and factors of safety will be applied to these in accordance with European design regulations. The turbine will be anchored to the foundation using a bolt assembly which shall be cast into the concrete. The anemometry mast is typically a free-standing structure which is also anchored to the reinforced concrete foundation or could be supported by guyed wires radiating out 51 metres in three directions from the tower. It is anticipated that the foundations for both the turbines and the anemometry mast will be either ground bearing foundations and that the formation level of the turbine foundations will be on the lower mineral subsoil or bedrock. Bases will measure approximately 21 m in diameter. They will likely be formed 1 m below the base of the peat layer on stiff subsoil material or bedrock, or at a suitable level directed by the Geotechnical Engineer/Designer. The foundations will be constructed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter;
- Where practical, the turf will be stripped over the area of the excavation and stored growing side up for reuse, the subsoil will be excavated and stored to one side for reuse during the landscaping around the finished turbine;
- No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practices;
- All groundwater and surface water arising from turbine base excavation will be pumped to the dirty water system and treated in settlement ponds, and/or specialist treatment systems, prior to discharge from the works area;
- Soil excavation shall be observed by a qualified archaeologist in accordance with a scheme of archaeological monitoring, in order to identify any significant remains as they come to light;
- At excavated turbine bases the excavation will be raised to formation level by compacted layers of well graded granular material will be spread and compacted to provide a hard area for the turbine foundation; and,
- Where an excavated turbine base cannot be used due to the depth of peat, a piled foundation using reinforced concrete piles will be installed.

Ground bearing reinforced concrete bases will be completed as follows:

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

- The foundation anchorage system will be checked both for level and line prior to the concrete being installed in the base. These checks will be passed to turbine manufacturer for their approval;
- Concrete will be placed using a concrete pump and compacted when in the forms using vibrating pokers to the levels and profile indicated on the drawings. Upon completion of the concreting works the foundation base will be covered and allowed to cure;
- Steel shutters will be used to pour the circular chimney section;
- Earth wires will be placed around the base;
- The foundation will be backfilled with a cohesive material, where possible using the material arising during the excavation and landscaped using the vegetable soil set aside during the excavation. A gravel footpath will be formed from the access track to the turbine door and around the turbine for maintenance; and,
- Soil, rock, and other materials excavated during construction shall not be left stockpiled on-site following completion of works. Excavated areas shall be appropriately restored within three months of the date of commissioning of the wind farm.

Reinforced concrete piled foundations will be completed as follows:

- The extent of the excavation will be marked out and will include an allowance for trimming the sides of the excavation to provide a safe working area and slope batter.
- No material will be removed from site and storage areas will be stripped of vegetation prior to stockpiling in line with best working practices.
- A piling platform for the piling rig will be constructed. This can be done in two ways depending on the bearing capacity of the underlying soil.
    - The first method is to lay geo-textile on the existing surface and a stone layer will then be placed on top of the geo-textile by an excavator and compacted in order to give the platform sufficient bearing capacity for the piling rig.
    - The second method is to excavate the soils to a suitable intermediate mineral subsoil and backfill to the formation level.

- The piling rig, fitted with an auger, will then bore through the soft material with a sleeve fitted around the auger to prevent the sidewalls of the peat from collapsing. The borehole is then extended to a suitable depth into the subsoil/bedrock.
- When the auger and the sleeve are removed high tensile steel cages will be lowered into the boreholes. These steel cages will extrude above the level of the top of the concrete pile.
- As the auger is removed concrete is pumped into the borehole.
- Reinforcing steel on the top of the pile will tie to the foundation base steel.

The procedure for standard excavated reinforced concrete bases as outlined above can be applied from here.

2.3.2.7 Crane Hardstands

All crane pads will be designed taking account of the loadings provided by the turbine manufacturer and will consist of a compacted stone structure. The crane hardstands will be constructed in a similar manner to the excavated site roads and will measure approximately to the turbine manufacturer's requirements. Where an excavated crane hardstand cannot be used due to the depth of peat, the hardstand will be supported by using reinforced concrete piles as per the methodology outlined for piled turbine foundations summarised above. The position of the crane pads varies between turbine locations depending on topography, position of the site access road, and the proposed turbine position.

2.3.2.8 Electricity Substation and Control Building

An electricity substation and associated control building are proposed to be constructed within the site, adjacent to the existing access road, as shown in Figure 2-1. The substation and control buildings will be constructed by the following methodology:

- The area of the buildings will be marked out using ranging rods or wooden posts and the soil stripped and removed to a temporary placement area for later use in landscaping. No material will be removed from site and the temporary placement areas will be stripped of vegetation prior to stockpiling in line with best working practices;
- The dimensions of the substation area will be set to meet the requirements of the ESB and the necessary equipment to safely and efficiently operate the wind farm;
- The foundations will be excavated down to the level indicated by the Project Engineer. The foundations will be shuttered and poured with reinforced concrete. An anti-bleeding admixture will be included in the concrete mix;
- The substation will be constructed with masonry blockwork. The block work walls will be built up from the footings to damp-proof course (DPC) level and the floor slab constructed, having first located any ducts or trenches required by the follow on mechanical and electrical contractors;
- The block work will then be raised to wall plate level and the gables and internal partition walls formed. Scaffold will be erected around the outside of the building for this operation;
- Concrete roof slabs will be lifted into position using an adequately sized mobile crane;
- The timber roof trusses will then be lifted into position using a telescopic load all or mobile crane depending on site conditions. The roof trusses will then be felted, battened, slated and sealed against the weather;
- Due to the specific nature of the proposed development there will be a very small water requirement for occasional toilet flushing and hand washing, and therefore the water requirement of the proposed development does not necessitate a potable source. It is proposed to harvest rainwater from the building roofs.
- The electrical equipment will be installed and commissioned;
- Perimeter fencing will be erected around the substation and control building compound area;
- All wastewater from the staff welfare facilities in the control buildings by means of a sealed storage tank which will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying; and,
- The construction and components of the substation will be to ESB or EIRGRID specifications;

2.3.2.9 Temporary Peat Storage Areas

The total estimated volume of peat to be excavated during the construction phase of the proposed development is 71,127m^3. Selected areas, within the site have been chosen as peat repository areas. The volume of excavated peat and overburden will be managed as outlined below:

- Excavators will remove the peat from the permanent development footprint areas i.e. excavated roads, hardstanding areas and turbine foundation areas.
- Temporary, sealed stockpiling areas, located adjacent to the hardstanding areas and turbine foundation areas, will be chosen following onsite discussions between the construction site manager, an ecologist, a geotechnical engineer and hydrologist.
- The excavators will move the excavated peat to the designated temporary stockpiling areas within the construction and soft levelled areas.
- The temporary stockpiling areas will be surrounded by silt fences to ensure sediment-laden run-off does not occur.

- The excavated peat will remain in these areas over a period of time until the volume of the peat has reduced as the water drains out of the mounded peat.
- The excavators will then load the peat directly into dump trucks, to transport the peat to the nearest peat repository area.
- The material will be backfilled into the peat reinstatement areas and will be spread evenly across the area.

This method of managing the volume of surplus peat and other overburden material will ensure that no excavated material will be left on-site, adjacent to access roads and turbine locations, following the completion of the construction works.

2.3.2.10 Cable Trenching

The transformer in each turbine is connected to the substation through a network of buried electrical cables. Fibre-optic cables will also connect each wind turbine to the wind farm control building in the substation compound. The ground is trenched typically using a mechanical digging machine. The top layer of soil is removed and saved so that it is replaced on completion. The cables are bedded with suitable material unless the ground conditions are such that no bedding is required. The depth of the cables are to meet all national and international requirements and will generally be up to 1.3 m below ground level depending on the ground conditions that are encountered. A suitable marking tape is installed between the cables and the surface. On completion the ground will be reinstated as per its original condition as outlined in Figure 4-11 of the EIAR. The route of the cables will generally follow the access tracks to each turbine location.

2.3.2.11 Grid Connection

A proposed connection to the national electricity grid will be made via an underground 38 kV electricity cable originating from the Ballynagare Wind Farm, running 7km southeast to the existing Clahane electricity substation in the townland of Pallas, Co. Kerry. The exact position of the cable/joint bays within the road curtilage will be subject to ESB/Eirgrid and Kerry County Council approval and a Road Opening Licence will be obtained.

The installation of the underground electrical cable will be completed using the following construction methodologies:

2.3.2.11.1 Parallel Road Excavations in Road and in Grass Margin

The grid connection route generally follows the existing road corridor. The cabling works are summarised as follows:

- The area where excavations are planned will be surveyed and all existing services will be identified.
- All relevant bodies i.e. ESB, Kerry County Council etc. will be contacted and all drawings for all existing services sought.
- A traffic management plan will be set up prior to any works commencing.
- A road opening license will be obtained where required and all plant operators and general operatives will be inducted and informed as to the location of any services.
- Excavation permit will be completed and all plant operators and general operatives will be inducted and informed as to the location of any services.
- A 13 tonne rubber tracked 360-degree excavator will be used to excavate the trench to the dimensions specified in the ESB Networks document, *Specification for the Installation of Ducts and Structures for Underground Power Cables and Communications Cables.*
- The 33 kV and 38 kV trench material build-up is designed to the *Functional Specification for the Installation of Ducts and Ancillary Structures for 38kV Underground Power Cables and Associated Communications Cables for Contestable Projects,* No. 18150. The

20 kV trench material build-up is designed to comply with the *Functional Specification for the Installation of Ducts and Ancillary Structures for 20kV Underground Power Cables and Associated Communications Cables for Contestable Projects*, No.18152.

- Where rock is encountered and requires removal, it will be done so using a hydraulic rock breaker. Blasting will not be used as a means of rock extraction on the grid connection works.
- All excavated material not used for backfilling will be removed to the on-site peat repositories, or to an approved landfill, or if suitable, stockpiled and reused where appropriate.
- All excavated material not used for backfilling will be removed from site using trucks.
- The trench depth is specified at 1220 mm and trench support will not be required, however where depths exceed 1250 mm trench support will be installed, or the trench sides will be benched or battered back where appropriate.
- Any ingress of ground water will be removed from the trench using submersible pumps.
- A silt filtration system will be used to prevent contamination of any watercourse.
- Once the trench has been excavated a base layer of lean concrete mix with a tested compression strength of at least 15 Newton per square millimeter (N/mm^2), to cement bound material category 4 (CBM4) will be installed and compacted. All concrete will be offloaded directly from the concrete truck directly into the trench.
- Ducting will then be placed in the trench as per specification, approved cable ties will be used where required to secure the trefoil ducts together (at 3 m centres).
- Once the trefoil ducts have been installed couplers will be fitted and capped to prevent any dirt etc. entering the duct. In poor ground conditions the end of the trefoil ducts will be shimmed up off the bed of the trench to prevent any possible ingress of water dirt. The shims will be removed again once the next length has been connected.
- Extreme care will be taken to ensure that all duct collars (both ends) are clean and in good condition prior to ducts being joined.
- The as-built location of the ducting will be surveyed using a total station/GPS.
- 15 N/mm^2 CBM4 concrete will be carefully installed so as not to displace the ducting to the underside of the communications duct and compacted as per approved detail.
- Spacers will be used to ensure that the correct cover is achieved at both sides of the trefoil ducting.
- ESB red marker board will be fitted above the trefoil ducting.
- The Communication duct will be fitted and kept to one side of the trench ensuring that the minimum cover is achieved and 15 N/mm^2 CBM4 concrete will be placed to the specified cover and compacted, see Plate 2-1.
- ESB red marker board will be installed and the remainder of trench will be backfilled in two compacted layers with approved material (lean mix concrete/clause 804).
- Yellow marker tape will be installed as per approved detail specifications, 300 mm maximum below finished road/ground level.
- Topsoil will be permanently reinstated where required or clause 804 stone used to finish the trench on grass margins where appropriate to give a more trafficable surface.
- Road finish: Where the cable route runs within the carriageway of a road the excavated area will be resurfaced and finished to the requirements of the relevant Roads Authority.

The contractor will ensure that there are no open excavations at the end of each working day with all trenches backfilled accordingly. Any works areas which have to be secured with will be done so using mobile security fencing which will be erected to secure the works and prevent the general public enter the works area during the works as well as outside normal working hours. It is not proposed to use hoarding as a means of securing the works area.

Plate 2-1 View of concrete cover in cable trench

2.3.2.11.2 Existing Underground Services

Any underground services encountered along the route will be surveyed for level and the ducting will pass over the service provided adequate cover is available. A minimum clearance of 300 mm will be required between the bottom of the ducts and the service in question. If the clearance cannot be achieved the ducting will pass under the service and again 300 mm clearance between the top of the communications duct and bottom of the service will be achieved. In deeper excavations, an additional layer of marker tape will be installed between the communications layer and yellow top-level marker tape. If the required separation distances cannot be achieved then a number of alternative options are available such as using steel plates laid across the width of the trench and using 35 N/mm^2 concrete surrounding the ESB ducts where adjacent services are within 600 mm, with marker tape on the side of the trench. Back fill around any utility services will be with dead sand/pea shingle where appropriate. All excavations will be kept within the roadway boundaries, i.e. in road or grass margin.

2.3.2.11.3 Joint Bays

Joint bays are pre-cast concrete chambers where lengths of cable ducting will be connected. They will be located at various points along the ducting route approximately every 600-1200 m. Where possible joint bays will be located in areas where there is a natural widening/wide grass margin on the road in order to accommodate easier construction, cable installation and create less traffic congestion. During construction, the joint bay locations will be completely fenced off and will be incorporated into the traffic management system. Once they have been constructed, they will be backfilled temporarily until cables are being installed.

2.3.2.11.4 Watercourse / Culvert Crossing – Grid Connection Cable Route

There are a total of 5 no. watercourse crossings on the grid connection cable route, the rest of the crossings on the proposed cable route are classified as minor culverts. Construction methodologies have been proposed to eliminate the need for instream works.

A list of the stream crossings along the grid connection route and the proposed crossing method at each location is provided in Table 2-1 below.

2.3.2.11.5 Piped Culvert Crossings over Culvert– Option 1

Watercourses will not be directly impacted upon since no instream works or bridge/culvert alterations are proposed. Where sufficient cover exists above the culvert, the trench will be excavated above the culvert and the ducts will be installed in the trefoil arrangement passing over the sealed pipe where no contact will be made with the watercourse. This method of duct installation is further detailed in Drawing no 05801-DR-119 of the Planning Application Drawings.

2.3.2.11.6 Piped Culvert Crossings under Culvert – Option 2

Where the culvert consists of a socketed concrete or sealed plastic pipe where sufficient cover over the culvert does not exist to accommodate the cable trench, a trench will then be excavated beneath the culvert and cable ducts will be installed in a flatbed arrangement under the sealed pipe.

If these duct installation methods cannot be achieved or utilised, the ducts will be installed by alternative means as set out in the following sections. This method of duct installation is further detailed Drawing no 05801-DR-116 of the Planning Application Drawings.

2.3.2.11.7 Flatbed Formation over Culverts – Option 3

Where cable ducts are to be installed over an existing culvert/bridge where sufficient cover cannot be achieved by installing the ducts in a trefoil arrangement, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert or the depth that can be achieved in the deck of a bridge structure. The ducts will be laid in this trench in a flatbed formation over the existing culvert/bridge and will be encased in 6mm thick steel galvanized plate with a 35N concrete surround as per ESB Networks specification.

After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench.

Where a bridge or culvert has insufficient deck cover to fully accommodate the required ducts, the ducts can be laid in a flatbed formation partially within the existing road make up. Where this option is to be employed, the ducts will also be encased in steel with a concrete surround as per Eirgrid and/or ESB Networks specifications. In order to achieve cover over these ducts and restore the carriageway of the road, it may be necessary to locally raise the pavement level to fully cover the ducts. The increase road level will be achieved by overlaying the existing pavement with a new wearing course as required. Any addition of a new pavement will be tied back into the existing road pavement at grade. After the crossing over the culvert has been achieved, the ducts will resume to the trefoil arrangement within a standard trench. This method of duct installation is further detailed in Drawing no 05801-DR-117 of the Planning Application Drawings.

The flatbed formation methodology will also be used at bridge structures where there is an existing footpath. The cables will be installed in the same flatbed arrangement where the existing footpath will be excavated to allow for the installation of the cables. The footpath will be reinstated after cable ducts have been installed. Where there is no existing footpath, it is proposed to install a footpath to encase the cable ducts after they have been laid in the flatbed formation.

2.3.2.11.8 Horizontal Directional Drilling – Option 4

In the event that none of the above methods are appropriate, directional drilling will be utilised.

The directional drilling method of duct installation will be carried out using Vermeer D36 x 50 Directional Drill (approximately 22 tonnes), or similar plant, will be utilised for the horizontal directional drilling at watercourse/culvert crossings listed below. The launch and reception pits will be approximately 2m wide, 3m long and 1 m deep. The pits will be excavated with a suitably sized excavator. The drilling rig will be securely anchored to the ground by means of anchor pins which will be attached to the front of the machine. The drill head will then be secured to the first drill rod and the operator shall commence to drill into the launch pit to a suitable angle which will enable him to obtain the depths and pitch required to the line and level of the required profile. Drilling of the pilot bore shall continue with the addition of 3.0m long drill rods, mechanically loaded and connected into position.

During the drilling process, a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ (environmentally friendly product (not toxic to aquatic organisms)) and water is pumped through the centre of the drill rods to the reamer head and is forced into void and enables the annulus which has been created to support the surrounding sub soil and thus prevent collapse of the reamed length. Depending on the prevalent ground conditions, it may be necessary to repeat the drilling process by incrementally increasing the size of the reamers. When the reamer enters the launch pit, it is removed from the drill rods which are then passed back up the bore to the reception pit and the next size reamer is attached to the drill rods and the process is repeated until the required bore with the allowable tolerance is achieved.

The use of a natural, inert and biodegradable drilling fluid such as Clear Bore™ is intended to negate any adverse effects arising from the use of other, traditional polymer-based drilling fluids and will be used sparingly as part of the drilling operations. It will be appropriately stored prior to use and deployed in the required amounts to avoid surplus. Should any excess drilling fluid accumulate in the reception or drilling pits, it will be contained and removed from the site in the same manner as other subsoil materials associated with the drilling process to an approved licensed waste facility.

Backfilling of launch & reception pits will be conducted in accordance with the normal specification for backfilling excavated trenches. The directional drilling methodology is further detailed in Drawing no 05801-DR-130 of the Planning Application Drawings.

Table 2-1 Grid Connection Stream Crossing Methodology

Crossing no.	Type and size	Cover from road level to top of culvert/bridge	Maximum depth of trench from road level under watercourse	Description	Watercourse Crossing Option	Extent of In-stream Works
1	1500mm high stone singe arch bridge	200mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
2	1500mm high stone arch bridge	0 mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of	Option 4	None. No in-stream works required.

				directional drilling which will ensure that no contact will be made with the watercourse during the works.		
3	500mm internal Ø concrete pipe	<200mm	n/a	Due to the lack of cover over the existing pipe, the cable will be installed under the existing pipe. No contact will be made with the watercourse during the works.	Option 2	None. No in-stream works required.
4	1500mm high stone arch bridge	290mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.
5	2000mm high stone arch bridge	350mm	n/a	Due to the lack of cover over the existing bridge, the cable will be installed under the watercourse by means of directional drilling which will ensure that no contact will be made with the watercourse during the works.	Option 4	None. No in-stream works required.

Prior to any works commencing a dilapidation survey will be conducted of the entire route, photographing and noting any existing damage or defects to structure or road surfaces. A copy of this survey will be submitted to Kerry County Council prior to works commencing.

Communication with the public, local residences and businesses along the route will be an important responsibility of the Project Supervisor. Keeping all affected parties up to date and informed both shortly prior and during the construction period at all times. Two to three weeks before any work commencing reasonable efforts will be made to inform all affected parties of the oncoming works.

Signage will be erected in the weeks prior to any works commencing along and on adjacent roads to the route notifying the public of the forthcoming construction. Contact details for the contractor and details of license will also be posted along the cable route during construction.

Every effort will be made to minimise the impact of the above works on local residences and traffic. Consideration will also be given to the agricultural community and works will be organised and sequenced so as not to inconvenience any such activities. Additional construction health and safety measures include the following:

- All personnel will be inducted and made familiar with the method statements, risk assessments and traffic management plans involved.
- All site-specific safety rules will be adhered to.
- All plant operators will have appropriate Construction Skills Certification Scheme (CSCS) training.
- All personnel on-site will be required to have a current Solas Safe Pass training card.
- Fire extinguishers and first aid supplies will be available in the work area.
- The roadway will be maintained in a clean condition at all times.
- Helmets, high visibility clothing, and safety footwear will be worn at all times.
- A competent foreman will be on site at all times.
- Excavations are back filled at the end of each working day.
- The trench will not be over-crowded.
- Unauthorised access will be monitored and prevented.
- Pipe work will be lifted into position manually.
- Hand dig will be used to expose any services detected during the survey.

2.3.2.12 Watercourse / Culvert Crossing on the Wind Farm Site

There will be a total of 20 no. culverts within the wind farm site. There will be 17 new water-crossings constructed and three existing water-crossing which will be upgraded. Two of the new water-crossings will cross natural watercourses and the remaining new water-crossings will cross man-made agricultural drains. The locations of all the water-crossing points are shown in Figure 2-3.

The existing water-crossing will be upgraded by extending the water-crossing infrastructure that is already in place. The length of extensions to existing water-crossings will be kept as short as is practically possible so as to minimise any impact on the watercourse channel.

The 11 new water-crossing points have been assessed in terms of ecological value, watercourse type and channel width. Based on the findings of these assessments, one of three proposed culvert types have been chosen for the construction or upgrade of the water-crossing at each point. The three types of water-crossing are as follows:

Watercourse Crossing Type 1

At a proposed new water-crossing point, where the channel width is a minimum of one metre, a pre-cast, three sided, 'bottomless' box culvert. This type of culvert minimises the impact on the watercourse channel by leaving the bed of the channel unaltered which will maintain its ecological integrity. Depending on the width of the channel, the three-sided, 'bottomless' box culverts, of a standard size, can be used in series if required.

Watercourse Crossing Type 2

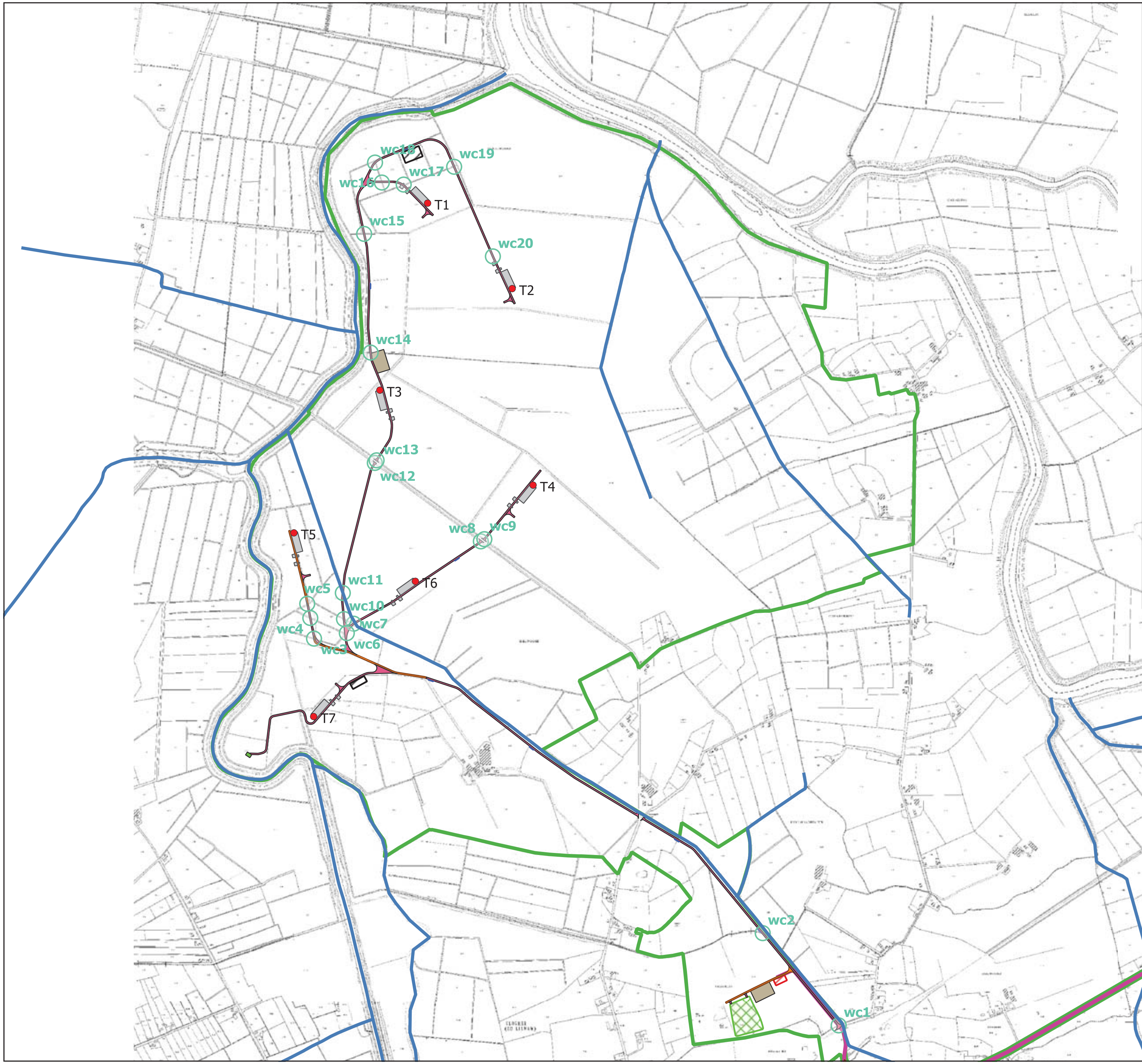
At a proposed new water-crossing point, where the channel width is less than one metre, a piped culvert will be used to construct the water-crossing. The culvert will be installed using the guidelines set out in the IFI's Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters so as to minimise impacts on the watercourse channel.

Watercourse Crossing Type 3

The existing water-crossings are all culverted by pipe culverts. Where upgrades and widening of the existing roads are taking place, these culverts will be lengthened using the same type of pipe culvert that is already in place. All three watercourse crossing types are illustrated in Appendix 4-3 of the EIAR.

Table 2-2, below, lists all of the on-site water-crossing points, as per Figure 2-3. The table outlines the location of the water-crossing points, whether it is an existing or new water-crossing, the status of the watercourse at each point, the width of the watercourse channel at each point, the type of culvert to be used and proposed action at each water-crossing point.

Where any new culverts of existing watercourses are proposed, they will be the subject of consent applications to the Office of Public Works under Section 50 of the Arterial Drainage Act, 1945.



Map Legend

- EIAR Study Area Boundary
- Water Course crossings
- Streams
- Proposed Turbine Locations
- Proposed Borrow Pit
- Proposed Hardstanding
- Proposed Turbine Foundation
- Proposed Substation
- Proposed Temporary Construction Compound
- Proposed New Roads
- Existing Roads for Upgrade
- Proposed Passing Bay
- Proposed Met Mast Location
- Proposed Temporary Peat Storage Areas
- Proposed 38kV Grid Connection

N

Drawing Title: Proposed Water Crossing Locations	
Project Title: Ballynagare Wind Farm	
Drawn By: TB	Checked By: MW
Project No.: 200512	Drawing No.: Figure 2.3
Scale: 1:15000	Date: 2021.10.13

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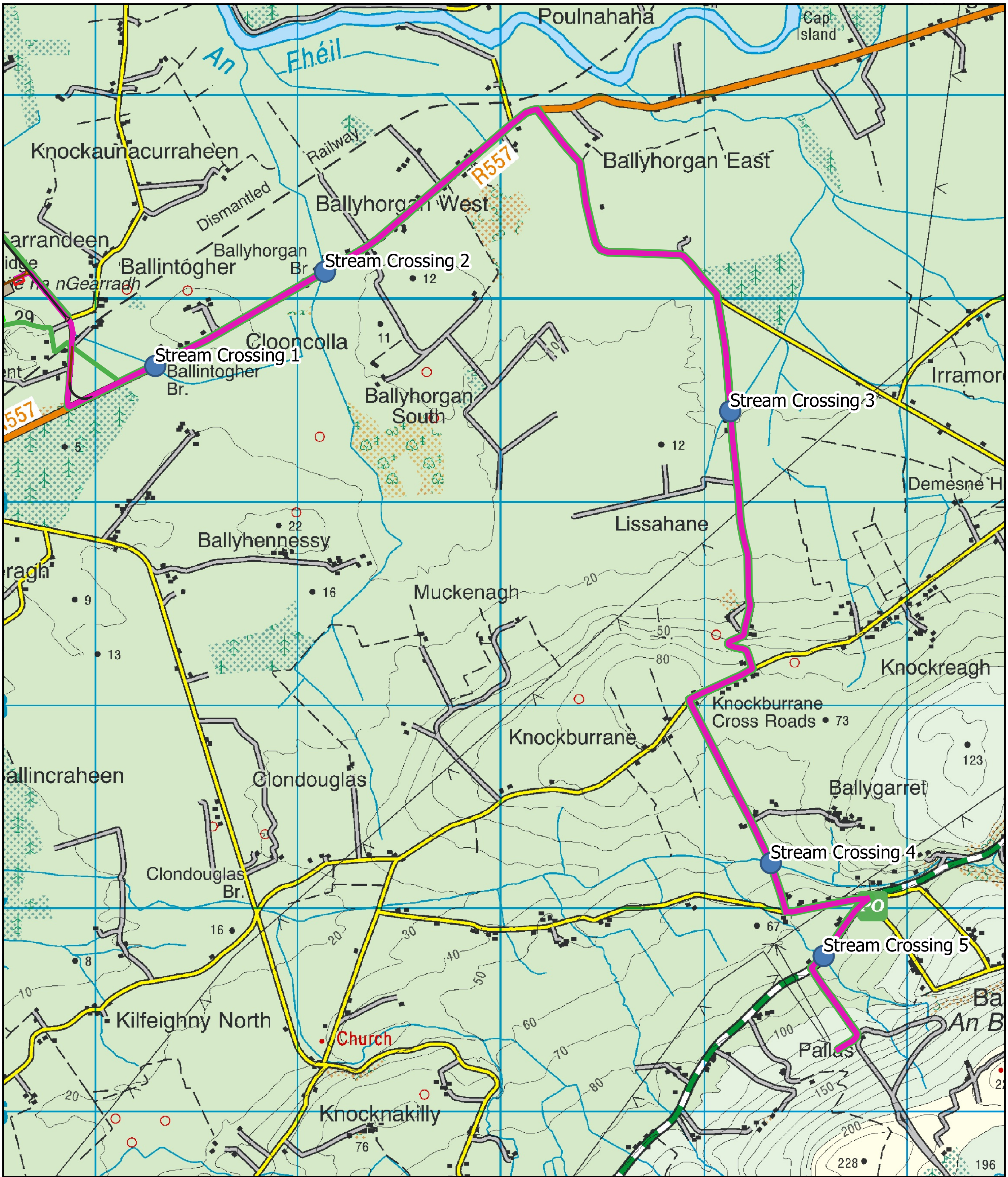

Map Legend

- EIAR Study Area
- Proposed 38kV Grid Connection
- Proposed Stream Crossings
- Proposed Substation

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Drawing Title	Grid Connection Stream Crossings
Project Title	Ballynagare Wind Farm
Drawn By: TB	Checked By: LW
Project No.: 200512	Drawing No.: Figure 2.4
Scale: 1:25000	Date: 30.09.21

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Table 2-2 On-site Watercourse Crossing Locations

Water Course ID	Easting	Northing	Existing/ Proposed New	Stream / Drain	Channel Width (m)	Culvert Type	Proposed Action
WC1	488829	631604	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing
WC2	490531	630328	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing
WC3	488707	631525	Existing	drain	0.5	Type 3	Extension to existing pipe culvert.
WC4	488692	631608	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing
WC5	488680	631666	Existing	drain	1.2	Type 3	Extension to existing pipe culvert.
WC6	488841	631547	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC7	488868	631585	Proposed New	stream	2.0	Type 1	Construct new watercrossing.
WC8	489385	631920	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC9	489400	631929	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC10	488829	631604	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing.
WC11	488824	631710	Proposed New	stream	2.0	Type 1	Construct new watercrossing.
WC12	488954	632239	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC13	488962	632249	Proposed New	drain	1.0	Type 1 /2	Construct new watercrossing.
WC14	488937	632687	Proposed New	drain	.75	Type 1 /2	Construct new watercrossing.
WC15	488911	633169	Existing	drain	1.0	Type 3	Extension to existing pipe culvert.
WC16	488983	633378	Proposed New	drain	1.5	Type 1 /2	Construct new watercrossing.
WC17	489072	633370	Proposed New	drain	0.5	Type 1 /2	Construct new watercrossing.
WC18	488955	633459	Proposed New	drain	1.5	Type 1 /2	Construct new watercrossing.
WC19	489277	633442	Proposed New	drain	1	Type 1/2	Construct new watercrossing.
WC20	489434	633078	Proposed New	drain	1	Type 1 /2	Construct new watercrossing.

2.3.2.13 Transport Route Accommodation Works

Turbine delivery route accommodation works are required at various locations as outlined in Section 14 of the EIAR. Required works along the transport route are minor and are all located within the existing road corridor. The construction methodology of the turbine delivery accommodation works is outlined as follows:

- Overburden within the required areas for the accommodation works will be excavated and temporarily stockpiled adjacent to the works area, where possible, until a competent stratum is reached.
- Any excess excavated overburden will be removed from the works area to the on-site peat management areas or a licensed tip or, if suitable, stockpiled and reused for backfilling where appropriate.
- A layer of geogrid/geotextile may be required at the surface of the competent stratum to provide further structural formation, if required.
- The competent stratum will be overlain with granular fill sourced from the on-site borrow pit or local quarries.
- A final surface running layer will be placed over the granular fill to provide a suitable surface to accommodate the turbine delivery/abnormal load vehicles.
- The temporary accommodation areas along the turbine delivery route will only be used by the turbine delivery/abnormal load vehicles and other vehicles associated with the delivery process.
- The temporary accommodation areas when not in use will be cordoned off from the public road, using bollards, where boundary walls, hedgerows or ditches have been removed.
- Upon completion of the turbine delivery phase of the proposed wind farm the granular surface of the accommodation works location will remain in place. All kerbing, barriers and boundary fencing will be reinstated.

Leaving the granular fill and final surface running layer in place within the accommodation areas will allow these to be used again in the future should it become necessary (i.e. at decommissioning stage for turbine removal, or in the unlikely event of having to swap out a blade component during the operational phase). Should this be required the boundary treatments will again be temporarily removed and managed as set out above.

2.3.3 Decommissioning

The design life of the wind farm is 35 years after which time decommissioning will occur, unless planning permission is granted to extend the duration of operation. At the end of the design life of the wind farm, or if the operations at the wind farm cease for a period of greater than one year, the turbines, met mast and all their associated above ground components will be dismantled and removed from site. The turbine foundations will be covered with soil to facilitate re-vegetation. The management of waste materials arising from the decommissioning of the development is outlined in the Waste Management Plan (Section 3 below).

Site roadways could be used for purposes other than operation of the wind farm by the time the decommissioning of the project is to be considered, and therefore it may be more appropriate to leave the site roads in-situ for future use. If the roads are not required in the future, they could be removed. Underground cables will be removed, and the ducting left in place.

A full reinstatement plan will be submitted to Kerry County Council three months prior to decommissioning.

3. ENVIRONMENTAL MANAGEMENT

3.1 Introduction

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

3.2 Protecting Water Quality

3.2.1 Environmental Management in the Construction Phase

Timing of civil works (road construction, excavation, rock-breaking, etc.) can significantly influence the potential impact upon the freshwater environment. Operations during wetter periods of the year pose a greater risk of causing erosion and siltation, which can be particularly severe following major rainfall or snow events. Traditionally, construction activity undertaken during the drier summer months would result in less erosion and siltation. Construction activities in the hydrological buffer zones shall be avoided during or immediately after a prolonged or intense rainfall event. Work will cease entirely near watercourses when it is evident that uncontrolled discharge is occurring. Given that this site has a largely established road network and existing watercourse crossing points, the impacts on watercourses are expected to be minimal.

3.2.2 Site Drainage Design

The site drainage features for this site have been outlined in Section 4.6 of the EIAR and are further developed in this section of the CEMP. The protection of the watercourses within and surrounding the site, and downstream catchments that they feed is of utmost importance in considering the most appropriate drainage proposals for the site of the proposed development. No routes of any natural drainage features will be altered as new watercourse crossings are kept to a minimum to facilitate the proposed development. Turbine locations and associated roadways were originally selected to avoid natural watercourses and existing roads are to be used wherever possible. The proposed development has, where possible, been kept a minimum of 50 m from natural watercourses. Where there is infrastructure proposed within 50 metres of a natural watercourse, stringent drainage measures will be put in place to ensure the protection of the water quality of the natural watercourse. There will be no direct discharges to any natural watercourses, with all drainage waters being dispersed as overland flows. Buffer zones around the existing natural drainage features have informed the layout of the proposed development.

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

3.2.3 Legislation and Best Practice Guidance

The drainage design has been prepared based on experience of the project team of other wind farm developments in peat-dominated environments, and a number of best practice guidance documents.

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

- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Department of Environment, Heritage and Local Government (2006): Wind Energy Development Guidelines for Planning Authorities;
- Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford;
- COFORD (2004): Forest Road Manual – Guidelines for the Design, Construction and Management of Forest Roads;
- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016);
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters;
- Scottish Natural Heritage (2010): Good Practice During Wind Farm Construction;
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) (2006): Guidance on 'Control of Water Pollution from Linear Construction Projects' (CIRIA Report No. C648, 2006);
- CIRIA 2006: Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors (CIRIA C532, 2006).
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018); and,
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017).

3.2.4 Site and Drainage Management

The proposed site drainage features for this site are outlined in Section 4.6 of the EIAR. As this CEMP is a working document and is presented as an Appendix to the EIAR, the detailed drainage measures are not included in this document. When the final CEMP report is prepared and presented as a standalone document, all drainage measures will be included in that document. The drainage proposals will be developed further prior to the commencement of construction. The following sections give an outline of drainage management arrangements in terms of pre-construction, construction and operational phases of the Proposed Development.

3.2.4.1 Pre-Construction Drainage

There is an existing drainage network across the site with runoff drains relatively freely to local watercourses and streams. This existing drainage system will continue to function as it is during the pre-construction phase. However, prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage. It is proposed to complete these inspections on a catchment by catchment basis as the construction works develop across the site, as works in all areas will not commence simultaneously.

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

3.2.4.2 Construction Phase Drainage

The Project Hydrologist/Design Engineer will complete a site drainage plan before construction commences and will attend the site to set out and assist with micro siting of proposed drainage controls as outlined in Section 4.6 of the EIAR. The drainage system will be excavated and constructed in conjunction with the road and hard standing construction. Drains will be excavated and stilling ponds constructed to eliminate any suspended solids within surface water running off the site. Drainage infrastructure will include:

- Interceptor drains will be maintained up-gradient of all proposed infrastructure to collect clean surface runoff, in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained. It will then be directed to areas where it can be re-distributed over the ground by means of a level spreader.
- Swales/roadside drains will be maintained to intercept and collect runoff from access roads and hardstanding areas of the site, likely to have entrained suspended sediment and channel it to stilling ponds for sediment settling;
- Check dams will be maintained at regular intervals along interceptor drains and swales/roadside drains in order to reduce flow velocities and therefore minimise erosion within the system during storm rainfall events; and,
- Stilling ponds/settlement ponds, emplaced downstream of swales and roadside drains, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to watercourses. The stilling ponds will be sized according to the size of the area they will be receiving water from but will be sufficiently large to accommodate peak flows storm events. Inspection and maintenance of all settlement ponds will be ongoing through the construction period.
- A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain, into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any proposed works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site.

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

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

3.2.4.3 Operational Phase Drainage

The project hydrologist will inspect and review the drainage system after construction has been completed to provide guidance on the requirements of an operational phase drainage system. This operational phase drainage system will have been installed during the construction phase in conjunction with the road and hardstanding construction work as described above and in Section 4.6 of the EIAR.

The drainage system will be monitored in the operational phase until such a time that all areas that have been reinstated become re-vegetated and the natural drainage regime has been restored.

3.2.4.4 Preparative Site Drainage Management

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

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

3.2.4.5 Pre-emptive Site Drainage Management

The works programme for the groundworks element of the construction phase will take account of weather forecasts and predicted rainfall in particular. The site Construction Manager/Site Supervisor is responsible for making the decision to postpone or abandon works. Large excavations, large movements of overburden or large-scale overburden or soil stripping will be suspended or scaled back if heavy rain is forecast. The extent to which works will be scaled back or suspended will relate directly to the amount of rainfall forecast.

3.2.4.6 Reactive Site Drainage Management

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

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

3.2.4.7 Rainfall Forecasting and Monitoring

Accurate forecasting and monitoring of rainfall is critical to the successful pre-emptive and reactive site drainage management as outlined in the subsections above.

Rainfall forecasts will be obtained for the nearest forecast reference point available via the www.yr.no weather forecasting website.

Construction personnel will be required to check the forecasted rainfall for the days ahead and plan for or suspend planned works accordingly. The forecasted rainfall should be recorded for reference and comparison with the rainfall levels to be recorded on-site.

Actual rainfall will be monitored on site, ideally via an automated rain gauge with regular recording intervals recommended by the Project Hydrologist and a means of alerting the construction personnel of rainfall trigger levels. The recorded rainfall data should be available on site at all times for review by the ECoW, Project Hydrologist or any regulatory authorities. The appointed contractor will be required to outline their proposed means of recording rainfall on site to the satisfaction of the ECoW and the Project Hydrologist prior to commencement of works.

3.3 Cable Trench Drainage

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

To efficiently control drainage runoff from cable trench works areas, excavated material is stored on the upgradient side of the trench. Should any rainfall cause runoff from the excavated material, the material is contained in the downgradient cable trench. Excess subsoil is removed from the cable trench works area immediately upon excavation and in the case of the proposed development, would be transported to one of the on-site borrow pits or used for landscaping and reinstatements of other areas elsewhere on site. Silt bags will be used where small to medium volumes of water need to be pumped from excavations.

On steeper slopes, silt fences, as detailed in Section 4.6 of the EIAR will be installed temporarily downgradient of the cable trench works area, or on the downhill slope below where excavated material is being temporarily stored to control run-off.

3.4 Refuelling, Fuel and Hazardous Materials Storage

The following mitigation measures are proposed to avoid release of hydrocarbons at the site:

- Minimal refuelling or maintenance of construction vehicles or plant will take place on site. Off-site refuelling should occur at a controlled fuelling station;
- On-site refuelling will take place using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site and will be towed around the site by a 4x4 vehicle to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the dumpers, excavators, etc. that will be used during construction. The 4x4 vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use. Only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Fuel volumes stored on site should be minimised. Any fuel storage areas will be bunded appropriately for the fuel storage volume for the time period of the construction. The

bunded area will be roofed to prevent the ingress of rainwater and fitted with a storm drainage system and an appropriate oil interceptor;
- The electrical substation will be bunded appropriately to the volume of oils likely to be stored and to prevent leakage to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used should be regularly inspected for leaks and fitness for purpose; and, an emergency plan for the construction phase to deal with accidental spillages will be contained within Environmental Management Plan.
- Spill kits will be available to deal with any accidental spillage in and outside the refuelling area.

The emergency response plan for the construction phase has been provided with this CEMP (Section 5) which sets out the procedure for dealing with accidental spillages will be maintained throughout the construction phase of the Proposed Development.

3.5 Cement Based Products Control Measures

The following mitigation measures are proposed to avoid release of cement leachate from the site:

- No batching of wet-cement products will occur on site;
- Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Where possible pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute need be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed;
- Use weather forecasting to plan dry days for pouring concrete;
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event;
- The small volume of water that will be generated from washing of the concrete lorry's chute will be directed into a concrete washout area, typically built using straw bales and lined with an impermeable membrane. Two examples are shown in Plate 3-1 below. The areas are generally covered when not in use to prevent rainwater collecting. In periods of dry weather, the areas can be uncovered to allow much of the water to be lost to evaporation. At the end of the concrete pours, any of the remaining liquid contents is taken off-site. Any solid contents that will have been cleaned down from the chute will have solidified and can be broken up and disposed of along with other construction waste.

The 50 m wide river buffer zone and 10 m existing artificial drainage buffer will be emplaced for the duration of the construction phase. No construction activity will occur within the buffer zone with the exception of bridge and culvert construction and access road construrction. The buffer zone will:

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

Plate 3-1 Typical concrete wash out areas

3.6 Peat Stability Management

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

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

3.6.1 General Recommendations for Good Construction Practice

The peat stability assessment carried out at the site indicates that there is insignificant risk of peat failure, although drainage mitigation measures would be required to prevent the build-up of water in the peat and reduce the risk of failure (GDG, 2021, EIAR Appendix 8-1).

The following issues incorporated into the construction phase of the project will assist in the management of the risks for this site (GDG, 2021, EIAR Appendix 8-1).

- Appointment of experienced and competent contractors;
- The site should be supervised by experienced and qualified personnel;
- Maintain a managed robust drainage system;
- Prevent placement of loads/overburden on marginal ground;
- Set up, maintain and report readings from peat stability monitoring systems;
- Revise and amend the Geotechnical Risk Register as construction progresses.
- Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge.
- All excavation shall be suitably supported to prevent collapse and development of tension cracks.
- Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits
- Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions.

- Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.
- Routine inspection of wind farm site by the contractor to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc.).

3.6.1.1 Peat and Spoil Usage in Restoration of Borrow Pit

Once excavated, peat will be temporarily stored in localised areas adjacent to excavations for roads and hardstands before being placed into the permanent peat storage areas within the borrow pit. All temporary storage areas will be upslope of founded roads/hardstands and will be inspected by a suitably qualified person before material is stored in the area.

Once the required volume of rock has been extracted from the borrow pit areas, it is intended to reinstate these areas with any surplus peat and overburden excavated from the works areas of the Proposed Development.

The general construction methodology for the construction of the borrow pits, as presented in the Peat & Spoil Management Plan in Appendix 8-1 of the EIAR, is summarised below. This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability.

As rock is being extracted from the borrow pit, upstands of rock will be left in place, depending on the type of rock, to act as intermediate retaining buttresses. Where this is not achievable, stone buttresses will be constructed within the borrow pit. The upstands or buttresses will form individual restoration areas within the borrow pit which will be filled once the required volume of rock has been extracted from each individual area. The buttresses will be wide enough to allow construction traffic access for the tipping of peat and spoil into the individual cells.

A temporary access track will be placed around the perimeter of the borrow pit area to allow for the tipping of material over the edge of the borrow pit area. The placement of peat and spoil within the borrow pits will likely require the use of long reach excavators, low ground pressure machinery and possibly bog mats in particular for drainage works.

The following particular recommendations/best practice guidelines for the placement of peat & in borrow pits should be considered and taken into account during construction.

- The borrow pits will be enclosed depressions and drainage from these areas will be managed effectively using temporary pumping arrangements and settlement ponds.
- Where possible, the surface of the placed peat & spoil should be shaped to allow efficient run-off of surface water from borrow pit areas.
- Silting ponds (settlement ponds) may be required at the lower side/outfall location of the borrow pits.
- The settlement ponds at the borrow pits will be designed to allow 24hr retention.
- A layer of geogrid to strengthen the surface of the placed peat & spoil within the borrow pits may be required.
- Infilling of the peat & spoil should commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. The contractor excavating the rock will be required to develop the borrow pits in a way which will allow the excavated peat & spoil to be placed safely.
- The height of the rock buttresses constructed should be greater than the height of the placed peat & spoil to prevent any surface peat & spoil run-off. Buttresses up to 5m in height are likely to be required.

3.7 Dust Control

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

Proposed measures to control dust include:

- Sporadic wetting of loose stone surface will be carried out during the construction phase to minimise movement of dust particles to the air. In periods of extended dry weather, dust suppression may be necessary along haul roads to ensure dust does not cause a nuisance. If necessary, water will be taken from stilling ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compound to prevent the generation of dust where required. Water bowser movements will be carefully monitored to avoid, insofar as reasonably possible, increased runoff.
- All plant and materials vehicles shall be stored in dedicated areas (on-site).
- Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction.
- Turbines and construction materials will be transported to the site on specified haul routes only.
- The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary.
- The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary.
- A Construction and Environmental Management Plan (CEMP) will be in place throughout the construction phase (see Appendix 4-2). The CEMP includes dust suppression measures.

3.8 Noise Control

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

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

3.9 Invasive Species Management

A baseline invasive species survey will be carried out at the site to identify the presence and location of any invasive species (listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) by a suitably qualified ecologist. If the presence of such species is found at or adjacent to the site, particularly in areas where its excavation may be required, an invasive species management plan will be prepared for the site to prevent the introduction or spread of any invasive species within the footprint of the works. An invasive species management plan, if required, will set out best practice control methods as summarised in the following sections.

3.9.1 Good Practice on Site Management

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

3.9.2 Establishing Good Site Hygiene

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

- A risk assessment and method statement must be provided by the Contractor prior to commencing works.
- Fences will be erected around areas of infestation, as confirmed by test pits, and warning signs shall be erected.

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

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

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

3.10 Waste Management

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

3.10.1 Legislation

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

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

The Department of the Environment provides a document entitled, *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*. It is important to emphasise that no demolition will take place at this site however, this document was referred to throughout the process of completing this WMP.

3.10.2 Waste Management Hierarchy

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

Prevention and Minimisation

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

Reuse of Waste

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

Recycling of Waste

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

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

3.10.3 Construction Phase Waste Management Plan

3.10.3.1 Description of the Works

The proposed development will involve the construction of 10 turbines, associated new site roads and upgrade of some existing roads, a substation and control building and an anemometry mast.

The proposed turbines will be manufactured off site and delivered to site where on-site assembly will occur.

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

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

The site roads will be constructed with rock won from the onsite borrow pit.

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

Table 3-1 Expected Waste Types Arising during Construction Phase

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

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

3.10.3.2 Waste Arisings and Proposals for Minimisation, Reuse and Recycling of Construction Waste

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

Appropriate measures should be taken to ensure excess waste is not generated during construction, including;

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

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

3.10.3.3 Waste Arising from Construction Activities

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

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

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

It is not envisaged that there will be any waste material arising from the materials used to construct the road as only the quantity of stone necessary will be excavated from the borrow pit on an 'as needed' basis.

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

3.10.3.4 Waste Arising from Decommissioning

The lengthy time frame between the completion of the construction phase and decommissioning will result in the only materials remaining on site at that time are likely to be turbines and associated cabling and crushed stone used in construction of roads, hardstand, foundations etc.

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

Table 3-2 Expected Waste Types Arising During Decommissioning

Materials Type	Example	EWC Code
Cables	Electrical wiring	17 04 11
Metals	Copper, aluminium, lead, iron and steel	17 04 07
Inert Materials	Crushed stone	17 05 04

3.10.4 Reuse

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

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

3.10.5 Recycling

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

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

3.10.6 Implementation

3.10.6.1 Roles and Responsibilities for Waste Management

Prior to the commencement of the proposed development a member of the on-site construction management staff will be assigned the role of Construction Waste Manager. The Construction Waste Manager will be in charge of the implementation of the objectives of the WMP, ensuring that all hired waste contractors have the necessary authorisations and that the waste management hierarchy is adhered to. The person nominated must have sufficient authority so that they can ensure everyone working on the proposed development adheres to the WMP.

3.10.6.2 Training

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

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

3.10.6.3 Record Keeping

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

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

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

- Signature of Confirmation of Dispatch detail
- Date and Time of Waste Arrival at Destination
- Weight of Material
- Site Address of Destination Facility

3.10.6.4 Waste Management Plan Conclusion

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

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

4. ENVIRONMENTAL MANAGEMENT IMPLEMENTATION

4.1 Roles and Responsibilities

The Site Supervisor/Construction Manager and/or ECoW are the project focal point relating to construction-related environmental issues.

In general, the ECoW will maintain responsibility for monitoring the works and Contractors/Sub-contractors from an environmental perspective. The ECoW will act as the point of contact on environmental matters and liaising with Kerry County Council and other statutory bodies as required.

The ECoW will report directly to the Site Supervisor/Wind Farm Construction Manager. A Project Ecologist, Project Hydrologist and Project Geotechnical Engineer will visit the site regularly and report to the Site ECoW. This structure provides a "triple lock" review/interaction by external specialists. An organogram structure for the construction stage is provided in Figure 4-1 below.

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

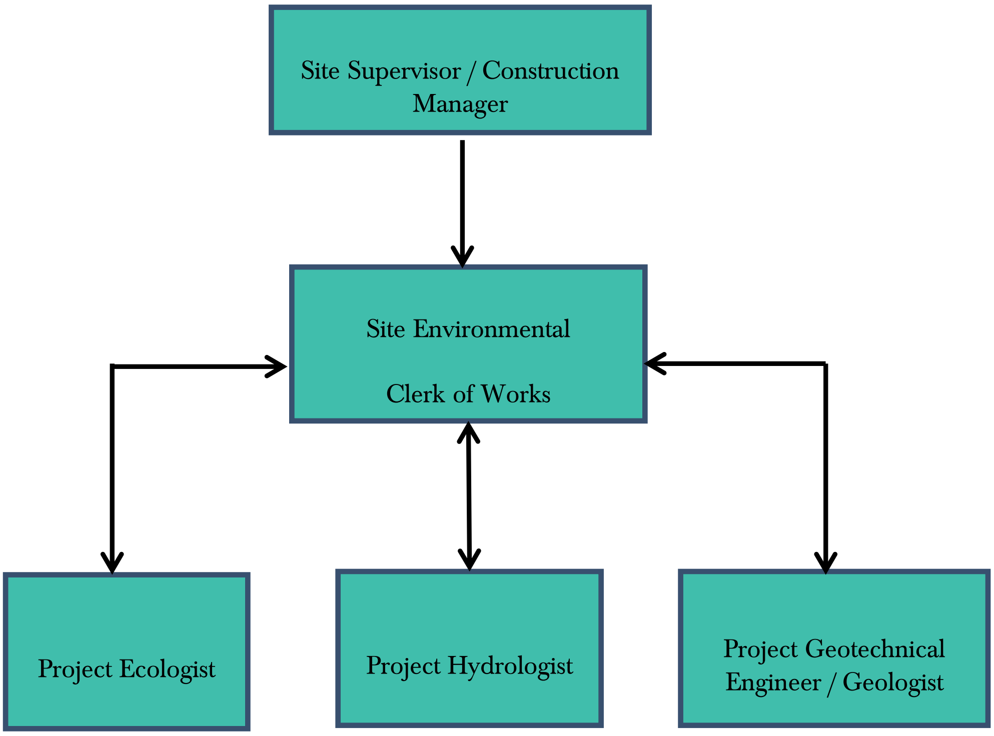


Figure 4-1 Construction Phase Environmental Management Roles

4.1.1 Wind Farm Construction Manager

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

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

4.1.1.1 Site Engineer

The main contractor will engage a qualified site engineer who will have input into the environmental management of the site. The proposed engineer has extensive experience in the construction of wind farms in Ireland and has fulfilled an environmental management role as part of those projects.

The Site Engineer will report to the Construction Manager and liaise with the ECoW. The responsibilities and duties of the Site Engineer will include the following:

- Undertake inspections, including visual inspections at watercourse crossings, and reviews to ensure the works are carried out in compliance with the CEMP;
- Advise site management/contractor/sub-contractors regarding:
    - Prevention of environmental pollution and improvement to existing working methods;
    - Suitability and use of plant, equipment and materials to prevent pollution;
    - Environmentally sound methods of working and systems to identify environmental hazards;

4.1.2 Site Environmental Clerk of Works

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

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

- Preparation of the CEMP and supporting environmental documentation and review/approval of contractor method statements;
- Undertake inspections and reviews to ensure the works are carried out in compliance with the CEMP;
- Monitor the implementation of the CEMP, particularly all proposed/required environmental monitoring;

- Generate environmental reports as required to show environmental data trends and incidents and ensure environmental records are maintained throughout the construction period;
- Advise site management/contractor/sub-contractors on:
  - Prevention of environmental pollution and improvement to existing working methods;
  - Changes in legislation and legal requirements affecting the environment;
  - Suitability and use of plant, equipment and materials to prevent pollution;
  - Environmentally sound methods of working and systems to identify environmental hazards;
- Ensure proper mitigation measures are initiated and adhered to during the construction phase;
- Liaise with Project Ecologist, Project Hydrologist and Project Geotechnical Engineer to ensure regular site visits and audits/inspections are completed;
- Ensure adequate arrangements are in place for site personnel to identify potential environmental incidents;
- Ensure that details of environmental incidents are communicated in a timely manner to the relevant regulatory authorities, initially by phone and followed up as soon as is practicable by e-mail;
- Support the investigation of incidents of significant, potential or actual environmental damage, and ensure corrective actions are carried out, recommend means to prevent recurrence and communicate incident findings to relevant parties; and,
- Identify environmental training requirements and arrange relevant training for all levels of site-based staff/workers.

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

4.1.3 Project Ecologist

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

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

- Review and input to the final construction phase CEMP in respect of ecological matters;
- In liaison with ECoW, oversee and provide advice on all relevant ecology mitigation measures set out in the planning documents for the proposed development;
- Regular inspection and monitoring of the development, through all phases of construction/operation and provide ecological advice as required;
- Carry out ecological monitoring and survey work as may be required by the planning authority; and,
- Complete a pre-commencement invasive species survey at the site.

4.1.4 Project Hydrologist

The Project Hydrologist will report to the ECoW and is responsible for inspection and review of drainage and water quality aspects associated with construction of the wind farm. The Project Hydrologist will not be full time on site but will visit the site at least once a month during construction. A qualified hydrologist from Malachy Walsh & Partners with experience working on wind farm projects will perform the role of Project Hydrologist.

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

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

4.1.5 Project Geotechnical Engineer / Geologist

The Geotechnical Engineer or Project Geologist will report to the ECoW and is responsible for inspection and review of geotechnical aspects associated with construction of the wind farm. The Geotechnical Engineer will not be full time on site but will visit site at least once a month during construction phase.

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

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

4.2 Environmental Awareness and Training

4.2.1 Environmental Induction

The Environmental Induction will be integrated into the general site induction on a case by case basis for each member of staff employed on-site depending on their assigned roles and responsibilities on site. Where necessary, the Environmental Induction will as a minimum include:

- A copy of the Environmental Management Site Plans and discussion of the key environmental risks and constraints;
- An outline of the CEMP structure;

- A discussion of the applicable Works Method Statement;
- The roles and responsibilities of staff, including contractors, in relation to environmental management; and,
- An outline of the environmental Incident Management Procedure.

4.2.2 Toolbox Talks

Toolbox talks will be held by the ECoW/Construction Manager at the commencement of each day, or at the commencement of new activities. The aims of the toolbox talks are to identify the specific proposed work activities that are scheduled for that day. In addition, the necessary work method statements and sub plans would be identified and discussed prior to the commencement of the day's activities. The toolbox talks will include training and awareness on topics including:

- On-site Ecological Sensitivities
- Buffers to be upheld – watercourses, archaeology, ecology
- Sediment and Erosion Control
- Good site practice
- On-site Traffic Routes and Rules
- Keeping to tracks – vehicle rules
- Strictly adhering to the development footprint
- Fuel Storage
- Materials and waste procedures

Site meetings would be held on a regular basis involving all site personnel. The objectives of a site meeting is to discuss the coming weeks proposed activities and identify the relevant work method statements and sub-plans that will be relevant to that week's activities. Additionally, any non-compliance identified during the previous week would also be discussed with the aim to reduce the potential of the same non-compliance reoccurring.

5. EMERGENCY RESPONSE MEASURES

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

5.1 Emergency Response Procedure

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

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

5.1.1 Roles and Responsibilities

The chain of command during an emergency response sets out who is responsible for coordinating the response. The Site Manager will lead the emergency response which makes him responsible for activating and coordinating the emergency response procedure. The other site personnel who can be identified at this time who will be delegated responsibilities during the emergency response are presented in Figure 6-1. In a situation where the Site Manager is unavailable or incapable of coordinating the emergency response, the responsibility will be transferred to the next person in the chain of command by the Construction Manager outlined in Figure 5-1. This will be updated throughout the various stages of the project.

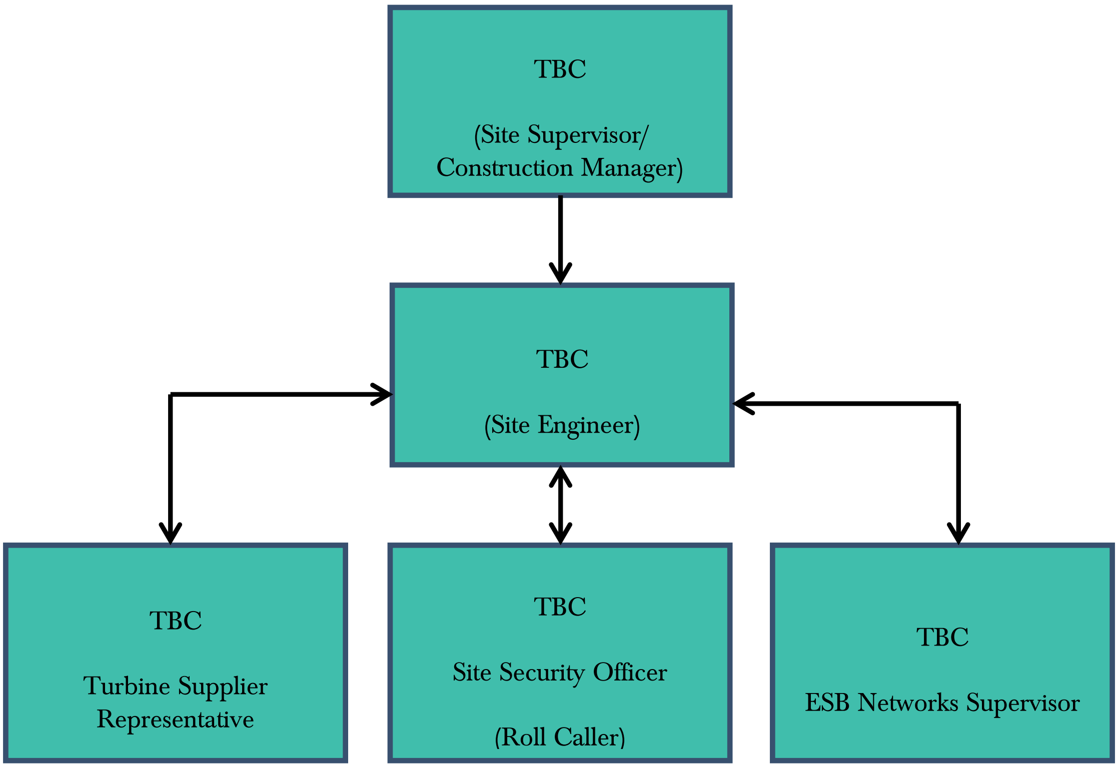


Figure 5-1 Emergency Response Procedure Chain of Command

5.1.2 Initial Steps

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

Table 5-1 Hazards Associated with Potential Emergency Situations

Hazard	Emergency Situation
Construction vehicles: dump trucks, tractors, excavators, cranes etc.	Collision or overturn which has resulted in operator or third-party injury.
Abrasive wheels/ portable tools	Entanglement, amputation or electrical shock associated with portable tools.
Contact with services	Electrical shock or gas leak associated with an accidental breach of underground services.
Fire	Injury to employee through exposure to fire or smoke.
Falls from heights including falls from scaffold towers, scissor lifts, and ladders.	Injury to employee after a fall from a height.
Sickness	Illness unrelated to site activities of an employee e.g. heart attack, loss of consciousness, seizure.

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

- Establish the scale of the emergency situation and identify the number of personnel, if any, have been injured or are at risk of injury.
- Where necessary, sound the emergency siren/fog horn that activates an emergency evacuation on the site. The Site Manager must proceed to the assembly point if the emergency poses any significant threat to their welfare **and if there are no injured personnel at the scene that require assistance.** The Site Manager will be required to use his own discretion at that point. In the case of fire, the emergency evacuation of the site should proceed, without exception. The site evacuation procedure is outlined in Section 5.1.3.
- Make safe the area if possible and ensure that there is no identifiable risk exists with regard to dealing with the situation e.g. if a machine has turned over, ensure that it is in a safe position so as not to endanger others before assisting the injured.
- Contact the required emergency services or delegate the task to someone if he is unable to do so. If delegating the task, ensure that they follow the procedures for contacting the emergency services as set out in Section 5.2.1.
- Take any further steps that are deemed necessary to make safe or contain the emergency incident e.g. cordon off an area where an incident associated with electrical issues has occurred.
- Contact any regulatory body or service provider as required e.g. ESB Networks, the numbers for which are provided in Section 5.2.2.
- Contact the next of kin of any injured personnel where appropriate. The procedure for this is outlined in Section 5.2.3.

5.1.3 Site Evacuation/Fire Drill

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

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

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

5.1.4 Excessive Peat Movement

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

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

5.1.5 Onset of Peat Slide

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

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

5.1.6 Spill Control Measures

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

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

Environmental incidents are not limited to just fuel spillages. Therefore, any environmental incident must be investigated in accordance with the following steps.

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

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

5.2 Contacting the Emergency Services

5.2.1 Emergency Communications Procedure

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

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

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

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

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

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

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

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

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

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

5.2.2 Contact Details

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

Table 5-2 Emergency Contacts

Contact	Telephone no.
Emergency Services – Ambulance, Fire, Gardaí	999 / 112
Hospital – Listowel Community Hospital	068 21022
Doctor - TBC	TBC
ESB Emergency Services	1850 372 999
Bord Gáis Emergency	1850 20 50 50
Gardaí –Listowel Garda Station	068 50820
Project Health and Safety Officer –TBC	TBC
Health and Safety Authority (HSA)	1890 289 389
Project Supervisor Construction Stage (PSCS): TBC	TBC
Project Supervisor Design Stage (PSDP): TBC	TBC
Developer / Client – Stacks Mountain Windfarm Ltd.	TBC

5.2.3 Procedure for Personnel Tracking

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

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

5.3 Induction Checklist

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

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

ERP Items to be included in Site Induction Status	Status
All personnel will be made aware of the evacuation procedure during site induction.	
Due to the remoteness of the site it may be necessary to liaise with and assist the emergency services on the ground in terms of locating the site. This may involve providing an escort from a designated meeting point that may be located more easily by the emergency services. This should form part of the site induction to make new personnel and sub-contractors aware of any	

ERP Items to be included in Site Induction Status	Status
such arrangement or requirement if applicable.	
All operatives on site without any exception will have undergo a site induction where they will be required to provide personal contact details which will include contact information for the next of kin.	

6. MITIGATION PROPOSALS

All mitigation measures relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the EIAR and all other relevant documents submitted as part of the planning permission application issued to Kerry County Council and ABP.

This section of the Construction and Environmental Management Plan groups together all of the mitigation measures presented in the EIAR. The mitigation measures are presented in Table 6-1 below.

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

Table 6-1 Site Preparation and Mitigation Measures

Ref. No.	Reference Location	Mitigation Measure	Audit Result	Action Required
Pre-Commencement Phase				
MM1	EIAR Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007. Information on the appointed permitted contractor and evidence of a maintenance contract will be submitted to the Planning Authority prior to any construction works taking place.		
MM2	EIAR Section 4	All site activities will be provided for in an Environmental Management Plan, prepared prior to the commencement of any operations onsite. The environmental management plan will set out all measures necessary to ensure works are carried out in accordance with the mitigation measures set out in the EIAR and will set out the monitoring and inspections procedures and frequencies.		
MM3	EIAR Section 4 CEMP Section 4	An ECoW will oversee the site works and implementation of the Environmental Management Plan and provide on-site advice on the mitigation measures as necessary to ensure the project proceeds as intended. The level, detail and frequency of reporting expected from the ECoW for the Construction Manager, developer's project manager, and any Authorities or other Agencies, will be agreed by all parties prior to commencement of construction, and may be further adjusted as required during the course of the project.		
MM4	EIAR Section 4	The arrangements for concrete deliveries to the site will be discussed with suppliers before work starts, agreeing routes, prohibiting on-site washout and discussing emergency procedures.		
MM5	CEMP Section 3	The Project Hydrologist/Design Engineer will assist in preparing a site drainage plan before construction commences.		
MM6	CEMP Section 3	All materials and equipment necessary to implement the drainage mitigation measures will be brought on-site in advance of any works commencing. The drainage measures outlined in the EIAR will be installed prior to, or at the same time as the works they are intended to drain. An adequate amount of clean stone, silt fencing, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary.		

MM7	CEMP Section 3	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts and predicted rainfall in particular.		
MM8	CEMP Section 3	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.		
MM9	EIAR Section 4	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site Environmental Clerk of Works or the supervising hydrologist.		
MM10	EIAR Section 4 CEMP Section 3	Culverts will be installed at locations where streams or natural drainage channels cross the new access track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		
MM11	EIAR Section 4 CEMP Section 3	All materials and equipment necessary to implement the drainage mitigation measures will be brought on-site in advance of any works commencing. The drainage measures outlined in the EIAR will be installed prior to, or at the same time as the works they are intended to drain. An adequate amount of straw bales, clean stone, terram, stakes, etc. will be kept on site at all times to implement the drainage design measures as necessary.		
MM12	EIAR Section 4 CEMP Section 3	The works programme for the ground works part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		

MM13	EIAR Section 4 CEMP Section 3	The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.		
MM14	EIAR Section 4	All discharges from the proposed works areas or from interceptor drains will be made over vegetated ground at a minimum of 50 metres distance from natural watercourses, or directly into artificial drainage ditches but only after silt traps, check dams and/or stilling ponds have been added to these drainage ditches.		
MM15	EIAR Section 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. Where sections of woody vegetation are removed for the purposes of the junction and road upgrades, these will be replaced with suitable hedge/tree species which are common in the local context		
MM16	EIAR Section 7	Works will commence outside the bird nesting season (1st of March to 31st of August inclusive).		
MM17	EIAR Section 6, 7	The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. There will be no access to the wider woodland area. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Act.		
MM18	EIAR Section 6 CEMP Section 3	A pre-construction invasive species survey will be undertaken a part of the proposed project. This will provide updated data in advance of any construction given the intervention time period between the original survey work and any future grant of permission/ construction. Measures will be in place to prevent the spread of these species during the proposed works. In addition, all necessary precautions will be taken to prevent the introduction of invasive species to the site from elsewhere.		

MM19	EIAR Section 4 CEMP Section 9	The procedures for the implementation of the mitigation measures outlined in such an EMP and their effectiveness and completion is typically audited by way of an Environmental Management Plan Audit Report. The EMP Audit Report effectively lists all mitigation measures prescribed in any of the planning documentation and any further mitigation measures proposed during the detailed design stage and allows them to be audited on a systematic and regular basis.		
MM20	EIAR Section 12	Two Bridges (CH8 and CH9) Poulboy Bridge and MacElligot's Bridge are adjacent to the proposed road which extends in a south-easterly direction to the proposed borrow pit and substation. No impacts to the bridges are anticipated.		
MM21	EIAR Section 12	▪ Pre-development testing (licensed by the National Monuments Service - NMS) in areas where peat depths allow a meaningful investigation. Testing should only be undertaken in areas where ground disturbance will take place as part of the development. For example, if roads are proposed to be floated, testing would not be required. Where peat depths become a limitation to testing, monitoring at the construction stage should be undertaken. The areas to be tested will be chosen by the appointed archaeologist and the number of test trenches agreed between the archaeologist and the National Monuments Service (NMS) through the licensing system. Peat depth data and local ground conditions may dictate the number and location of test trenches to be excavated. ▪ Licensed archaeological monitoring of the proposed roads, internal cable, passing bays and entrances during the construction phase of the development should be undertaken. If archaeological finds, features or deposits are uncovered during archaeological monitoring, the NMS will be informed of such findings and a method statement for the resolution of the archaeology will be provided, where relevant. The developer will be prepared to provide resources for the resolution of such features whether by preservation by record (excavation) or preservation in situ (avoidance). A report on the results of the monitoring will be compiled and submitted to the relevant authorities on completion of the project.		
Construction Phase				

Construction Management				
MM22	EIAR Section 4 CEMP Section 3	On-site refuelling will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site, and will be towed around the site by a 4x4 jeep to where machinery is located. It is not practical for all vehicles to travel back to a single refuelling point, given the size of the cranes, excavators, etc. that will be used during the construction of the proposed wind farm development. The 4x4 towing vehicle will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction when not in use.		
MM23	EIAR Section 4 CEMP Section 3	No batching of wet-cement products will occur on site. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place. Only ready-mixed concrete will be used during the construction phase, with all ready-mixed concrete being delivered from local batching plants in sealed concrete delivery trucks.		
MM24	EIAR Section 4 CEMP Section 3	No washing out of any plant used in concrete transport or concreting operations will be carried out onsite. When concrete is delivered to site, only the chute of the delivery truck will be cleaned, using the smallest volume of water necessary, before leaving the site. Concrete trucks will be directed back to their batching plant for washout.		
MM25	EIAR Section 4	No concrete will be transported around the site in open trailers or dumpers so as to avoid spillage while in transport.		
MM26	EIAR Section 4	Clearly visible signs in prominent locations will be placed close to concrete pour areas specifically stating washout of concrete lorries is not permitted on the site		
MM27	EIAR Section 4	All concrete used in the construction of turbine bases will be poured directly into the shuttered formwork from the delivery truck. If this is not practical, the concrete will be poured from the delivery truck into a hydraulic concrete pump or into the bucket of an excavator, which will transfer the concrete to the location where it is needed.		

MM28	EIAR Section 4	Main pours will be planned days or weeks in advance. Large pours will be avoided when prolonged periods of heavy rain are forecast.		
MM29	EIAR Section 4	Concrete pumps and machine buckets will be restricted from slewing over watercourses while placing concrete.		
MM30	EIAR Section 4	Excavations will be sufficiently dewatered before concreting begins. Dewatering will continue while concrete sets.		
MM31	EIAR Section 4	Covers will be available for freshly placed concrete to avoid the surface washing away in heavy rain.		
MM32	EIAR Section 4	Surplus concrete after completion of a pour will be used elsewhere at suitable locations around the site where it is required.		
MM33	EIAR Section 4 CEMP Section 3	If necessary, water will be taken from settlement ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust. Silty or oily water will not be used for dust suppression.		
MM34	CEMP Section 3	All construction related traffic will have speed restrictions on un-surfaced roads to 20 kph.		
MM35	CEMP Section 3	The following additional mitigation measures will be adopted to reduce the generation of dust associated with Borrow Pit activities ○ Compact, grade and maintain internal haul roads. This will ensure that the level of surface dust is kept do a minimum particularly when periods of dry weather occur. ○ Use water sprays as a dust suppression measure during periods of dry weather. ○ All crushing and screening equipment should be used within its design capacity with regular maintenance checks carried out.		

		○ The height from which material drops should be minimised to reduce dust generation. This is most relevant where rock is being processed to ensure crushed material is not dropping from a height which will increase the volume of dust generation. ○ Maintain speed limits on haul roads and reduce during dry spells where dust volumes are likely to be higher. Drilling equipment should be fitted with dust extractors and collectors if blasting is used as an extraction method.		
MM36	EIAR Section 4	A temporary screening berm will be installed at the perimeter of the borrow pit. This will reduce any potential impact from dust generation associated with rock extraction.		
MM37	EIAR Section 4	A road sweeper will be available if any section of the public roads were to be dirtied by trucks associated with the proposed development.		
MM38	EIAR Section 5	During construction of the proposed development, all staff will be made aware of and adhere to the Health & Safety Authority's *'Guidelines on the Procurement, Design and Management Requirements of the Safety, Health and Welfare at Work (Construction) Regulations 2006'*. This will encompass the use of all necessary Personal Protective Equipment and adherence to the site Health and Safety Plan		
MM39	CEMP Section 2	Any area where excavations are planned will be surveyed and all existing services will be identified prior to commencement of any works. Liaison will be held with the relevant sections of the Local Authority including all the relevant area engineers to ensure all services are identified. Excavation permits will be completed and all plant operators and general operatives will be inducted and informed as to the location of any services.		
Drainage Design and Management				
MM40	EIAR Section 9 CEMP Section 3	Where possible, a 50-metre buffer zone will be maintained around watercourses during the windfarm construction. With the exception of access roads, road crossings of streams and associated culvert construction, no development infrastructure, vehicle or plant movement, construction activity or stock-piling of construction materials or construction waste will take place within this zone, and no vegetation will be removed from within this zone. Many of the proposed access roads cross mapped drains/streams requiring control measures, which are outlined further on		

		in this section. These control measures will be implemented at the proposed watercourse and drain crossings and where the roads run parallel and in close proximity to drains.		
MM41	EIAR Section 4 CEMP Section 3	Swales will be used to intercept and collect run off from construction areas of the site during the construction phase, and channel it to settlement ponds for sediment attenuation.		
MM42	EIAR Section 4 CEMP Section 3	Interceptor drains will be installed upgradient of any works areas to collect surface flow runoff and prevent it reaching excavations and construction areas of the site. It will then be directed to areas where it can be re-distributed over the ground as sheet flow.		
MM43	EIAR Section 4 CEMP Section 3	Check dams will not be used in any natural watercourses, only artificial drainage channels and interceptor drains. The check dams will be left in place when the interceptor drains are backfilled at the end of the construction phase to limit linear flow in the backfilled drain. The check dams will be installed at regular intervals along interceptor drains to restrict flow velocity, minimise channel erosion and promote sedimentation behind the dam. The check dams will be installed as the interceptor drains are being excavated. The spacing and frequency of the check dams will be dependent on the gradient of the interceptor drain or swale in which they are being installed.		
MM44	EIAR Section 4	A level spreader will be constructed at the end of each interceptor drain to convert concentrated flows in the drain into diffuse sheet flow on areas of vegetated ground. The levels spreaders will be located downgradient of any works areas in locations where they are not likely to contribute further to water ingress to construction areas of the site. They will also be emplaced at end of swales carrying discharge from settlement ponds. The level spreaders will distribute clean drainage water onto vegetated areas where the water will not be re-concentrated into a flow channel immediately below the point of discharge. The discharge point will be on level or only very gently sloping ground rather than on a steep slope so as to prevent erosion. No drains will discharge directly to surface waters.		

MM45	EIAR Section 4	Vegetation filters, that is areas of existing vegetation, accepting drainage water issuing from level spreaders as sheet flow, will remove any suspended sediment from water channelled via interceptor drains or any remaining sediment in waters channelled via swales and settlement ponds.		
MM46	EIAR Section 4	Settlement ponds, placed either singly or a pair in series, will buffer volumes of run-off discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to water courses. Settlement ponds will be designed to retain the volume associated with a 1 in 50-year return period rainfall event. The embankment that forms the sloped sides of the settlement ponds will be stabilised with vegetated turves, which will have been removed during the excavation of the settlement ponds area.		
MM47	EIAR Section 4 EIAR Section 6	A siltbuster or similar equivalent piece of equipment will be available if required to filter any water pumped out of excavation areas, prior to its discharge to settlement ponds or swales. This includes turbine base excavations and borrow bit excavations. This water is likely to have a high sediment load and will be directed via swales to settlement ponds after treatment in the unit.		
MM48	EIAR Section 4 CEMP Section 3	Culverts will be installed at locations where streams or natural drainage channels cross the new access track route. All works involving culverts, whether they are new, upgraded or extended, will be carried out to follow a method statement to be agreed with Inland Fisheries Ireland.		
MM49	EIAR Section 4	Silt fences will be installed along the routes of existing watercourses or drainage ditches where site roads pass over the watercourses, immediately downstream of the construction area. Silt fences will be installed along a level contour, so water does not pond more than 400 mm at any point. The silt fence will be trenched at least 500 mm into the ground and will be stretched tight between the posts. The fences will not be allowed to sag or break away from the fence posts. During the near stream construction work double silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase.		

MM50	EIAR Section 8	Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods will be implemented		
MM51	EIAR Section 4 CEMP Section 3	The works programme for the groundworks part of the construction phase of the project will also take account of weather forecasts, and predicted rainfall in particular.		
MM52	EIAR Section 4 CEMP Section 3	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the ECoW or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather, ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.		
MM53	EIAR Section 4 CEMP Section 2,3	Material excavated to create the working area will be stored locally for later reuse in backfilling the working area around the turbine foundation. The excavated material will be covered with polythene sheets or sealed with the excavator bucket and surrounded by silt fences to ensure sediment-laden run-off does not occur where appropriate.		
MM54	EIAR Section 9	A constraints zone will be identified and implemented at each crossing location during construction. The purpose of the constraint zone is to: ○ Avoid physical damage to surface water channels; ○ Provide a buffer against hydraulic loading by additional surface water run-off; ○ Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks;		

		○ Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and, ○ Avoid storage of construction plant materials used during construction and chemicals or waste associated with temporary on–site sanitary facilities.		
Peat, Subsoils and Bedrock				
MM55	CEMP Section 3	General recommendation for good construction practice to minimise the risk of construction activity causing potential peat instability are outlined in Section 3.6 of the CEMP.		
MM56	EIAR Section 4 CEMP Section 2	Peat removed from turbine locations will be transported to the designated peat reinstatement areas.		
MM57	EIAR Section 4	Any excess mounded peat in temporary storage for long periods will be digger-bucket sealed and covered with polyethylene sheets or reseeded at the earliest opportunity.		
MM58	EIAR Section 4	In order to minimise runoff during the construction phase, stripping of peat should not take place during excessively dry weather (to prevent dust generation) or extremely wet periods (to prevent increased silt rich runoff).		
MM59	EIAR Section 4	Bog mats and brash mats will be used where necessary to support vehicles on soft ground, reducing peat and mineral soils erosion and avoiding the formation of rutted areas, in which surface water ponding can occur. Brash mat renewal should take place when they become heavily used and worn. Provision should be made for brash mats along all off-road routes, to protect the soil from compaction and rutting.		
MM60	EIAR Section 8 CEMP Section 3	The following issues incorporated into the construction phase of the project will assist in the management of the risks for this site (FT, 2020): • Appointment of experienced and competent contractors; • The site should be supervised by experienced and qualified personnel; • Allocate sufficient time for the project (be aware that decreasing the construction time has the potential to increase the risk of initiating a peat movement);		

		• Prevent undercutting of slopes and unsupported excavations; • Maintain a managed robust drainage system; • Prevent placement of loads/overburden on marginal ground; • Set up, maintain and report findings from monitoring systems; • Ensure construction method statements are followed or where agreed modified/ developed; and, • Revise and amend the Geotechnical Risk Register as construction progresses.		
Flora and Fauna				
MM61	EIAR Section 7	The footprint of the Proposed Development will be clearly marked out and fenced off prior to works commencing by a qualitied ecologist. There will be no access to the wider woodland area. All machinery will work from the existing access road corridor. Vegetation removal will be conducted in line with the provisions of the Wildlife Acts 1976-2021		
MM62	EIAR Section 7	Construction works along the c. 0.2km section of the proposed cable route within the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA will be undertaken outside the bird breeding season (1st of March to the 31st of August inclusive)		
MM63	EIAR Section 7	If bird breeding activity of species of conservation concern are identified during the works, the nest sites will be located, and no works shall be undertaken within 500m buffer in line with industry best practise.		
MM64	EIAR Section 6	Hedgerow will be replanted along an internal farm trackway within the proposed development site which will be of a greater length than that which will be lost and will ensure that there are no long-term negative effects. The additional planting will result in a biodiversity net gain.		
MM65	EIAR Section 6	The following measures will be undertaken for the avoidance of disturbance/displacement and direct mortality will be implemented during the construction phase of the proposed development: • An exclusion zone around the sett will be maintained for the duration of the construction works. No works will be undertaken within 100m of the sett. • All of the above works will be undertaken or supervised by an appropriately qualified ecologist. To protect individual badgers during the construction phase of the proposed development, all open excavations on site will be covered when not in use and backfilled as soon as possible. Excavations		

		will also be covered at night and any deep excavations left open will have appropriate egress ramps in place to allow mammals to safely exit excavations should they fall in.		
MM66	EIAR Appendix 6-2	Noise Disturbance During the construction phase, plant machinery will be turned off when not in use and all plant and equipment for use will comply with the Construction Plant and Equipment Permissible Noise Levels Regulations (SI 359/1996). Lighting Disturbance Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. This will be achieved using lighting accessories, such as hoods, cowls, louvers and shields, to direct the light to the intended area only.		
MM67	EIAR Appendix 6-2	Bat Buffers Felling of coniferous plantation will be conducted during the construction phase to facilitate the required bat buffers surrounding turbines located within or at the edge of conifer forestry habitats.		
MM68	EIAR Section 7	The removal of woody vegetation will be undertaken in full compliance with Section 40 of the Wildlife Act 1976 – 2018. The removal of wetland vegetation and clearance/cutting of hedges and trees will be undertaken outside the breeding season (i.e. outside of the 1st of March and the 31st of August) including along the cable route.		
MM69	CEMP Section 3	Measures will be in place to prevent the spread of these species during the proposed works. In addition, all necessary precautions will be taken to prevent the introduction of invasive species to the site from elsewhere. Best practice measures in relation to invasive species are described below: › All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their further use elsewhere. › Care will be taken not to disturb or cause the movement of invasive species fragments, either intentionally or accidentally. › Stands of Rhododendron will be clearly demarcated by temporary fencing and tracking within them will be strictly avoided. › Good construction site hygiene will be employed to prevent the spread of these species with vehicles thoroughly cleaned down prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down on site to prevent the spread of invasive plant. All clean down must be undertaken in areas with no potential to result in the spread of invasive species.		

		› Any material that is imported onto any site will be verified by a suitably qualified ecologist to be free from any invasive species listed on the 'Third Schedule' of Regulations 49 & 50 of Regulations 49 and 50 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011). This will be carried out by searching for rhizomes and plant material. The treatment and control of invasive alien species will follow guidelines issued by the National Roads Authority. The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads (NRA 2010).		
Noise				
MM70	EIAR Section 11	Equipment will be sensitively located, away from sensitive properties, taking account of local topography and natural screening.		
MM71	EIAR Section 11	All construction work will be restricted to the specified working hours. Any construction work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.		
MM72	EIAR Section 11	Plant will be selected taking account of the characteristics of noise emissions from each item. All plant and machinery used on the site shall comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.		
MM73	EIAR Section 11	The contract documents will clearly specify that the Contractor undertaking the construction of the works will be obliged to adhere to the following noise abatement measures: ○ No plant used on site will be proposed to cause an on-going public nuisance due to noise. ○ The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by on site operations. ○ All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract. ○ Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers. ○ Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.		

		○ Any plant, such as generators or pumps, which is required to operate near any sensitive receptors before 07:00hrs or after 19:00hrs will be surrounded by an acoustic enclosure or portable screen. ○ Residents will be notified in advance of all blasting schedules. During the course of the construction programme, supervision of the works will include ensuring compliance with the limits detailed in Table 12.10 using methods outlined in BS 5228 "*Noise and Vibration Control on Construction and open sites*".		
MM74	EIAR Section 11	All construction operations shall comply with guidelines set out in British Standard documents *'BS 5338: 'Code of Practice for Noise Control on Construction and Demolition Sites'* and *'BS5228: Part 1: 1997: Noise & Vibration Control on Construction and Open Sites'.*		
Air Quality and Dust				
MM75	EIAR Section 4 CEMP Section 3 EIAR Section 10	○ All plant and materials vehicles shall be stored in dedicated areas (on-site). ○ Areas of excavation will be kept to a minimum, and stockpiling will be minimised by coordinating excavation, spreading and compaction. ○ Turbines and construction materials will be transported to the site on specified haul routes only. ○ The agreed haul route roads adjacent to the site will be regularly inspected for cleanliness and cleaned as necessary. ○ The transport of construction materials to the site that have significant potential to cause dust, will be undertaken in tarpaulin or similar covered vehicles where necessary. ○		
MM76	EIAR Section 10	All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.		
MM77	EIAR Section 10	In periods of extended dry weather, dust suppression may be necessary along haul roads and around the borrow pit area to ensure dust does not cause a nuisance. If necessary, water will be taken from settlement ponds in the site's drainage system and will be pumped into a bowser or water spreader to dampen down haul roads and site compounds to prevent the generation of dust.		

		Silty or oily water will not be used for dust suppression, because this would transfer the pollutants to the haul roads and generate polluted runoff or more dust. Water bowser movements will be carefully monitored, as the application of too much water may lead to increased runoff.		
Traffic				
MM78	EIAR Section 14	A comprehensive set of mitigation measures will be put in place before and during the construction stage of the project in order to minimise the effects of the additional traffic generated by the Proposed Development. For delivery of abnormal sized loads - The following are the main points to note for these deliveries which will take place after peak evening traffic: o The delivery of turbine components is a specialist transport operation with the transportation of components carried out at night when traffic is at its lightest and the impact minimised. o The deliveries will be made in consultation with the relevant Authorities and An Garda Síochána. o It is estimated that 64 abnormal sized loads will be delivered to the site, comprising 22 convoys of 3, undertaken over 22 separate nights. o These nights will be spread out over an approximate period of 11 weeks and will be agreed in advance with the relevant authorities o In order to manage each of the travelling convoys, for each convoy there will be two police escort vehicles that will stop traffic at the front and rear of the convoy of 3 vehicles. o There will also be two escort vehicles provided by the haulage company for each convoy.		
MM79	EIAR Section 14	A detailed **Traffic Management Plan (TMP)**, will be provided specifying details relating to traffic management and included in the CEMP prior to the commencement of the construction phase of the proposed development. The TMP will be agreed with the local authority and An Garda Síochána prior to construction works commencing on site. The detailed TMP will include the following:		

		• **Traffic Management Coordinator** – a competent Traffic Management Co-ordinator will be appointed for the duration of the project and this person will be the main point of contact for all matters relating to traffic management. • **Delivery Programme** – a programme of deliveries will be submitted to the County Council in advance of deliveries of turbine components to site. Liaison with the relevant local authorities and Transport Infrastructure Ireland (TII) will be carried out where required regarding requirements such as delivery timetabling. The programme will ensure that deliveries are scheduled in order to minimise the demand on the local network and minimise the pressure on the access to the site. • **Information to locals** – Locals in the area will be informed of any upcoming traffic related matters e.g. temporary lane/road closures (where required) or delivery of turbine components at night, via letter drops and posters in public places. Information will include the contact details of the Project Co-ordinator, who will be the main point of contact for all queries from the public or local authority during normal working hours. An "out of hours" emergency number will also be provided. • **A Pre and Post Construction Condition Survey** – Where required by the local authority, a pre-condition survey of roads associated with the proposed development can be carried out immediately prior to construction commencement to record an accurate condition of the road at the time. A post construction survey will be carried out after works are completed to ensure that any remediation works are carried out to a satisfactory standard. Where required the timing of these surveys will be agreed with the local authority. All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers. • **Liaison with the relevant local authority** - Liaison with the County Council and An Garda Síochána, will be carried out during the delivery phase of the large turbine vehicles, when an escort for all convoys will be required. Once the surveys have been carried out and "prior to commencement" status of the relevant roads established, (in compliance with the provisions of the CEMP), the Roads section will be informed of the relevant names and contact numbers for		

		the Project Developer/Contractor Site Manager as well as the Site Environmental Manager. - **Implementation of temporary alterations to road network at critical junctions** – at locations highlighted in section 14.1.8. In addition, in order to minimise the impact on the existing environment during turbine component deliveries the option of blade adaptor trailers will also be used where deemed practicable. - **Identification of delivery routes** – These routes will be agreed with the County Council and adhered to by all contractors. - **Delivery times of large turbine components** - The management plan will include the option to deliver the large wind turbine plant components at night in order to minimise disruption to general traffic during the construction stage. - **Travel plan for construction workers** – While the assessment above has assumed the worst case in that construction workers will drive to the site, the construction company will be required to provide a travel plan for construction staff, which will include the identification of routes to / from the site and identification of an area for parking. - **Additional measures** - Various additional measures will be put in place where appropriate in order to minimise the effects of the development traffic on the surrounding road network including wheel washing facilities on site and sweeping / cleaning of local roads as required. These are set out in the CEMP which is contained in Appendix 4-2 - **Re-instatement works** - All road surfaces and boundaries will be re-instated to pre-development condition, as agreed with the local authority engineers.		
Cultural Heritage				
MM80	EIAR Section 12	A buffer zone of a minimum of 10m should be established between KE009-088– Road – unclassified togher and the hardstand for T1. No ground works or storage of peat/topsoil should take place within the buffer zone. The buffer zone should be defined by durable fencing for the duration of the construction phase of the project with 'Keep Out' signage placed on same		
Operational Phase				

MM81	EIAR Section 4	The removal and disposal of wastewater from the site will be carried out by a fully permitted waste collector holding valid Waste Collection Permits as issued under the Waste Management (Collection Permit) Regulations, 2007. Information on the appointed permitted contractor and evidence of a maintenance contract having been submitted to the Planning Authority prior to any construction works taking place.		
MM82	EIAR Section 4, 8, 9 NIS Section 5 CEMP Section 3, 5	The electrical substation will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;		
MM83	EIAR Section 5	An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM84	EIAR Chapter 6	To reduce the value of the habitat for bat species in the areas surrounding the turbines, a buffer of at least 50m between the tip of the blade and any trees or other tall vegetation that could provide high quality foraging habitat for bat species will be implemented.		
MM85	EIAR Chapter 5	Where daily or annual shadow flicker exceedances are experienced at buildings, a site visit will be undertaken to determine the level of occurrence, existing screening and window orientation. The shadow flicker prediction data will be used to select dates on which a shadow flicker event could be observed at one or multiple affected properties and the following process will be adhered to. In the event of shadow flicker being noted as occurring the details of the duration (times) of the occurrence will be recorded. In the event of an occurrence of shadow flicker exceeding guideline threshold values of 30 minutes per day at residential receptor locations, mitigation options will be discussed with the affected homeowner, including: - Installation of appropriate window blinds in the affected rooms of the residence; - Planting of screening vegetation;		

		› Other site-specific measures which might be agreeable to the affected party and may lead to the desired mitigation. If it is not possible to mitigate any identified shadow flicker limit exceedance locally using the measures detailed above, wind turbine control measures will be implemented.		
MM86	EIAR Chapter 5	Access to the turbines is through a door at the base of the structure, which will be locked at all times outside maintenance visits.		
MM87	EIAR Chapter 5	An operational phase Health and Safety Plan will be developed to fully address identified Health and Safety issues associated with the operation of the site and providing for access for emergency services at all times.		
MM88	EIAR Section 11	Modern wind turbines can be programmed to run in reduced modes of operation (or low noise modes) to achieve the attenuation required in the specific wind conditions (i.e. wind speed and direction). Operating the turbines in reduced noise modes is generally referred to as curtailment. Should predicted exceedances be confirmed at the commissioning stage of the development, it is possible to mitigate for this through curtailment of turbine(s) in the relevant wind speed and directions. The curtailment strategy would ultimately be developed for the specific turbine technology installed on the site and the associated noise emissions at the various operational wind speeds. If necessary, a detailed curtailment strategy matrix will be developed at the detailed design stage in order to achieve the relevant noise criteria at all NSL's.		
MM89	EIAR Section 6	Blade Feathering Blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine. Bat Buffers		

		The required bat buffers surrounding turbines located within or at the edge of conifer forestry habitat will remain free from vegetation for the duration of the operational phase of the proposed development. Bat Monitoring Plan Post-construction bat monitoring will be undertaken for at least three years' post construction of the renewable energy development. The monitoring will also include corpse searching in the areas surrounding the turbines to gather data on any actual collisions. The results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements, including curtailment if deemed necessary following post construction monitoring. Lighting The applicant commits to the use of lights during operation in line with guidance that is provided in the Institute of Lighting Professionals Guidance Note 08/18 Bats and artificial lighting in the UK and Dark Sky Ireland Lighting Recommendations. Exterior lighting will be designed to minimise light spillage by using directional accessories (Stone, 2013).		
MM90	EIAR Section 14	It is standard practice of 2RN to produce a Protocol Document for wind farm developments, which will be signed by the developer. The Protocol Document ensures that in the event of any interference occurring to television or radio reception due to operation of the wind farm, the required measures, as set out in the document, will be carried out by the developer to rectify this. The Protocol Document ensures that the appropriate mitigation is carried out in the event of unanticipated broadcast interference arising to television or radio reception as a result of the Proposed Development. In the event of interference occurring to telecommunications, the Department of the Environment, Heritage and Local Government Wind Farm Planning Guidelines (2006) state that these effects are generally easily dealt with by the use of divertor relay links out of line with the proposed wind turbines.		

7. MONITORING PROPOSALS

All monitoring proposals relating to the pre-commencement, construction and operational phases of the proposed development were set out in the relevant chapters of the Environmental Impact Assessment Report (EIAR).

This section of the Construction and Environment Management Plan groups together all of the monitoring proposals presented in the EIAR. The monitoring proposals are presented in Table 7-1 below.

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

Table 7-1 Monitoring Measures

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
Pre-Commencement Phase					
MX1	EIAR Section 4 CEMP Section 4	An inspection and maintenance plan for the drainage system on site will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be necessary, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water at parts of the systems where it is not intended. The inspection of the drainage system will be the responsibility of the site ECoW or the Project Hydrologist.	On going	Monthly	ECoW
MX2	CEMP Section 3	Prior to commencement of works in sub-catchments across the site main drain inspections will be competed to ensure ditches and streams are free from debris and blockages that may impede drainage.	As Required	Monthly	
MX3	EIAR Section 7	Pre-commencement surveys will be undertaken prior to the initiation of works at the wind farm. The survey will include a thorough walkover survey to a 500m radius of the development footprint and all works areas, where access allows. If winter roosting or breeding activity of birds of high conservation concern is identified, the roost or nest site will be located and earmarked for monitoring at the beginning of the first winter or breeding season of the construction phase. If it is found to be active during the construction phase, no works shall be undertaken within a disturbance buffer (Forestry Commission Scotland, 2006; Ruddock and Whitfield, 2007) in line with industry best practise. No works shall be permitted within the buffer until it can be demonstrated that the roost/nest is no longer occupied. During pre-commencment surveys, the whooper swan enhancement lands will be visited to confirm that there is suitable high quality foraging habitat for swans. The lands should comprise agricultural pasture with a sward height of 30cm or less. There should be no disturbance (including livestock) between the start of October until the migration of the swans in spring. Enhancement lands should be established prior to the commencement of construction activity.	Once	As Required	Project Ornithologist
Construction Phase					

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
MX4	EIAR Section 12	Archaeological monitoring of ground works (to include roads, substation, turbine hardstands, bases and cable trenching) will be undertaken at the construction phase of the development.	Once	As required	Project Archaeologist
MX5	CEMP Section 3	A system of peat monitoring will be implemented under the supervision of the project geotechnical engineer. This will include movement monitoring posts the findings of which will be reviewed by the geotechnical engineer.	Monthly or more frequently as required by construction programme	Monthly	Project Geotechnical Engineer
MX6	EIAR Section 4, 9	Check dams will be inspected and maintained regularly to insure adequate performance. Maintenance checks will also ensure the centre elevation of the dam remains lower than the sides of the dam.	As Required	As Necessary	ECoW
MX7	EIAR Section 4	A daily visual inspection of each settlement pond will be undertaken to identify when sediment are nearing capacity within the pond and sediment will be cleaned out as required. Settlement ponds will also be checked for anything else that might interfere with flows.	As Required	As Necessary	ECoW
MX8	EIAR Section 4	Settlement ponds will be inspected weekly and following significant rainfall events i.e. after events of >25mm rainfall in any 24-hour period. Inlet and outlets will be checked for sediment accumulation and anything else that might interfere with flows. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose.	Weekly / As Required	As Necessary	ECoW
MX9	EIAR Section 4	All culverts will be inspected regularly to ensure they are not blocked by debris, vegetation or any other material that may impede conveyance.	Weekly / Monthly	As Necessary	ECoW
MX10	EIAR Section 4	The effectiveness of drainage measures designed to minimise runoff entering works areas and capture and treat silt-laden water from the works areas, will be monitored continuously by the ECoW or supervising hydrologist on-site. The ECoW or supervising hydrologist will respond to changing weather,	As Required	As Necessary	ECoW / Project Hydrologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
	CEMP Section 3 & 4	ground or drainage conditions on the ground as the project proceeds, to ensure the effectiveness of the drainage design is maintained in so far as is possible. This may require the installation of additional check dams, interceptor drains or swales as deemed necessary on-site.			
MX11	EIAR Section 9 CEMP Section 3	The plant used should be regularly inspected for leaks and fitness for purpose.	Before Use	As Necessary	Drivers / ECoW
MX12	EIAR Section 9	Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.	Weekly/ Monthly	As Necessary	ECoW
MX13	EIAR Section 9	During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs should be undertaken for each watercourse and specifically following heavy rainfall events (*i.e.* weekly, monthly and event based). This will be completed in consultation with the Fisheries Board.	Weekly, monthly and event based	As Necessary	ECoW / Project Hydrologist
MX14	CEMP Section 3	Training and supervision of drivers to ensure smooth machinery operation/driving, and to minimise unnecessary noise generation.	As Required	As Necessary	ECoW
MX15	EIAR Section 7	Works will commence outside the bird nesting season (1st of March to 31st of August inclusive). Any requirement for construction works to run into the subsequent breeding season following commencement will be subject to pre-construction bird surveys to confirm the absence of breeding birds.	Prior to the subsequent breeding season	As Necessary	Project Ornithologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
MX16	CEMP Section 3	Dust gauges to be put in place during the construction phase of the development to monitor dust emissions generated by the development of the wind farm.	Monthly	Quarterly	ECoW
MX17	CEMP Section 3	A Project Ecologist will be appointed. The responsibilities and duties of the Project Ecologist will include the following: › Undertake a pre-construction transect/walkover bird survey to ensure that significant effects on breeding birds will be avoided. › Inform and educate on-site personnel of the ornithological and ecological sensitivities within the Proposed Development area. › Oversee management of ornithological and ecological issues during the construction period and advise on ornithological issues as they arise. › Provide guidance to contractors to ensure legal compliance with respect to protected species onsite. Liaise with officers of consenting authorities and other relevant bodies with regular updates in relation to construction progress.	As required	As required	Project Ecologist
Operational Phase					
MX18	EIAR Section 6	Habitat condition monitoring will be undertaken during construction and in year 1 post construction to ensure that there are no negative effects on marsh fritillary habitat	As required	As required	
MX19	CEMP Section 3	Monthly sampling for laboratory analysis for a range of parameters adopted during pre-commencement and construction phases will continue for six months during the operational phase. The Project Hydrologist will monitor and advise on the readings being received from the testing laboratory.	Monthly	Monthly	
MX20	EIAR Section 7	A detailed post-construction Bird Monitoring Programme has been prepared for the operational phase of the proposed development (refer to EIAR	Years 1, 2, 3, 5, 10 and 15	Annually	Project Ornithologist

Ref. No.	Reference Location	Survey / Monitoring Measure	Frequency	Reporting Period	Responsibility
		Appendix 7-6 for further details). The programme of works will monitor parameters associated with collision, displacement/barrier effects and habituation during the lifetime of the project. Surveys will be scheduled to coincide with Years 1, 2, 3, 5, 10 and 15 of the lifetime of the wind farm. Monitoring measures are broadly based on guidelines issued by SNH (2009). The following individual components are proposed: • Monthly flight activity surveys: vantage point surveys • Targeted bird collision surveys: corpse searches with trained dogs • Hen harrier roost monitoring: hen harrier roost surveys • Whooper swan monitoring: enhancement land site visits and adjacent Ballyouneen I-WeBS site.	of the life of a wind farm		
MX21	EIAR Section 6	Post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity The results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements, including curtailment, to ensure that there are no significant residual effects on bat species	Monthly or as required	Years 1, 2 and 3 of the life of a wind farm	Project Ornithologist
MX22	EIAR Section 9	Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.	As Required	Weekly	ECoW
MX23	EIAR Section 11	Once the site is operational a Noise Compliance Monitoring Programme will be carried out by a suitable qualified noise consultant/engineer	Once	On completion of Programme	Project Noise Consultant

8. PROGRAMME OF WORKS

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

The EIAR stipulated that in the interest of breeding birds, construction would not commence during the breeding bird season, which runs from March to August.

Therefore, to comply with the above voluntary restrictions, construction could commence at any stage from September onwards to the end of February, so that construction activities are ongoing by the time the next breeding bird season comes around.

At this time, it is envisaged that construction will commence in the third quarter of 2022. This provisional start date is dependent on some final details relating to various factors such as grid connection and turbine supply but is the current projected start date that project team members are working towards.

The phasing and scheduling of the main construction task items are outlined in Figure 8-1 below, where September 2025 has been shown as the start date for construction activities.

ID	Task Name	Q3 2025	Q4 2025	Q1 2026	Q2 2026	Q3 2026	Q4 2026	Q1 2027	Q2 2027
1	Site Health and Safty								
2	Site Compounds								
3	Site Roads								
4	Turbine Hardstands								
5	Turbine Foundations								
6	Substation Construction and Electrical Works								
7	Backfilling and Landscaping								
8	Turbine Delivery and Erection								
9	Substation Commissioning								
10	Turbine Commisioning								

Figure 8-1 Indicative Construction Schedule

9. COMPLIANCE AND REVIEW

9.1 Site Inspections and Environmental Audits

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

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

9.2 Auditing

An Environmental audit will first be carried out prior to the construction phase of the development to ensure the implementation of pre-construction mitigation measures, completion of baseline studies and implementation of pre-construction felling mitigation measures. Further environmental audits will be carried on a monthly basis during the construction phase of the project and again after the commissioning of the wind turbines.

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

An audit of compliance with the pre-commencement mitigation measures will be completed by the ECoW prior to the commencement of the construction phase of the development. An audit of compliance with the construction phase mitigation measures will be completed monthly during the construction phase. The findings of each audit will be documented by the ECoW in an audit report within the EMP for the site. The audit report will be made available to Kerry County council on request.

Once the wind farm is operational and turbines have been commissioned, a report of compliance with operational phase mitigation measures will be prepared.

9.3 Environmental Compliance

The following definitions shall apply in relation to the classification of Environmental Occurrences during construction of the wind farm:

Environmental Near Miss: An occurrence which if not controlled or due to its nature could lead to an Environmental Incident.

Environmental Incident: Any occurrence which has potential, due to its scale and nature, to migrate from source and have an environmental impact beyond the site boundary.

Environmental Exceedance Event: An environmental exceedance event occurs when monitoring results indicate that limits for a particular environmental parameter (as indicated in the Environmental Monitoring Programme) has been exceeded.

An exceedance will immediately trigger an investigation into the reason for the exceedance occurring and the application of suitable mitigation where necessary.

Exceedance events can be closed out on achieving a monitoring result below the assigned limit for a particular environmental parameter.

Environmental Non-Compliance: Non-fulfilment of a requirement and includes any deviations from established procedures, programs and other arrangements related to the CEMP.

9.4 Corrective Action Procedure

A corrective action is implemented to rectify an environmental occurrence on-site. Corrective actions will be implemented by the Construction Manager, as advised by the Site ECoW. Corrective actions may be required as a result of the following;

- Environmental Audits;
- Environmental Inspections and Reviews;
- Environmental Monitoring;
- Environmental Incidents, Exceedances; and,
- Environmental Complaints.

A Corrective Action Notice will be used to communicate the details of the action required to the main contractor. A Corrective Action Notice is a form that describes the cause and effect of an environmental problem on site and the recommended corrective action that is required. The Corrective Action Notice, when completed, will include details of close out and follow up actions. The Corrective Action Notice will be held at the site offices.

If an environmental problem occurs on site that requires immediate action, direct communications between the Construction Manager and the Site ECoW will be conducted. This in turn will be passed down to the site staff involved. A Corrective Action Notice will be completed at a later date.

9.5 Construction Phase Plan Review

This CEMP will be updated and reviewed prior to commencement of construction, and every six months thereafter, during the construction phase of the project.

APPENDIX 4

EIAR CHAPTER 9 - HYDROLOGY

9. HYDROLOGY AND HYDROGEOLOGY

9.1 Introduction

9.1.1 Background and Objectives

Hydro-Environmental Services (HES) was engaged by MKO Ireland (MKO) to carry out an assessment of the potential effects of the proposed Ballynagare Wind Farm, Co. Kerry. The proposed wind farm site is located approximately 500m northeast of Lixnaw village, 3.7km southeast of Ballyduff and 9.6km west of Listowel. The proposed site is situated in the townlands of Ballynagare, Dysert and Dysert Marshes.

The proposed Ballynagare wind farm development comprises 7 no. turbines and associated hardstands, site access tracks, upgrades to existing roads, 1 no. met mast, 1 no. on-site electrical substation, 1 no. borrow pit, 2 no. temporary construction compounds, 2 no. peat repositories, underground cable works and all associated drainage infrastructure. The development also includes 2 no. proposed grid route connection routes (only one of which will be developed), between the proposed on-site substation and the 110kV substation at Clahane.

This Chapter provides a baseline assessment of the environmental setting of the proposed Ballynagare Wind Farm development and the grid connection route in terms of the water environment (hydrology and hydrogeology) and discusses the potential effects that the construction and operation of the proposed development will have. Where required, appropriate mitigation measures to limit any identified significant impacts to the water environment are recommended.

9.1.2 Statement of Authority

Hydro-Environmental Services (HES) are a specialist geological, hydrological, hydrogeological and environmental practice which delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

Our core areas of expertise and experience include upland hydrology and windfarm drainage design. We routinely complete impact assessments for hydrology and hydrogeology for a large variety of project types.

This chapter of the EIAR was prepared by Michael Gill, Adam Keegan and Conor McGettigan.

Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 18 years' environmental consultancy experience in Ireland. Michael has completed numerous hydrological and hydrogeological impact assessments of wind farms and renewable projects in Ireland. He has substantial experience in surface water drainage design and SUDs design and surface water/groundwater interactions. For example, Michael has worked on the EIS for Oweninny WF, Cloncreen WF, and Yellow River WF, and over 100 other wind farm-related projects.

Adam Keegan (BSc, MSc) is a hydrogeologist with two years of experience in the environmental sector in Ireland. Adam has been involved in Environmental Impact Assessment Reports (EIARs) for numerous projects including wind farms, grid connections, quarries and small housing developments. Adam holds an MSc in Hydrogeology and Water Resource Management. Adam has worked on several wind farm EIAR projects, including Croagh WF, Lyrenacarriga WF (SID), Cleanrath WF, Carrownagowan WF (SID), and Fossy WF.

Conor McGettigan (BSc, MSc) is a recent graduate, holding an M.Sc. in Applied Environmental Science (2020) from University College Dublin, graduating with a First-Class Honours degree. Conor has also completed a B.Sc. in Geology (2016) from University College Dublin (First Class Honours). In recent times Conor has assisted in the preparation of the hydrology and hydrogeology chapters for several wind farm developments.

9.1.3 Scoping and Consultation

The scope for this assessment has been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties as summarised in Section 2.6 of Chapter 2 of the EIAR. Consultation responses relating to the water environment were received from the Geological Survey of Ireland and the Health Services Executive. Details of these scoping responses and actions taken to address them are outlined in Section 2.6.2 of this EIAR.

9.1.4 Relevant Legislation

The EIAR is prepared in accordance with the requirements of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (the 'EIA Directive') as amended by Directive 2014/52/EU.

The following legislation has been complied with:

- Planning and Development Acts, 2000 (as amended);
- Planning and Development Regulations, 2001 (as amended);
- S.I. No 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of the EIA Directive as amended by the Directive 2014/52/EU into Irish Law;
- S.I. No. 94 of 1997: European Communities (Natural Habitats) Regulations, resulting from EU Directives 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and 79/409/EEC on the conservation of wild birds (the Birds Directive);
- S.I. No. 293 of 1988: Quality of Salmon Water Regulations;
- S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended, and S.I. No. 722 of 2003 European Communities (Water Policy) Regulations, as amended, which implement EU Water Framework Directive (2000/60/EC) and provide for implementation of 'daughter' Groundwater Directive (2006/118/EC). Since 2000 water management in the EU has been directed by the Water Framework Directive (WFD). The key objectives of the WFD are that all water bodies in member states achieve (or retain) at least 'good' status by 2015. Water bodies comprise both surface and groundwater bodies, and the achievement of 'Good' status for these depends also on the achievement of 'good' status by dependent ecosystems. Phases of characterisation, risk assessment, monitoring and the design of programmes of measures to achieve the objectives of the WFD have either been completed or are ongoing. In 2015 it will fully replace a number of existing water related directives, which are successively being repealed, while implementation of other Directives (such as the Habitats Directive 92/43/EEC) will form part of the achievement of implementation of the objectives of the WFD;
- S.I. No. 684 of 2007: Waste Water Discharge (Authroisation)Regulations, resulting from EU Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances (the Groundwater Directive);
- S.I. No. 249 of 1989: Quality of Surface Water Intended for Abstraction (Drinking Water), resulting from EU Directive 75/440/EEC concerning the quality required of surface water intended for the abstraction of drinking water in the Member States (as amended by 2000/60/EC in 2007);
- S.I. No.106 of 2007: European Communities (Drinking Water)Regulations and S.I. No. 122 of 2014: European Union (Drinking Water) Regulations , arising from EU Directive

98/83/EC on the quality of water intended for human consumption (the Drinking Water Directive) and WFD 2000/60/EC (the Water Framework Directive);
- S.I. No. 9 of 2010: European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended; and,
- S.I. No. 296 of 2009: European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009, as amended.

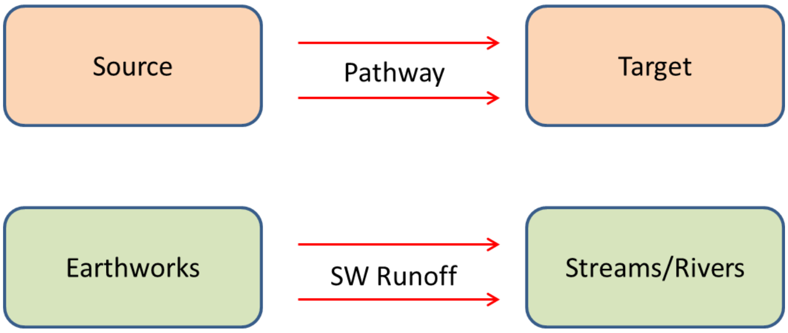
9.1.5 Relevant Guidance

The Hydrology and Hydrogeology chapter of the EIAR is carried out in accordance with guidance contained in the following:

- Environmental Protection Agency (2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports;
- Environmental Protection Agency (September 2015): Draft - Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (September 2015): Draft – Revised Guidelines on the Information to be Contained in Environmental Impact Statements;
- Environmental Protection Agency (2003) Advice Notes on Current Practice (in the preparation of Environmental Impact Statements);
- Environmental Protection Agency (2006): Environmental Management in the Extractive Industry;
- Environmental Protection Agency (2002) Guidelines on the Information to be Contained in Environmental Impact Statements;
- Institute of Geologists Ireland (2013) Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Wind Farm Development Guidelines for Planning Authorities (2006);
- Forestry Commission (2004) Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009) Forest Operations & Water Protection Guidelines;
- Forestry Services (Draft) Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures;
- Forestry Services (2000) Forestry and Water Quality Guidelines;
- Inland Fisheries Ireland (2016): Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Watercourses;
- Good Practice During Wind farm Construction (Scottish Natural Heritage, 2010);
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Water Courses (UK Guidance Note);
- CIRIA (Construction Industry Research and Information Association) Guidance on ‘Control of Water Pollution from Linear Construction Projects’ (CIRIA Report No. C648, 2006); and,
- Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors. CIRIA C532. London, 2001.

9.2 Overview of Impact Assessment Process

The conventional source-pathway-target model (see below, top) was applied to assess potential effects on downstream environmental receptors (see below, bottom as an example) as a result of the proposed wind farm development and grid connection routes.



Where potential effects are identified, the classification of impacts in the assessment follows the descriptors provided in the Glossary of Impacts contained in the following guidance documents produced by the Environmental Protection Agency (EPA):

- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003);
- Guidelines on the Information to be contained in Environmental Impact Statements (EPA, 2002); and,
- Environmental Protection Agency (August 2017): Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports.

The description process clearly and consistently identifies the key aspects of any potential impact source, namely its character, magnitude, duration, likelihood and whether it is of a direct or indirect nature.

In order to provide an understanding of the stepwise impact assessment process applied below (Sections 9.4.2 to 9.4.4), a summary guide is presented below, which defines the steps (1 to 7) taken in each element of the impact assessment process. The guide also provides definitions and descriptions of the assessment process and shows how the source-pathway-target model and the EPA impact descriptors are combined.

Using this defined approach, this impact assessment process is then applied to all wind farm construction, operation and decommissioning activities (including the grid connection) which have the potential to generate a source of significant adverse impact on the geological and hydrological/ hydrogeological (including water quality) environments.

Table 9-1: Impact Assessment Process Steps

Step 1	Identification and Description of Potential Impact Source This section presents and describes the activity that brings about the potential impact or the potential source of pollution. The significance of effects is briefly described.	
Step 2	Pathway / Mechanism:	The route by which a potential source of impact can transfer or migrate to an identified receptor. In terms of this type of development, surface water and groundwater flows are the primary pathways, or for example, excavation or soil erosion are physical mechanisms by which potential impacts are generated.
Step 3	Receptor:	A receptor is a part of the natural environment which could potentially be impacted upon, e.g. human health, plant / animal species, aquatic habitats, soils/geology, water resources, water sources. The potential impact can only arise as a result of a source and pathway being present.
Step 4	Pre-mitigation Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impact before mitigation is put in place.
Step 5	Proposed Mitigation Measures:	Control measures that will be put in place to prevent or reduce all identified significant adverse impacts. In relation to this type of development, these measures are generally provided in two types: (1) mitigation by avoidance, and (2) mitigation by (engineering) design.
Step 6	Post-Mitigation Residual Impact:	Impact descriptors which describe the magnitude, likelihood, duration and direct or indirect nature of the potential impacts after mitigation is put in place.
Step 7	Significance of Effects:	Describes the likely significant post-mitigation effects of the identified potential impact source on the receiving environment.

9.3 Methodology

9.3.1 Desk Study

A desk study of the proposed wind farm development site, grid connection route and surrounding area was largely completed prior to the undertaking of field mapping and walkover assessments. The desk study involved collecting all relevant geological, hydrological, hydrogeological and meteorological data for the area. This included consultation of the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive "catchments.ie" Map Viewer (www.catchments.ie);

- Bedrock Geology 1:100,000 Scale Map Series, Sheet 17 (Geology of the Shannon Estuary);Geological Survey of Ireland (GSI, 1999);
- Geological Survey of Ireland - Groundwater Body Characterisation Reports;
- OPW Indicative Flood Maps (www.floodmaps.ie);
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie); and,
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie).

9.3.2 Baseline Monitoring and Site Investigations

A hydrological walkover survey, including detailed drainage mapping and baseline monitoring/sampling, was undertaken by HES on 01st July and 13th July 2021. Previous site visits and walkover surveys were conducted on several dates from April to July 2021.

Site investigations to address the Water Section of the EIAR included the following:

- Walkover surveys and hydrological mapping of the proposed wind farm site, grid connection routes, and the surrounding areas were undertaken whereby water flow directions and drainage patterns were recorded;
- A preliminary flood risk assessment for the proposed wind farm site and grid connection route;
- A total of over 180 no. peat probes were undertaken by GDG and HES to determine the thickness and geomorphology of the peat at the wind farm site;
- A geotechnical assessment of peat stability for the wind farm site was completed by GDG (2021);
- Two continuous water level loggers were installed in the vicinity of the wind farm site to record water levels in surface watercourse to aid the understanding of the local hydrological regime;
- Field hydrochemistry measurements of unstable parameters (electrical conductivity, pH and temperature) were taken to determine the origin and nature of surface water flows within the wind farm site and along the grid connection routes; and,
- A total of 10 no. surface water samples were undertaken to determine the baseline water quality of the primary surface waters originating from the wind farm site and along the grid connection route.

9.3.3 Impact Assessment Methodology

Please refer to Chapter 1 of the EIAR for details on the impact assessment methodology used in this EIAR (EPA, 2002 & 2003). In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study and baseline study. Levels of sensitivity which are defined in Table 9-2 are then used to assess the potential effect that the proposed development may have on them.

Table 9-2: Receptor Sensitivity Criteria (Adapted from www.sepa.org.uk)

Sensitivity of Receptor	
Not sensitive	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as A3 waters or seriously polluted), fish sporadically present or restricted). Heavily engineered or artificially modified and may dry up during summer months. Environmental equilibrium is stable and is resilient to changes which are considerably greater than natural fluctuations, without detriment to its present character. No abstractions for public or private water supplies. GSI groundwater vulnerability "Low" – "Medium" classification and "Poor" aquifer importance.
Sensitive	Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as A2. Salmonid species may be present and may be locally important for fisheries. Abstractions for private water supplies. Environmental equilibrium copes well with all natural fluctuations but cannot absorb some changes greater than this without altering part of its present character. GSI groundwater vulnerability "High" classification and "Locally" important aquifer.
Very sensitive	Receptor is of high environmental importance or of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as A1 and salmonid spawning grounds present. Abstractions for public drinking water supply. GSI groundwater vulnerability "Extreme" classification and "Regionally" important aquifer.

9.3.4 Limitations and Difficulties Encountered

No limitations or difficulties were encountered during the preparation of the Hydrology and Hydrogeology Chapter of the EIAR.

9.4 Receiving Environment

9.4.1 Site Description and Topography

9.4.1.1 Wind Farm Site

The proposed wind farm site ("the site") is located approximately 500m northeast of Lixnaw village, 7km southeast of the village of Ballyduff and 8.3km southwest of Listowel, Co. Kerry. The site has a total area of approximately 594 hectares and is located in the townlands of Ballynagare, Dysert Marshes and Dysert.

Much of the centre of the site is located on a peat bog which has historically been subject to peat harvesting. Narrow peat fields are orientated southwest to northeast towards the south of the bog area, and northwest to southeast in the north. The peat bog is surrounded by agricultural grasslands on all sides. Much of the east and south of the site comprises agricultural lands with fields separated by hedgerows and drains with occasional farmhouses located within the site boundary.

Topography at the site is generally flat and low-lying with ground elevations ranging from 0-5m OD (metres above Ordnance Datum). The site is located in the Tralee Bay Feale Catchment and is bordered by the Brick river to the west and the River Feale to the east. These two watercourses confluence to the north of the site, forming the Cashen River Estuary. The Lower River Shannon SAC is located immediately to the west, north and east of the site while the Cashen River Estuary pNHA is also located to the northeast of the site along the upper tidal reaches of the Feale River. Flood embankments have been installed along the Brick and Feale Rivers in the vicinity of the site.

Access to the site is via a local Ballynagare to Clahane road which dissects the southwest of the site before crossing the Brick River. The bog area of the site is accessible by various access tracks, which are used to facilitate local peat harvesting. These tracks branch off the local road and crosscut the bog area. The agricultural areas in the south and west of the site are accessed via access tracks from a farmyard.

9.4.1.2 Grid Connection Route

The proposed underground connection route to the Clahane 110kV substation is approximately 13.8km in length. The route travels from the existing quarry road, before veering northwards along the R557 for 2.7km where it turns to the southeast in the townland of Ballyhorgan East. The route then travels south along tertiary roads for 5.5km before turning west on the L1027 for 0.35km. The route then turns to the south in the townland of Lissahane, where it continues for 1.1km. The route joins the L6074 for 0.4km to Banemore Cross where it joins the N69. It then continues southwest for 0.45km before turning to the south along the entrance to Clahane substation. The topography of the route is relatively flat along public road networks with a notable increase in slope before it joins the L6074. The Ballynagare WF Grid Connection – Preliminary Route Development (2021) states that there are a total of 5 no. major watercourse crossings along this proposed grid connection route which may require Horizontal Direction Drilling (HDD).

9.4.2 Water Balance

Long term rainfall and evaporation data was sourced from Met Éireann. The long-term average rainfall (1981 - 2010) recorded at Ballyduff G.S., approximately 2km northwest of the site, is presented in Table 9-3.

Table 9-3 Local Average long-term Rainfall Data (mm)

Station		X-Coord		Y-Coord		Ht (MAOD)		Year Start		Year End		Total
Ballyduff G.S.		287000		134800		36.00		1941		N/A		
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Total
114	81	81	58	66	65	68	91	95	117	116	122	1,073

The closest synoptic station[1] where the average potential evapotranspiration (PE) is recorded is at Shannon Airport, approximately 50km to the northeast. The long-term average PE for this station is 543mm/yr. This value is used as a best estimate of the site PE. Actual Evaporation (AE) at the site is estimated as 516mm/yr (which is 0.95 × PE).

The effective rainfall (ER) represents the water available for runoff and groundwater recharge. The ER for the site is calculated as follows:

Effective rainfall (ER) = Average Annual Rainfall – AE

= 1,073 mm/yr – 516 mm/yr

ER = 557 mm/yr

[1] *A station at which meteorological observations are made for the purposes of synoptic (large spatial scale) analysis*

Based on the groundwater recharge coefficient of 4% for peat bogs at this site (www.gsi.ie), an estimate of 22.3 mm/year average annual recharge is given for cut over raised peat at the site. This means that the hydrology of the site is characterised by very high surface water runoff rates and very low groundwater recharge rates. Therefore, conservative annual recharge and runoff rates for the site are estimated to be 22.3mm/yr and 534.7mm/yr respectively.

Table 9-4 below presents return period rainfall depths for the area of the site. These data are taken from https://www.met.ie/climate/services/rainfall-return-periods and they provide rainfall depths for various storm durations and sample return periods (1-year, 50-year, 100-year). These extreme rainfall depths will be the basis of the proposed wind farm drainage hydraulic design as described further below.

Table 9-4: Return Period Rainfall Depths for the Wind Farm site

	Return Period (Years)			
Duration	1	5	30	100
5 min	3.5	5.6	9.2	12.5
15 mins	5.7	9.2	15.1	20.5
1 hour	9.7	14.8	22.8	29.8
6 hours	19.4	27.3	38.8	51.9
12 hours	25.4	34.6	47.7	58.1
24 hours	33.2	44.0	58.6	70.1
2 days	42.5	54.8	71.1	83.6

9.4.3 Regional Hydrology

9.4.3.1 Wind Farm Site

On a regional scale, the site is located in the Tralee Bay-Feale surface water catchment within Hydrometric Area 23. On a more local scale, the site is located in the Brick River surface water sub-catchment (Brick_SC_020).

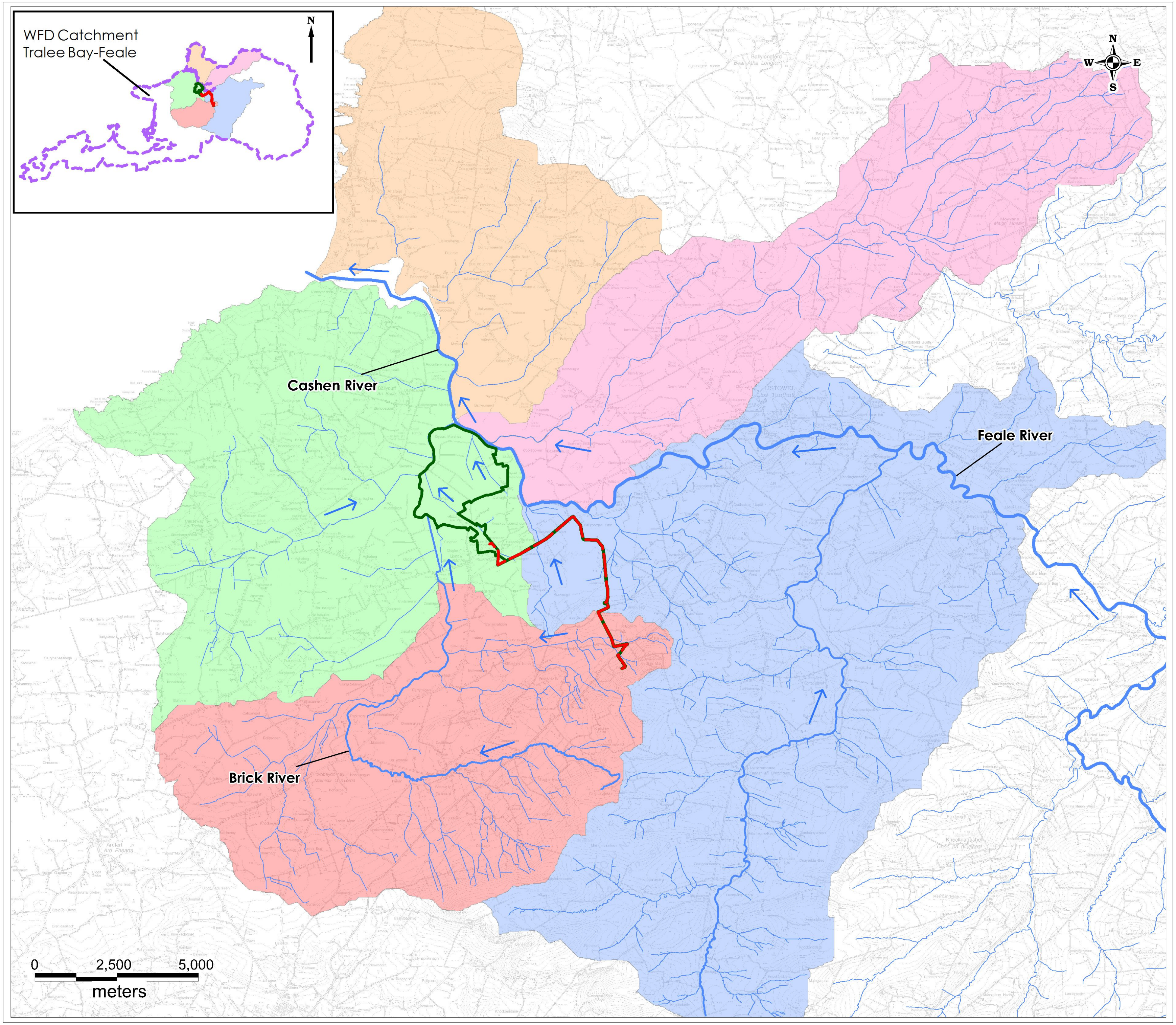
The Feale River (EPA Code: 23F01) forms the north-eastern boundary of the site. The Feale River rises near Rockchapel in the Mullaghareirk Mountains in north Co. Cork and flows to the northwest, through the town of Abbeyfeale, Co. Limerick. Along its route it is joined by several tributaries including the Clydagh, Owveg, Allaghaun and Oolagh Rivers. Closer to the site the Feale is joined by the Smearlagh River to the south of Listowel. The Smearlagh River drains the central and eastern parts of the Stack's Mountains. The Feale then flows westwards collecting from the River Galey to the north and the River Brick to the south. The Brick River (EPA Code: 23B03) forms the western boundary of the site. The Feale River is tidal in the vicinity of the site, referred to as the Upper Feale Estuary and the Cashen River Estuary upstream and downstream of its confluence with the Brick River respectively. The tidal influence extends upstream of the site as far as Finuge, located approximately 4km east of the site. The Cashen River Estuary discharges into the Mouth of the Shannon approximately 3km south of Ballybunnion and 6km northwest of the site.

9.4.3.2 Grid Connection Route

On a regional scale the proposed grid connection route is located in the Tralee Bay-Feale surface water catchment.

The grid connection route begins in the Brick River surface water sub-catchment (Brick_SC_020), and enters the Feale River surface water sub-catchment (Feale_SC_040) to the west of the site in the townland of Ballyhorgan. The grid route then veers to the south and enters the Brick River surface water sub-catchment (Brick_SC_010) in the townland of Lissahane.

A regional hydrology map for the wind farm site and the grid connection route is shown as Figure 9-1.



Legend

EIAR Site Boundary

Clohane Grid Route

Watercourses

WFD Subcatchments

Brick_SC_010

Brick_SC_020

Feale_SC_040

Galey_SC_020

GLOURIA_SC_010

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Job: Ballynagare WF, Co. Kerry	
Title: Regional Hydrology Map	
Figure No: 9-1	
Drawing No: P1531-0-1021-A3-901-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:110,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

9.4.4 Wind farm Site Drainage

On a more local scale, the south and centre of the site are mapped in the Brick_040 WFD River sub-basin (IE_SH_23B030700). In terms of key wind farm infrastructures: 5 no. turbines (T2, T4, T5, T6 & T7), the substation, the southern construction compound, borrow pit, met mast, the southern proposed peat repository and associated access roads are located in this WFD river sub-basin.

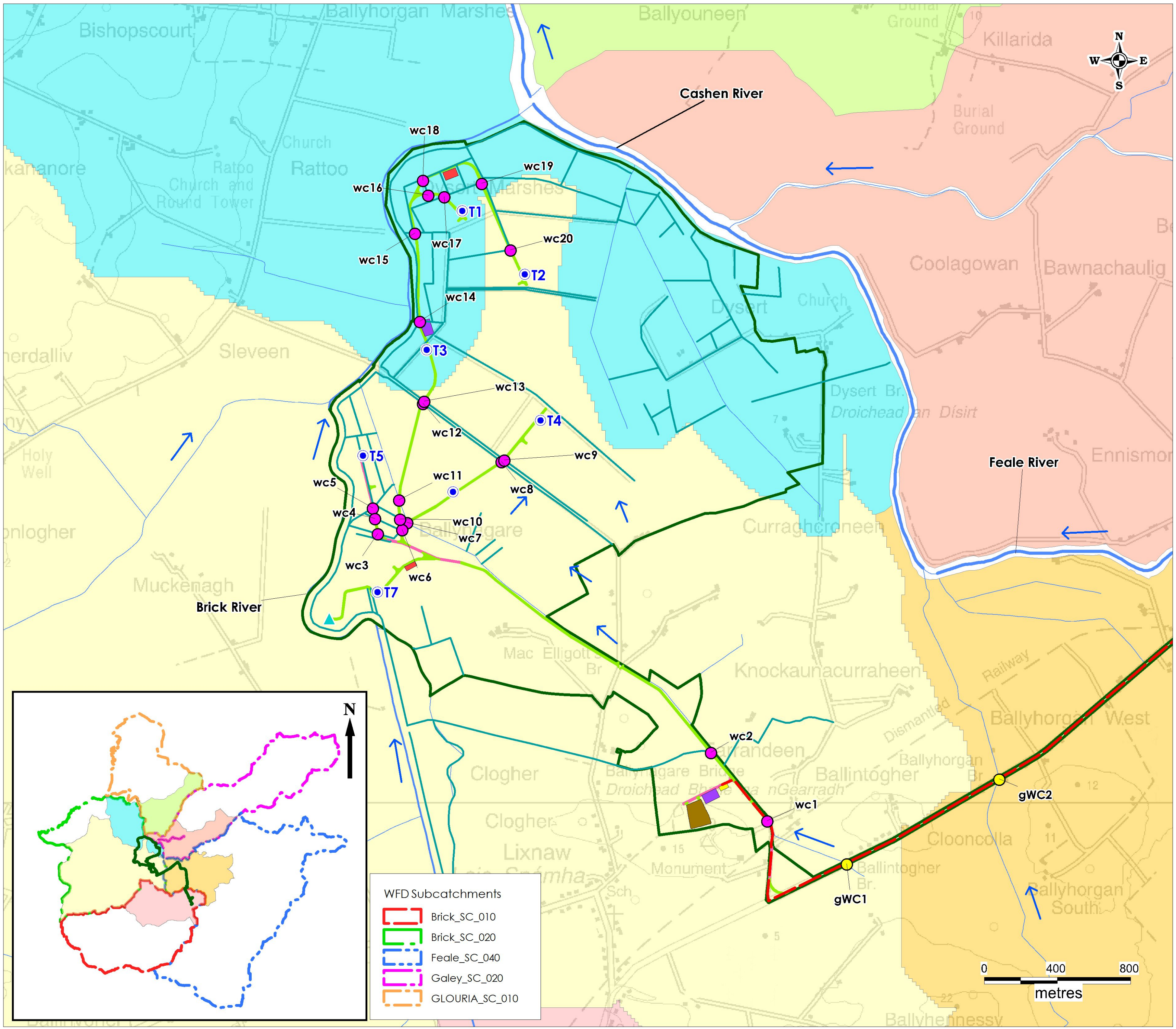
The EPA maps the Brick River to flow to the north, approximately 150m west of T5, 150m south of T7 and approximately 90m west of the proposed met mast. The EPA also maps a small stream/drain, referred to as Monument stream (EPA Code: 23M41), to dissect the western and southern sections of the site. The Monument stream flows to the northwest, approximately 60m east of the proposed substation location and adjacent and parallel to a proposed new access road for 1.8km. This stream then flows approximately 250m southwest of T6 and 90m east of T5 before discharging into the Brick River approximately 400m north of T5. The Brick River then continues to meander northwards before its confluence with the Feale River.

Meanwhile the northwest and east of the site are located in the Knoppoge_South_010 WFD River sub-basin (IE_SH_23K120820). In terms of key wind farm infrastructures, 2 no. turbines (T1 and T3), the northern temporary construction compound and the northern peat repository are mapped in this WFD river sub-basin. The EPA maps the presence of two streams/drains in the east of the site, referred to as the Dysert Marshes (EPA Code: 23D19) and Ballyouneen stream (EPA Code: 23B32). These drains flow to the north before discharging into the Feale River which flows approximately 60m northeast of the site. No wind farm infrastructures are located in the vicinity of these EPA mapped drains. Further west, the Brick River flows along the western boundary of the site, approximately 200m west of T3 and 400m west of T1. Table 9-5 presents a summary of the key proposed wind farm infrastructures and their respective WFD surface water catchments.

A local hydrology map for the site showing WFD river sub-basins is shown as Figure 9-2.

Table 9-5: Summary of Regional/Local hydrology & Proposed Windfarm Infrastructure

Regional Catchments	Sub-catchment	WFD River Sub-Basin	Main Development Infrastructure	Primary Waterbodies
Tralee Bay-Feale	Brick_SC_020	Brick_040	T2, T4, T5, T6, T7, substation, southern construction compound, southern peat repository, borrow pit & met mast	Brick River & Monument Stream
		Knoppoge_South_010	T1, T3, northern construction compound & northern peat repository	Brick and Feale Rivers



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Job: Ballynagare WF, Co. Kerry	
Title: Local Hydrology Map (WF)	
Figure No: 9-2	
Drawing No: P1531-0-1021-A3-902-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:20,000	Drawn By: GD
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2 no. continuous water level loggers were installed in the main boundary drain (SW1) and on the Brick River (SW2), near the bridge to the southwest of T3, from the 13th April to the 12th July 2021. These continuous water levels are shown in Plate 9-1below, with Plate 9-2 showing continuous water levels for the first week in May 2021. The monitoring results showed a distinctive tidal regime, with two high and two low tides recorded each day. Greater water level fluctuations were recorded in the Brick River, with a maximum recorded water level of 2.05mOD and a minimum recorded water level of -0.47mOD. Meanwhile, smaller water level fluctuations were recorded in the drain, with a range of -0.28 to 0.25mOD.

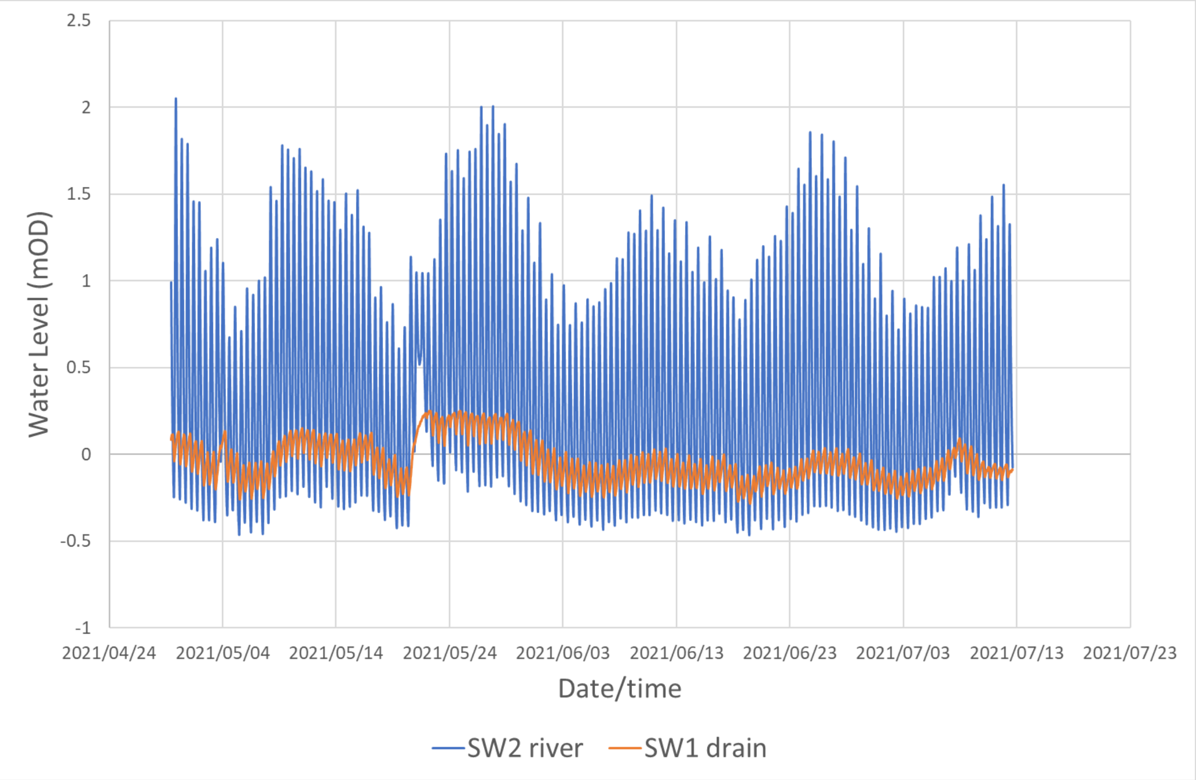


Plate 9-1: Continuous water level monitoring (April to July 2021)

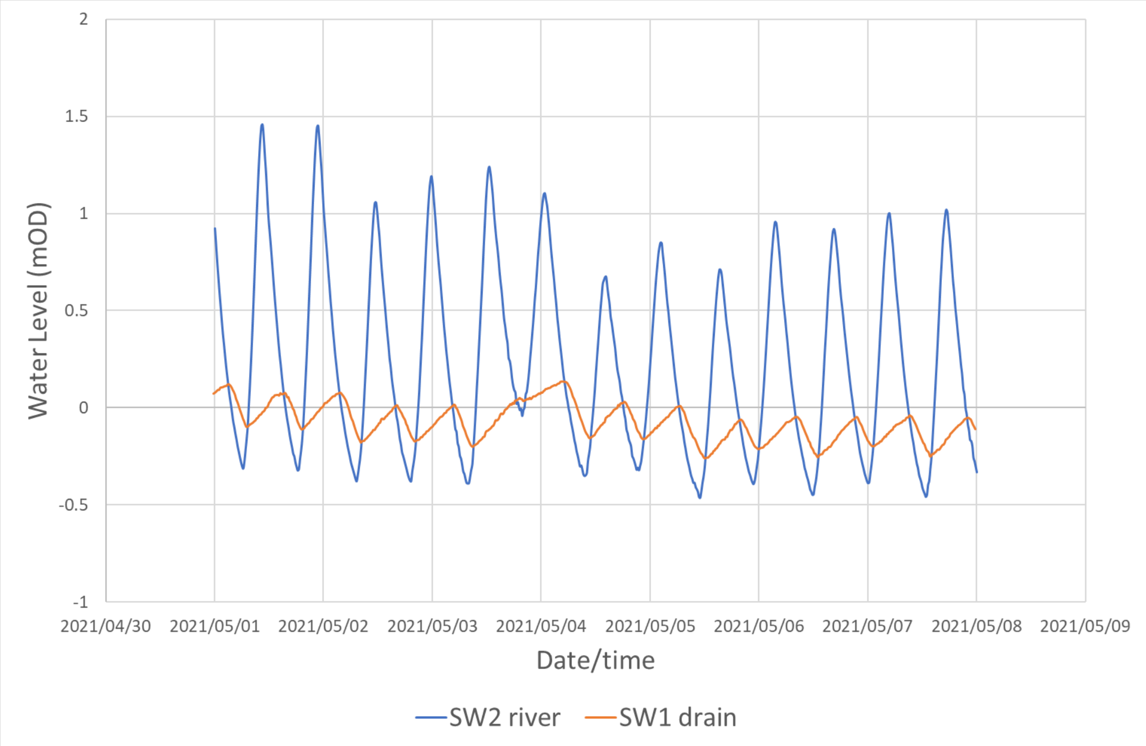


Plate 9-2: Selected continuous water levels (01/05/2021 – 08/05/2021)

As discussed, the majority of the site is located in a peat basin which has its own drainage system. Of the 7 no. turbines, 2 are located on agricultural land (T5 and T7) with the remainder within the peat bog. The format of the drainage system in the cutover bog is outlined below.

The surface of the cutover bog is drained by a network of field drains that are typically spaced every 15 to 20m along the boundary of existing and remnant peat cutting plots. These drains are orientated southwest to northeast in the south and centre of the site and in a northwest to southeast orientation towards the north. Surface water runoff collected in these drains is conveyed to larger main drains which typically run perpendicular to the smaller field drains and also along the edges of the internal bog track network. These main drains direct surface water to a boundary drain that outfalls via sluice gates to the bounding tidal rivers. There are 8 no. main outfalls to the west of the proposed wind farm site which discharge to the Brick River, with an additional 7 no. outfalls located along the Feale River (however no wind farm infrastructure is proposed in the area draining towards the Feale.

During site walkovers conducted on 1st July 2021, the parallel running bog field drains were noted to be relatively shallow and do not intercept the mineral subsoil underlying the peat. The larger main drains, including the Monument stream and the boundary drain were noted be significantly deeper.

In the southwest of the site, T5 and T7 are located on agricultural grasslands. Drainage in these agricultural areas is via drains along field boundaries which discharge into the boundary drain running parallel with the embankment.

The proposed site access roads are mapped to cross several drains within the site.

9.4.5 Grid Connection Route Drainage

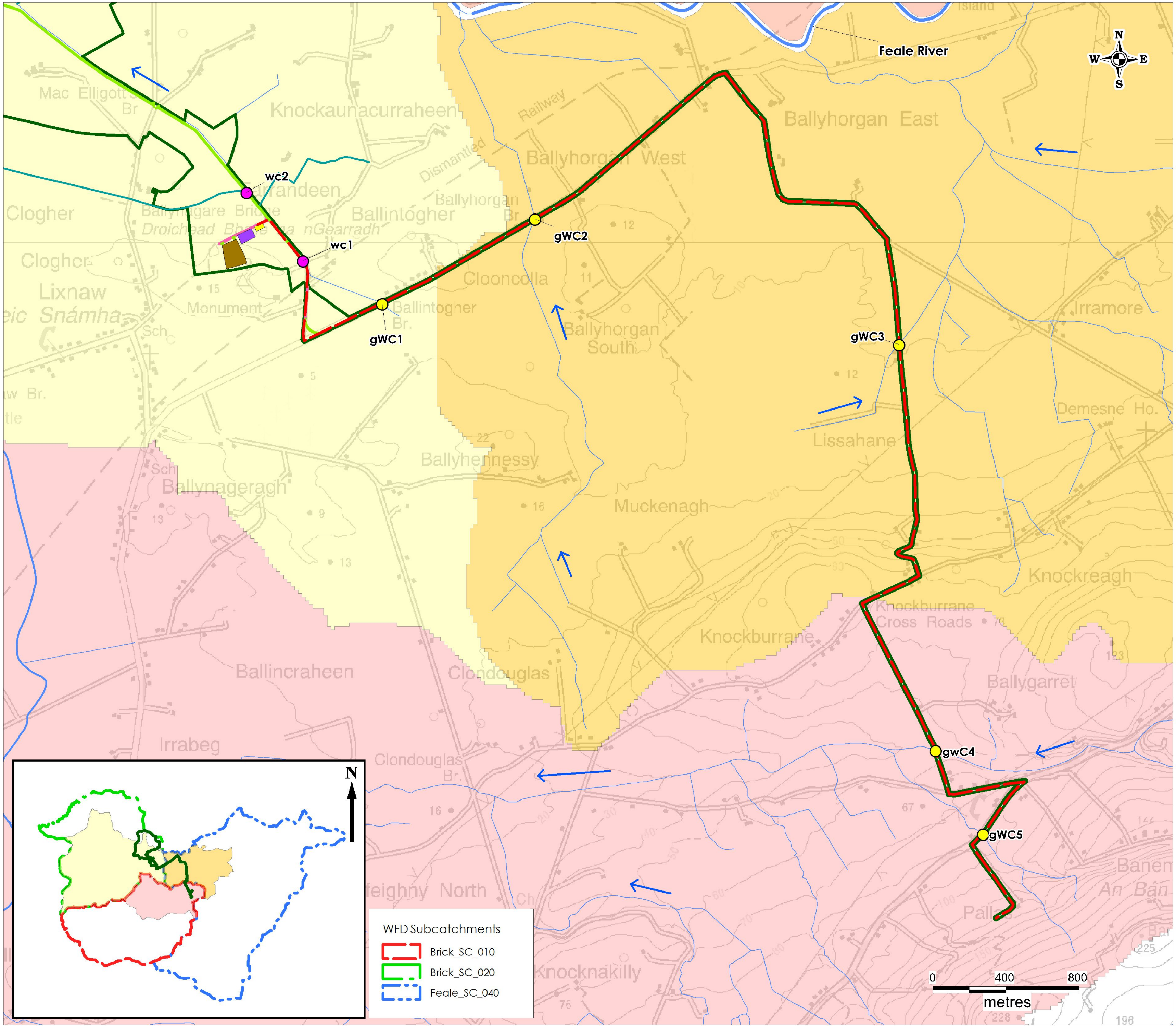
As stated above the grid connection route is located in the Brick River surface water sub-catchment (Brick_SC_020). In the vicinity of the site, the grid route is located in the Brick_040 WFD River sub-basin, with the grid route mapped to cross the Monument stream (EPA Code: 23M41) along the R557. Further east in the townlands of Ballyhorgan West, Ballyhorgan East and south to Lissahane, the route is mapped in the Feale River surface water sub-catchment (Feale_SC_040) and the Mountcoal_010 WFD River sub-basin. Here surface water flows northwards towards the Feale River, with the grid route crossing the Ballyhennessy stream in the west and the Lissahane stream, a tributary of the Mountcoal River, further east. Finally in the townlands of Ballygarret, Banemore and in the vicinity of Clahane 110kV substation the route is located in the Brick River surface water sub-catchment (Brick_SC_010) and the Brick_030 WFD River sub-basin. In this region, drainage is directed to the west towards the Brick River. The grid route is mapped to cross both the Knockburrane stream (EPA Code: 23K73) and the Pallas stream (EPA Code: 23P07).

The drainage density along the proposed grid connection route is relatively high. According to EPA mapping, there are a total of 5 no. main watercourse crossings along this route which are listed in Table 9-6 below. All crossings will be in the carriageway of existing public roads.

A local hydrology map for the grid route showing WFD river sub-basins and watercourse crossings is shown as Figure 9-3. A local hydrology map for the wind farm site is shown as Figure 9-4.

Table 9-6 : Summary of Grid Option A1 watercourse crossings.

WFD Sub-catchment	WRD River Sub-basin	EPA Name	EPA Code	Road Crossing
Brick_SC_020	Brick_040	Monument	23M41	Along R557
Feale_SC_040	Mountcoal_010	Ballyhennessy	23B12	Along R557
Feale_SC_040	Mountcoal_010	Lissahane	23L09	Small Tertiary Road
Brick_SC_010	Brick_030	Knockburrane	23K73	Before junction with L6074
Brick_SC_010	Brick_030	Pallas	23P07	Along N69



WFD Subcatchments

Brick_SC_010

Brick_SC_020

Feale_SC_040

Legend

EIAR Site Boundary

Clohane Grid Route

Proposed Substation

Proposed Borrow Pit

Proposed Construction Compound

Proposed New Roads

Existing Roads to be Upgraded

Watercourses

Main drains

WC Crossings_Grid Route

WC Crossings_Wind Farm

WFD Sub-Basins

BRICK_030

BRICK_040

MOUNTCOAL_010

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Figure No: 9-3	
Drawing No: P1531-0-1021-A3-902-0A	
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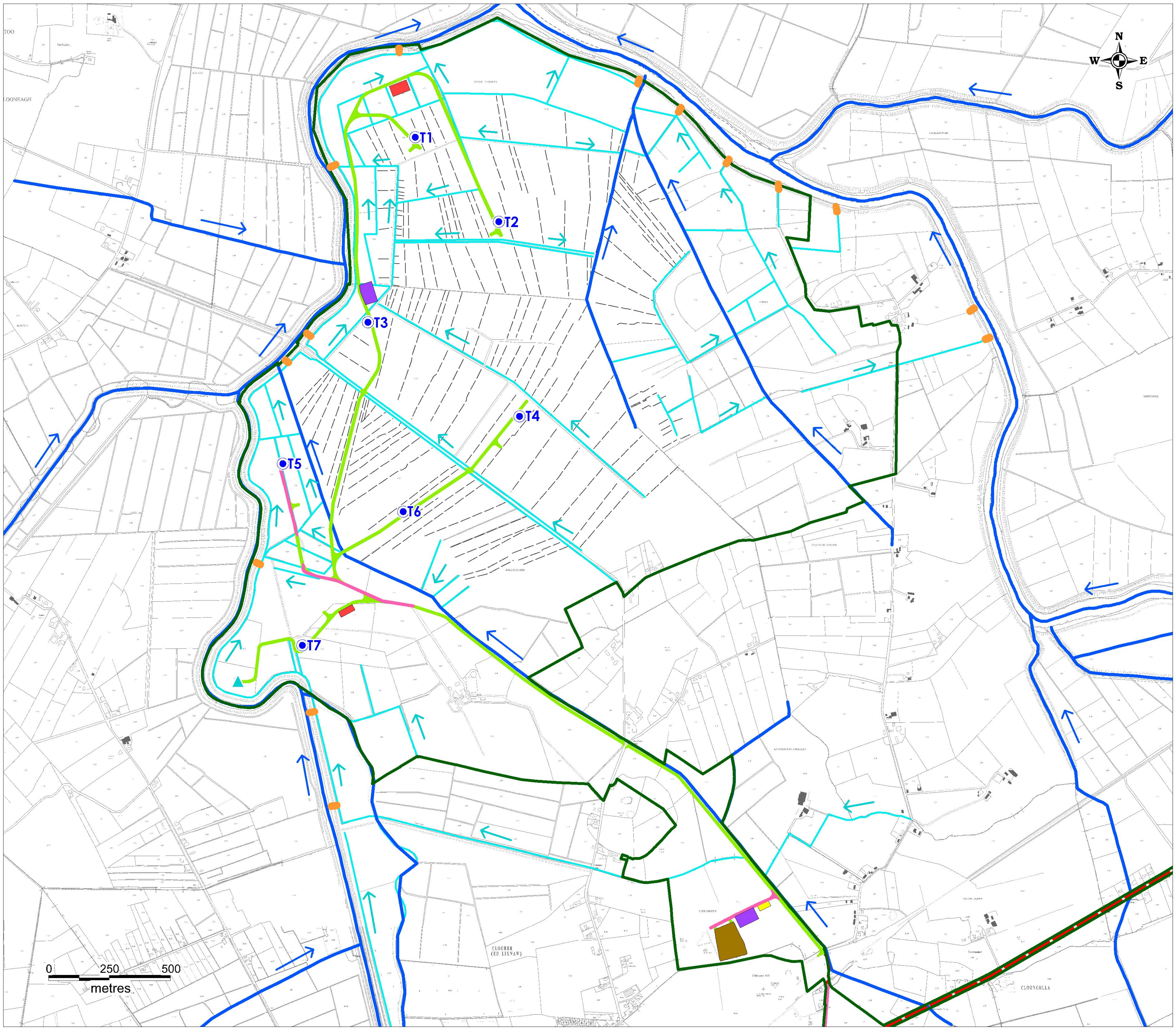
Date: 07/10/2021	Checked By: MG



Legend

	EIAR Site Boundary
	Proposed Turbine Layout
	Clohane Grid Route
	Proposed Met Mast
	Proposed Substation
	Proposed Borrow Pit
	Proposed Construction Compound
	Existing Roads to be Upgraded
	Proposed New Roads
	Temporary Peat Storage Area
	Watercourses
	Main Drains
	Field Drains
	Outfall

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Job: Ballynagare WF, Co. Kerry	
Title: Site Drainage Map	
Figure No: 9-4	
Drawing No: P1531-0-1021-A3-904-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:15,000	Drawn By: GD
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9.4.6 Baseline Assessment of Site Runoff

This section undertakes a long-term water balance assessment and surface water runoff assessment for the baseline conditions at the site.

The rainfall depths used in this water balance, long term averages, are not used in the design of the sustainable drainage system for the wind farm.

The water balance calculations are carried out for the month with the highest average recorded rainfall minus evapotranspiration, for the current baseline site conditions (Table 9-7). It represents therefore, the long-term average wettest monthly scenario in terms of volumes of surface water runoff from the site pre-wind farm development. The surface water runoff co-efficient for the site is estimated to be 96% based on the predominant peat coverage.

The highest long term average monthly rainfall recorded at Ballyduff G.S. is in December, at 122mm. The average monthly evapotranspiration for the synoptic station at Shannon Airport over the same period in December was 3.1mm. The water balance indicates that a conservative estimate of surface water runoff for the site during the highest rainfall month is 678,942m^3/month or 21,901m^3/day for the proposed wind farm site (Table 9-8).

Table 9-7: Water Balance and Baseline Runoff Estimates for Wettest Month (December)

Water Balance Component	Depth (m)
Average December Rainfall (R)	0.122
Average December Potential Evapotranspiration (PE)	0.0031
Average December Actual Evapotranspiration (AE = PE x 0.95)	0.00295
Effective Rainfall December (ER = R - AE)	0.1191
Recharge (4% of ER)	0.00476
Runoff (96% of ER)	0.1143

Table 9-8: Baseline Runoff for the Wind farm Site

Approx. Area (ha)	Baseline Runoff per month (m3)	Baseline Runoff per day (m3)
594	678,942	21,901

9.4.7 Flood Risk Assessment

9.4.7.1 Wind Farm Site & Grid Connection Routes

A Flood Risk Assessment of the site has been carried out by HES, the results of which are presented in full in Appendix 9-1 of this EIAR. To identify those areas as being at risk of flooding, OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), historical mapping (i.e. 6" and 25" base maps) and the Irish Coastal Protection Strategy Study (ICPSS) maps were consulted.

Several recurring flood incidents and historic flood events are recorded in the vicinity of the site. A recurring flood event associated with tidal flooding on the Feale River is mapped approximately 1km north of the site at Ballyhorgan. A significant flood event in this region dates from 1998, with widespread flooding on the Brick and Feale Rivers which encroached upon the area of the site. No historic or recurring flood instances are located on grid route to Clahane substation.

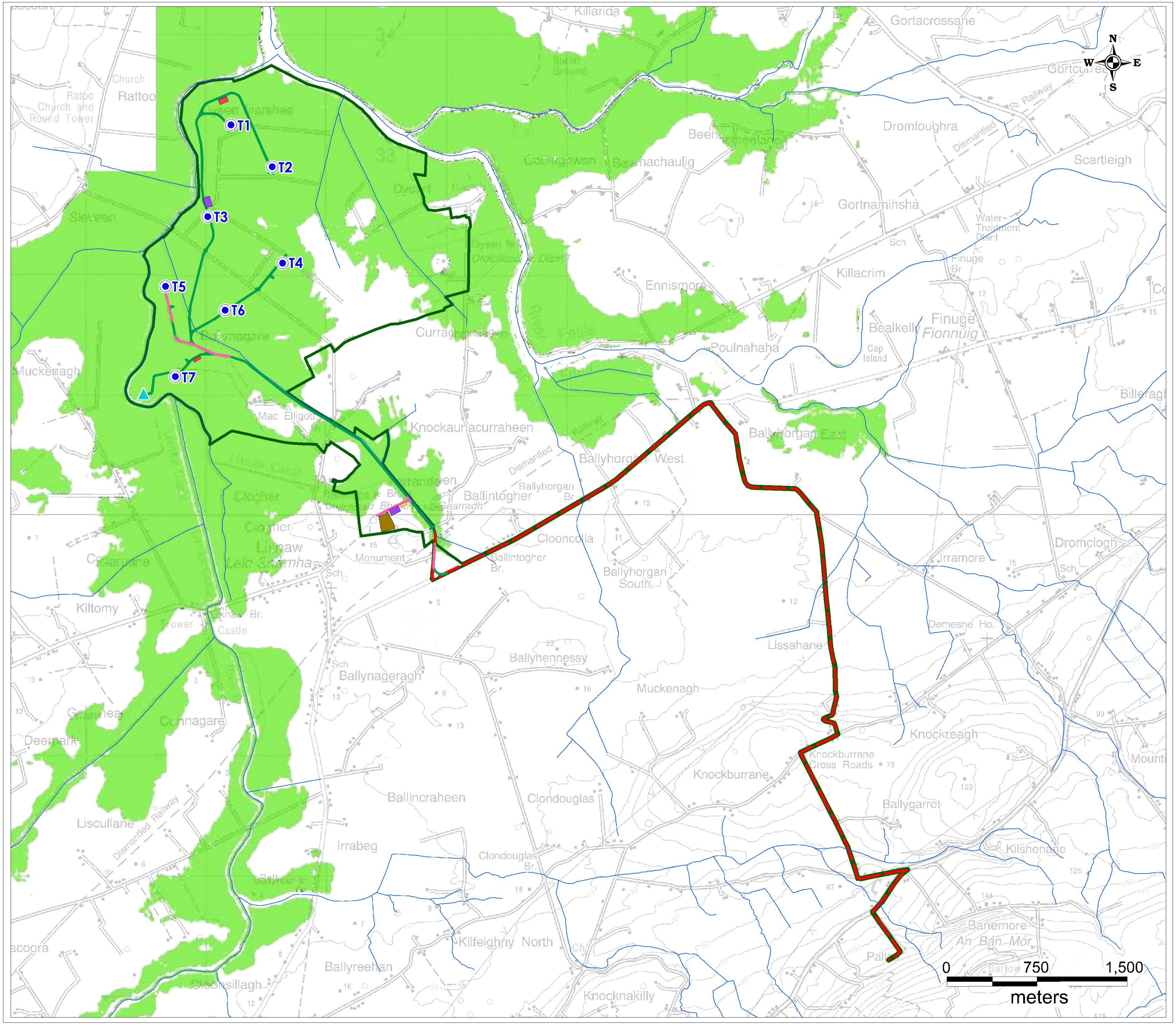
The land on the banks of the Brick and Feale rivers and within the site are mapped as "Benefiting Lands". Benefiting lands are a dataset prepared by the Office of Public Works which identifies land that might benefit from the implementation of Arterial (Major) Drainage Schemes (under the Arterial Drainage Act 1945, as amended) and indicates lands which are subject to flooding or poor drainage. The OPW drainage maps show several drains within the site. Flood defences in the form of embankments running along the Brick and Feale rivers have been erected to prevent floodwaters entering the site. The drainage network described in Section 9.4.4 removes rainfall from the land behind these embankments. In terms of the grid route, the area of the proposed Ballynagare substation and a small section of the R557 near Ballyhorgan west are mapped as Benefited lands.

CFRAM mapping indicates that the site and grid connection route are situated outside the extents of the indicative 1 in 1,000-year fluvial (i.e. river) and coastal (i.e. tidal) food zones. The flood maps suggest that coastal/tidal flooding is widespread within the Cashen River Estuary. The coastal flood zones are mapped on the riverbanks/floodplain opposite the site, to the north and east of the River Feale and to the west of the River Brick. This CFRAM mapping considers the flood defences with preferential flooding to the north. However, the OPW guidelines (2009) state that "the presence of flood protection structures should be ignored in determining flood zones".

The ICPSS (Irish Coastal Protection Strategy Study) flood maps do not consider the presence of the embankments in their flood modelling. These maps show that the majority of the site is located within the 1 in 200-year coastal flood zone. The modelled water level associated with such a flood event is 3.28mOD (0.5% AEP elevation) and would result in flood depths in excess of 1m across much of the site. The ICPSS flood map for the site is shown as Figure 9-5.

Under current conditions the primary potential source of flooding at the site is pluvial as the site is surrounded by flood defences which protect it from coastal flooding. Pluvial flooding is likely after heavy or prolonged periods of rainfall. However, if the flood embankments were to fail then the site would also be at risk from coastal flooding.

Within the flood risk assessment (see Appendix 9-1), a justification test has been completed. The flood risk has been assessed based on the normal defended scenario and in the case of an extreme undefended scenario (where the flood embankments are breeched). Flood resilience measures are proposed which include a custom design of the turbine interior where the sensitive turbine elements will be placed on a platform at an elevation in excess of 7m above ground level and above any future flood level. Other elements of the development are less sensitive to flooding, and infrequent flooding will not effect the maintenance or management of the wind farm. A volume displacement analysis has demonstrated that the potential presence of the wind farm footprint will have a negligible impact on flood water depths under normal conditions or in the extreme coastal flood scenario.



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Clohane Grid Route
- Proposed Met Mast
- Proposed Substation
- Proposed Borrow Pit
- Proposed Construction Compound
- Existing Roads to be Upgraded
- Proposed New Roads
- Temporary Peat Storage Area
- Watercourses
- 0.5% AEP Flood Extent (200 years)
- 0.1% AEP Flood Extent (1000 years)

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Drawing No: P1531-0-1021-A3-905-0A	
Sheet Size: A3	Project No: P1531-0
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9.4.8 Surface Water Hydrochemistry

9.4.8.1 Wind Farm Site

Biological Q-rating data for EPA monitoring points on the Brick and Feale Rivers are shown on Table 9-9 below. The Q-Rating is a water quality rating system based on both the habitat and the invertebrate community assessment and is divided into status categories ranging from 0-1 (Poor) to 4-5 (Good/High).

No Q-ratings are directly available for any streams/drains within the site. Similarly no Q-ratings are available for the Brick or Feale Rivers in the vicinity of the site. The closest EPA monitoring point on the Brick River is located approximately 5km to the southwest and upstream of the site at a bridge west of Garrynagore, 3.5km northeast of the small village of Abbeydorney. Here the Brick River achieved a Q-rating of Q3-4 (2020) and is classified as being of Moderate status. The closest EPA monitoring point on the Feale River is located at Finuge bridge, approximately 4km east and upstream of the site. Here the Feale River has been assigned a Q-rating of Q3-4 ('Moderate' status). No biological Q-rating data is available downstream of the site due to the estuarine nature of the waters.

Table 9-9: EPA Q-rating Scores for waterbodies upstream of Wind Farm Site

Station Code	Station Name	River Waterbody	Year	Q-Rating
RS23B030400	Bridge W of Garrynagore	Brick_020	2020	Q3-4
RS23F010800	Finuge Bridge	Feale_090	2020	Q3-4

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at the surface water sampling locations SW1 (drain) and SW2 (Brick River) in the vicinity of the site on 1st July 2021 and on 13th July 2021. These data are presented in Table 9-10*Table 9-10* below.

Electrical conductivity values for the drain ranged between 251 - 15,427µS/cm. pH values were recorded as being slightly acidic. Electrical conductivity values for the Brick River ranged from 719 – 77,412µS/cm, while the pH was recorded as being slightly basic. Turbidity ranged from 6.7 FNU in the Brick River to 8.4 FNU in the boundary drain on the 1st July 2021.

Grab sampling was also completed on 1st July and 13th July 2021 and results for the site (SW1 and SW2) are shown below in Table 9-11 below alongside relevant EQS values for surface water. The locations of the sampling points are shown on Figure 9-6.

Table 9-10: Field Hydrochemistry Range of Measurements (Windfarm)

Location	Waterbody	EC (µS/cm)	pH [H+]	Temperature (^{0}C)	Turbidity (FTU)
SW1	Boundary drain	251 - 15,427	6.6 - 6.8	17.9 - 18	8.4
SW2	Brick River	719 - 77,412	6.6 - 8.6	17.9 - 19	6.7

Table 9-11: Surface Water Sampling Results (Windfarm)

Parameter	EQS	Sample ID			
		SW1 R1	SW1 R2	SW2 R1	SW2 R2
Total Suspended Solids (mg/L)	25 (+)	64	27	90	20
Ammonia (mg/L)	≤0.065 to ≤ 0.04(*)	0.49	<0.02	0.33	0.15
Nitrate NO3 (mg/L)	-	<5	<5	<5	<5
Nitrite NO2 (mg/L)	-	<0.05	<0.05	<0.05	<0.05
Ortho-Phosphate P (mg/L)	≤ 0.035 to ≤0.025(*)	0.03	0.05	<0.02	0.06
Nitrogen (mg/L)	-	<1	1.9	<1	2.5
Phosphorous (mg/L)	-	0.14	0.2	0.1	0.17
Chloride (mg/L)	-	5582.1	60.6	9919.4	226.8
BOD	≤ 1.3 to ≤ 1.5(*)	4	6	16	2

R1 – 1st July and R2 – 13th July 2021

(+) S.I. No. 293 of 1988: Quality of Salmon Water Regulations.

(*) S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended.

Total suspended solids ranged between 20 – 90mg/L. Ammonia ranged between <0.02 and 0.49mg/L with most results being above the "Good Status" threshold with respect to the Surface Water Regulations (S.I. 272 of 2009). The EPA states that when present in levels above 0.1mg/L it may be indicative of sewage or industrial contamination.

Results for nitrate and nitrite were at or below the detection limit of the laboratory while orthophosphate ranged between <0.02 – 0.06mg/L.

BOD was reported to range from 2 -16 with all results above the "Good Status" threshold. The high BOD results recorded during this monitoring campaign is likely to be a result of organic pollution from agricultural runoff.

Chloride concentrations ranged from 60.6 – 9,919.4mg/L. These elevated chloride levels would be expected due to the site's proximity to the Cashen River Estuary and the tidal influence which this has on nearby surface waters. However the elevated chloride concentrations may also indicate some local pollution as the WFD state that this surface waterbody is under pressure from several stresses including agricultural activities and urban wastewater (refer to Section 9.4.14.1).

9.4.8.2 Grid Connection Route

Biological Q-rating data for EPA monitoring points on the Brick and Feale Rivers in the vicinity of the proposed grid route are shown on Table 9-12 below. Most recent data available (2020) shows that the Q-rating for the Brick River and Feale Rivers ranges from 'Poor' to 'High' status upstream of the of the proposed grid connection route. There are no EPA monitoring points located downstream of the proposed grid connection route.

Similar to the site above the closest monitoring point on the Brick River is located at the bridge west of Garrynagore, where the Brick River is reported as being of 'Moderate' status (Q3-4). Further upstream at Shannow Bridge and a bridge east of Milltown house near Abbeydorney, the Brick River also achieved a Q-ratings of Q3-4 in 2020.

To the east and upstream of the grid route the Feale River achieved a Q-rating of Q5 ('High' status) at Trienearagh, south of Listowel. Further downstream in Listowel the Feale River achieved a Q-rating of Q4 ('Good' status) near the Racecourse Footbridge. Meanwhile at Finuge Bridge, approximately 4km east of the proposed site, the Feale River has been assigned a Q-rating of Q3-4 ('Moderate' status).

Table 9-12:EPA Water Quality Monitoring Q-Rating Values (Grid Route)

Station Code	Station Name	River Waterbody	Year	Q-Rating
RS23F010550	Trienearagh	Feale_070	2020	Q4-5
RS23F010725	0.1km d/s Racecourse Footbridge	Feale_090	2020	Q4
RS23F010800	Finuge Bridge	Feale_090	2020	Q3-4
RS23B030300	Shannow Bridge	Brick_010	2020	Q3-4
RS23M040100	Bridge E of Milltown House	Brick_020	2020	Q3-4
RS23B030400	Bridge W of Garrynagore	Brick_020	2020	Q3-4

Field hydrochemistry measurements of unstable parameters, electrical conductivity (µS/cm), pH (pH units) and temperature (°C) were taken at the surface water sampling locations SW3, SW4 and SW5 along the proposed grid route on 1st July and 13th July 2021. SW3 is located at the proposed grid route crossing of the Ballyhennessy stream on the R557. SW4 is located where the route is proposed to cross the Knockburrane Stream. SW5 is located on one of the major tributaries of the Feale River, the Smearlagh River. These data are presented in Table 9-13 below.

Electrical conductivity values for these watercourses ranged from 77µS/cm to 479µS/cm. pH values were all neutral to slightly basic, ranging from 7.2 to 7.8. Turbidity recorded on the 1st July 2021 ranged from

30 FNU in the Ballyhennessy stream to less than 2 FNU in both the Knockburrane stream and the Smearlagh River.

Grab sampling was also completed on 1st July and 13th July 2021 and results for watercourse along the proposed grid routes (SW3, SW4 and SW5) are shown in Table 9-14 below. The locations of the sampling points are shown on Figure 9-6.

Table 9-13: Field Hydrochemistry Range of Measurements (Grid Route)

Location	Waterbody	EC (µS/cm)	pH [H+]	Temperature (^{0}C)	Turbidity (NTU)
SW3	Ballyhennessy stream	77 – 434.6	7.6 - 7.7	15 – 19.2	30.6
SW4	Knockburrane stream	375 - 479	7.2 - 7.7	14 – 16.7	1.9
SW5	Smearlagh River	78 - 151	7.5 - 7.8	15.4 - 17	1.3

Table 9-14: Surface Water Sampling Results (Grid Route)

Parameter	EQS	Sample ID		
		SW3 Range	SW4 Range	SW5 Range
Total Suspended Solids (mg/L)	25 (+)	12 - 14	<5 - <10	<5 - <10
Ammonia (mg/L)	≤0.065 to ≤ 0.04(*)	0.06 - 3.73	<0.02 – 0.04	<0.02 - 0.02
Nitrate NO3 (mg/L)	-	<5	<5 – 5.9	<5
Nitrite NO2 (mg/L)	-	<0.05 – 0.06	<0.05	<0.05
Ortho-Phosphate P (mg/L)	≤ 0.035 to ≤0.025(*)	0.6 - 0.11	0.02 – 0.04	<0.02
Nitrogen (mg/L)	-	2.9 – 3.1	1.6 - 2.2	<1 - 1.5
Phosphorous (mg/L)	-	0.25 – 0.6	<0.1	<0.1
Chloride (mg/L)	-	33.5 - 46.1	25.6 - 37	9.7 - 17.5

Parameter	EQS	Sample ID		
		SW3 Range	SW4 Range	SW5 Range
BOD	≤ 1.3 to ≤ 1.5(*)	2 - 4	<1 - 2	1

R1 – 1st July and R2 – 13th July 2021
(+) S.I. No. 293 of 1988: Quality of Salmon Water Regulations.

(*) S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009, as amended.

Total suspended solids ranged between <5 – 14mg/L. Results for nitrate and nitrite were at or below the detection limit of the laboratory while orthophosphate ranged between <0.02 – 0.06mg/L.

Ammonia ranged between <0.02 and 3.73mg/L with both the Smearlagh River and the Knockburrane stream being of "High Status". Results for the Ballyhennessy stream were above the "Good Status" threshold with respect to the Surface Water Regulations (S.I. 272 of 2009).

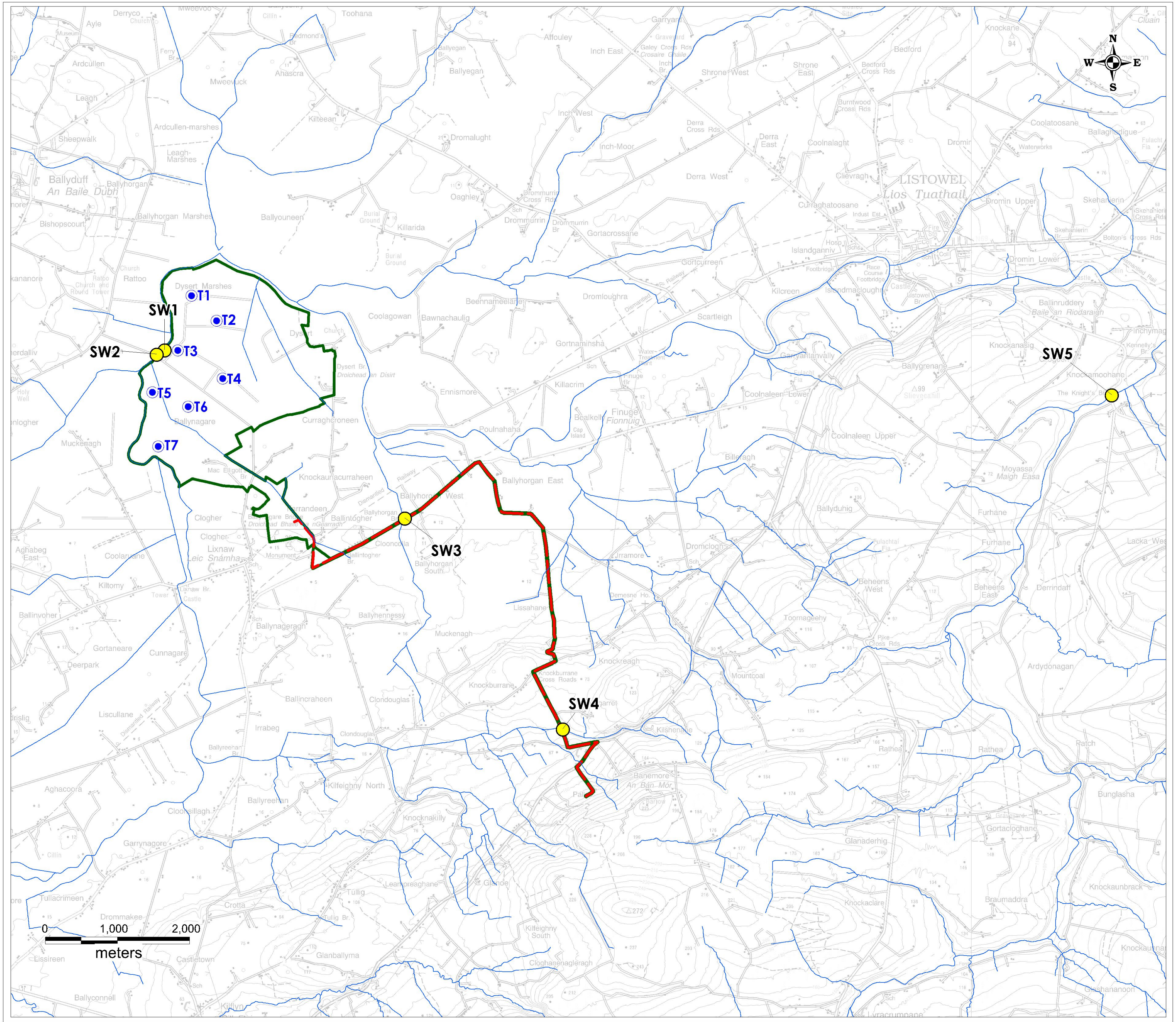
BOD was reported to range from <1 – 4. Results for the Smearlagh River were of "High Status", while results for the Knockburrane stream were above the "Good Status" threshold.

Chloride concentrations ranged from 17.5 – 46.1mg/L. Such chloride concentrations generally fall within the natural levels in rivers and freshwater and are far below the drinking water standards (less than 250mg/L).

*Table 9-15: Chemical Conditions Supporting Biological Elements**

Parameter	Threshold Values (mg/L)
BOD	High status ≤ 1.3 (mean)
	Good status ≤ 1.5 mean
Ammonia-N	High status ≤ 0.04 (mean)
	Good status ≤0.065 (mean)
Orthophosphate	High status ≤0.025 (mean)
	Good status ≤0.035 (mean)

* S.I. No. 272 of 2009: European Communities Environmental Objectives (Surface Waters) Regulations 2009 (as amended by S.I. No. 296/2009; S.I. No. 386/2015; S.I. No. 327/2012; and S.I. No. 77/2019 and giving effect to Directive 2008/105/EC on environmental quality standards in the field of water policy and Directive 2000/60/EC establishing a framework for Community action in the field of water policy).



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Clohane Grid Route
- Watercourses
- SW Sampling locations

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Title: SW Sampling Location Map	
Figure No: 9-6	
Drawing No: P1531-0-1021-A3-906-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:50,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

9.4.9 Regional Hydrogeology

9.4.9.1 Wind Farm Site

The Dinantian Sandstones, Shales and Limestones (DESS) of the Lower Limestone Shale formation which underlie the northwestern corner of the site are classified by the GSI as a Poor aquifer – Bedrock which is Generally Unproductive except for Local Zones (Pl). Further south, the Dinantian Lower Impure Limestones (DLIL) of the Ballysteen Formation, are classified as a Locally Important Aquifer – Bedrock which is moderately Productive only in Local Zones (Ll). Meanwhile the Dinantian Pure Unbedded Limestones (DPUL) of the Waulsortian Limestone Formation, which underlie the south and east of the site, are classified as a Regionally Important Aquifer – Karstified (diffuse) (Rkd).

According to the EPA, the north and west of the site is underlain by the Kerry Head Groundwater Body (GWB) (WFD Code: IE_SH_G_118), which is classified as poorly productive bedrock (PP). The Kerry Head GWB occupies the uplands and slopes of Kerry Head, with the site located at its northeastern boundary. The western margins of the GWB are underlain by Devonian Old Red Sandstones which form high cliffs, with the lowest ground located in the south and east, underlain by muddy and impure limestones. Transmissivities in the old red sandstone and lower impure limestone aquifers are reported to be in the range of 2 – 20m^3/day, with aquifer storativity low in all rock units. Localized zones of enhanced permeability can occur along fracture zones. The GSI state that the GWB is overlain sandstone till and cutover peat, with subsoil thicknesses ranging from 3m in the uplands to >20m on lower ground. Recharge occurs diffusely through these subsoils. Groundwater flow will follow local topography, with flows concentrated in the upper 15m of the aquifer. Groundwater will have short flow paths and be rapidly discharged to numerous surface watercourses which cross the aquifer and flow to the Cashen River Estuary. Groundwater levels are generally 4 - 10m below ground level but closer to the surface near the Cashen River Estuary. A small volume of groundwater may flow into the Ballybunnion GWB located further to the east (GSI, 2004).

The Ballybunnion GWB, (WFD Code: IE_SH_G_027) which underlies the south and east of the site, is hosted within the Waulsortian Limestones. No GSI Characterization report is available for this GWB. However the GWB is characterised as being Karstic (KA) in nature. Karstification refers to the development of enlarged conduits which form along faults, bedding planes or fractures due to dissolution of the limestone bedrock. Groundwater will therefore flow along these preferential flowpaths. Transmissivity in the pure unbedded limestones can range up to several thousand m^2/day (GSI, 2004). Most groundwater flow is likely to occur in the epikarst layer at the top of the aquifer and in zones of interconnected fissures and conduits. The GSI characterization report for the Kerry Head GWB states that while its groundwater discharges to the Cashen Estuary, it does so in small volumes compared with that from the Ballybunnion GWB.

In terms of key wind farm infrastructures, T1, T2, T3, T5, the northern construction compound and the northern peat repository are underlain by the poorly productive Kerry Head GWB. All remaining infrastructures (T4, T6, T7, southern construction compound, southern peat repository, borrow pit, and substation) are underlain by the karstic Ballybunnion GWB.

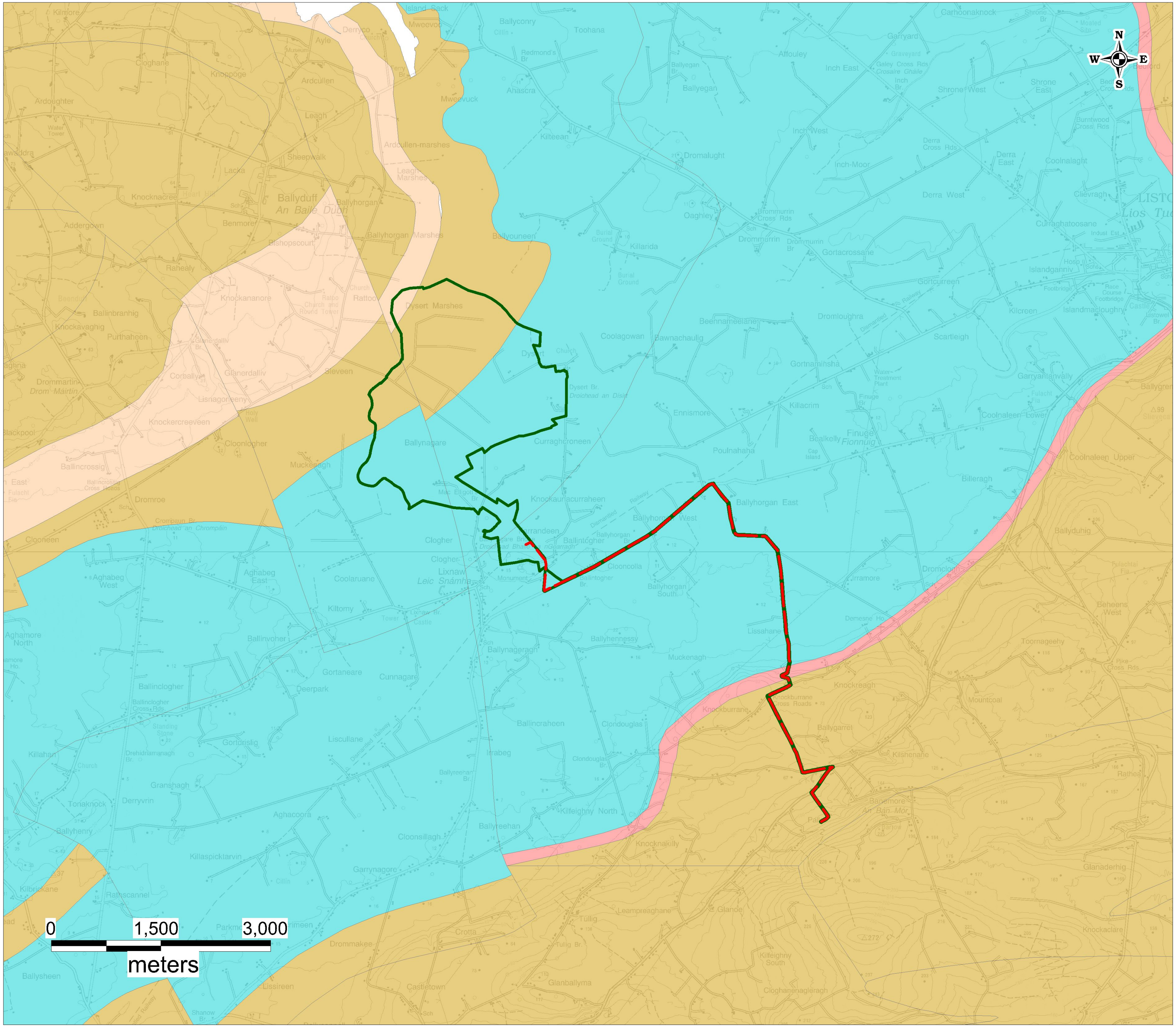
9.4.9.2 Grid Connection Route

In the vicinity of the site, the proposed grid route is underlain by Dinantian Pure Unbedded Limestones (DPUL) of the Waulsortian Limestone Formation, which are classified as a Regionally Important Aquifer – Karstified (diffuse) (Rkd). Further to the southeast, the Namurian Shales (NSH) of the Clare Shale Formation are classified as a Poor Aquifer – Bedrock which is Generally Unproductive (Pu). The southern section of the grid route is underlain by the Namurian Undifferentiated (Nu) rocks of the Shannon Group are classified as a Locally Important Aquifer – Bedrock which is Moderately Productive only in Local Zones.

The grid route is underlain by the Ballybunnion GWB, as described above, from the site as far as the townland of Lissahane. The southern section of the route is mapped to be underlain by the Abbeyfeale GWB (WFD Code: IE_SH_G_001).

The Abbeyfeale GWB is classified by the GSI as comprising poorly productive bedrock (PP). Topography in this GWB is generally hilly and dissected by numerous rivers and streams. The GWB is composed of low permeability rocks although zones of greater permeability may occur along fractures and faults. Transmissivity is in the range of 2 – 20m^2/day while aquifer storativity is low. Groundwater flow is primarily in the upper weathered zone of the aquifer and in deeper fracture zones. The water table ranges from 0 – 6m below ground level and follows the surface topography. Groundwater flow paths are typically short while deep confined flow paths may be longer. Dry weather flows are generally low indicating the low storativity of this aquifer. Groundwater discharges to nearby surface water streams, with the overall flow direction being to the west.

The bedrock aquifer map for the wind farm site and the grid route is shown as Figure 9-7.



Legend

EIAR Site Boundary

Clohane Grid Route

Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Poor Aquifer - Bedrock which is Generally Unproductive

Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones

Regionally Important Aquifer - Karstified (diffuse)

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Title: Local Bedrock Aquifer Map	
Figure No: 9-7	
Drawing No: P1531-0-1021-A3-907-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:50,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

9.4.10 Groundwater Vulnerability

9.4.10.1 Wind Farm Site

Groundwater vulnerability at the site ranges from 'Low' to 'Extreme-E' vulnerability. The south and east of the site are underlain by a Regionally Important karst aquifer which can be particularly vulnerable to groundwater pollution. The majority of the site, including all proposed turbine locations, is mapped by the GSI as being of 'Low' to 'Moderate' groundwater vulnerability. This is due to the widespread coverage of blanket peat across much of the site. Further south, the substation, construction compound and borrow pit are located in an area of 'Extreme-E'. Subsoils in this area are more permeable, mapped by the GSI as comprising till derived from Namurian sandstones and shales. A small section of the borrow pit is located in an area of 'Extreme-X' vulnerability. This area is mapped by the GSI as having rock close to or at the surface.

9.4.10.2 Grid Connection Routes

Groundwater vulnerability along the proposed grid route to the Clahane 100kV substation ranges from 'Low' to 'Extreme-X'. The sections of the grid route which are particularly vulnerable to groundwater pollution (High to Extreme vulnerability) are outlined below:

- The section from the site along the R557 as far as the townland of Ballyhorgan West;
- Along local roads in the townland of Lissahane; and,
- From Banemore Cross along the L6074, the N69 and along the access road as far as Clahane 110kV substation.

9.4.11 Groundwater Hydrochemistry

9.4.11.1 Wind Farm Site

There are no groundwater quality data for the site and groundwater sampling would generally not be undertaken for this type of development in terms of EIAR reporting, as groundwater quality impacts would not be anticipated.

The GSI (2004) state that there is no hydrochemical data available for the Kerry Head GWB. However, based on data from other GWBs, groundwater is expected to have a calcium-bicarbonate signature. Groundwater in the Ballysteen Formation will be hard to very hard with high alkalinities. Meanwhile the sandstones to the west of the site will be less hard and less alkaline. Hydrochemistry in the Ballybunnion GWB will also have a calcium-bicarbonate signature, with high alkalinities. Typical electrical conductivities of limestone aquifers range from 500-700µS/cm (GSI, 2004). Chloride levels in groundwater may be elevated due to the proximity to the coast.

9.4.11.2 Grid Connection Route

As stated above in Section 9.4.11.1, the Ballybunnion GWB will have a calcium-bicarbonate signature, with high alkalinities and electrical conductivities in the range of 500-700µS/cm.

There is no data currently available for the Abbeyfeale GWB. The GSI (2004) state that groundwater samples in the adjoining Ballylongford GWB, found to the northeast, are moderately hard and have moderate alkalinities. Measured electrical conductivities range from 440 – 560µS/cm. Both iron and magnesium may exceed allowable concentrations due to the presence of bedrock shales. The limestone bedrock aquifers within this GWB will have a calcium-bicarbonate signature.

9.4.12 Water Framework Directive Water Body Status & Objectives

The River Basin Management Plan was adopted in 2018 and has amalgamated all previous river basin districts into one national river basin management district. The River Basin Management Plan (2018 - 2021) objectives, which have been integrated into the design of the proposed wind farm development, include the following:

- Ensure full compliance with relevant EU legislation;
- Prevent deterioration and maintain a 'high' status where it already exists;
- Protect, enhance and restore all waters with aim to achieve at least good status by 2021;
- Ensure waters in protected areas meet requirements; and,
- Implement targeted actions and pilot schemes in focused sub-catchments aimed at (1) targeting water bodies close to meeting their objectives and (2) addressing more complex issues that will build knowledge for the third cycle.

Our understanding of these objectives is that surface waters, regardless of whether they have 'Poor' or 'High' status, should be treated the same in terms of the level of protection and mitigation measures employed, i.e. there should be no negative change in status at all.

Strict mitigation measures (refer to Section 9.6.2 and Section 9.6.3) in relation to maintaining a high quality of surface water runoff from the development and groundwater protection will ensure that the status of both surface water and groundwater bodies in the vicinity of the wind farm site will be at least maintained (see below for WFD water body status and objectives) regardless of their existing status.

9.4.13 Groundwater Body Status

Local Groundwater Body status and risk result are available from (www.catchments.ie) and are summarized in Table 9-16.

The Kerry Head Groundwater Body (GWB: IE_SH_G_118) achieved 'Good Status'[2] (www.wfdireland.ie) in the latest WFD monitoring round (2013-2018). This GWB is deemed to be "Not at risk" and no significant pressures have been identified.

Similarly, the Ballybunnion (GWD: IE_SH_G_027) and Abbeyfeale GWBs have been assigned 'Good Status' applying to both quantitative status and chemical status. The Ballybunnion GWB has been deemed to be "At risk" and is under significant pressure from anthropogenic activities. Meanwhile the Abbeyfeale GWB is 'Not at risk' and the WFD do not recognise any significant pressures to be impacting on this GWB.

Table 9-16: Summary WFD Information for Groundwater Bodies

GWB Code	Groundwater Body Name	Chemical Status	Overall Status	Quantitative Status	Risk Status	Pressure Category
IE_SH_G_118	Kerry Head	Good	Good	Good	Not at risk	N/A
IE_SH_G_027	Ballybunnion	Good	Good	Good	At risk	Anthropogenic
IE_SH_G_001	Abbeyfeale	Good	Good	Good	Not at risk	N/A

[2] *'Status' means the condition of the water in the waterbody. It is defined by its chemical status and its ecological status, whichever is worse. Waters are ranked in one of 5 classes: High, Good, Moderate, Poor and Bad (WFD, 2010).*

9.4.14 Surface Water Body Status

9.4.14.1 Wind Farm Site

A summary of the WFD status and risk result of Surface Water Bodies (SWBs) immediately upstream and downstream of the site are shown in Table 9-17 below. Local Surface Water Body status and risk result are available from www.catchments.ie.

Upstream of the site, the Brick River (Brick_030) has not been assigned a status in the latest WFD monitoring round (2013-2018). The risk status of this SWB is currently 'Under review' while this watercourse has been deemed to be under significant pressure from agricultural and hydromorphological pressures. Similarly in the vicinity of the site, the Brick_040 SWB has not been assigned an overall status or a risk status. This SWB is listed as being under pressure from agricultural activities, river hydromorphology and urban wastewater.

To the east and upstream of the site the Feale_080, east of Listowel, achieved 'Good Status' in the latest WFD monitoring round. This SWB has been deemed to be 'Not at risk' and no significant pressures have been identified. Downstream of Listowel, The Feale_090 SWB, achieved 'Moderate Status' and has been deemed to be 'At risk'. The Feale_090 SWB is listed as being under pressure from agriculture, hydromorphology and urban run-off. Upstream of the village of Finuge, the Feale River has been mapped as a Salmonid River.

Immediately to the east of the site, the Upper Feale Estuary achieved 'Poor Status' and was deemed to be 'At risk' in the latest WFD round. Meanwhile immediately downstream of the site, the Cashen River Estuary also achieved 'Poor Status' and is at 'At risk' of not meeting its WFD objectives. Both of these transitional waterbodies are under pressure from agricultural activities and urban wastewater and have been classified as "Nutrient Sensitive Areas". Meanwhile, the mouth of the Shannon is of 'Good Status' and 'Not at risk'.

Table 9-17: Summary WFD Information for Surface Water Bodies at Wind Farm Site

SWB Code	Water Body	Overall Status	Risk Status	Pressures
IE_SH_23B030500	Brick_030	Unassigned	Under review	Agriculture, Hydromorphology
IE_SH_23B030700	Brick_040	Unassigned	Under review	Agriculture, Hydromorphology and Urban wastewater
IE_SH_060_0100	Cashen River Estuary	Poor	At risk	Agriculture and Urban wastewater
IE_SH_060_0200	Upper Feale Estuary	Poor	At risk	Agriculture, Hydromorphology and Urban wastewater
IE_SH_23F010800	Feale_090	Moderate	At risk	Agriculture, Hydromorphology and Urban Run-off

9.4.14.2 Grid Connection Route

A summary of the WFD status and risk result of SWBs in the vicinity of the proposed grid connection route is shown in Table 9-18 below.

The proposed grid route is drained by the Brick_030 and Mountcoal_010 SWBs which have not been assigned a status in the latest WFD round. Agriculture and hydromorphology have been identified as significant pressures impacting these rivers. In the vicinity of the site, the status of the Brick_040 SWB is described above.

Table 9-18: Summary WFD Information for Surface Waterbodies along Grid Route

SWB Code	Water Body	Overall Status	Risk Status	Pressures
IE_SH_23B03 0500	Brick_030	Unassigned	Under Review	Agriculture, Hydromorphology
IE_SH_23M4 40980	Mountcoal_0 10	Unassigned	Under Review	Agriculture and Hydromorphology
IE_SH_23B03 0700	Brick_040	Unassigned	Under Review	Agriculture, Hydromorphology and Urban wastewater

9.4.15 Designated Sites

9.4.15.1 Wind Farm Site

In the Republic of Ireland, designated sites include proposed National Heritage Areas (pNHAs), National Heritage Areas (NHAs), Special Areas of Conservation (SAC) and Special Protection Areas (SPAs).

Ecological surveys of the site have identified two small areas of uncut raised bog remaining in the study area. However these areas are not defined as active raised bog or classified as the Annex I habitat Degraded Raised bog still capable of natural regeneration. Due to the extensive drainage network outlined in Section 9.4.4 these areas do not support active peat formation and do not have have potential to revert to active peat forming systems within 30-years. Therefore the site does not contain any Annex I habitats and does not lie within the boundaries of a designated site.

The site borders the Cashen River Estuary pNHA (Site Code:001340) to the north and the Lower River Shannon SAC (Site Code: 002165) to the north and west, along the Feale and Brick Rivers.

The Lower River Shannon SAC is a very large site stretching from the Shannon valley in Killaloe, Co. Clare to Kerry Head. This designated site includes the Feale estuary and much of the freshwater stretches of the Feale catchment. The eastern sections of the Feale catchment flow through Namurian rocks while the western stretches flow through Carboniferous limestones. The Feale catchment is reported to exhibit all the aspects of a river from source to mouth. Semi-natural habitats such as wet grassland, wet woodland and marsh occur along the river however improved grassland is the most common habitat. Floating river vegetation is present along the major rivers within this SAC including the Feale. Five species of fish listed on Annex II of the Habitats Directive are found within the SAC. The Feale River is important for spring salmon and for grilse and is a designated Salmonid Water under the E.U., Freshwater Fish Directive. The Feale catchment has also been identified to contain populations of freshwater pearl mussel.

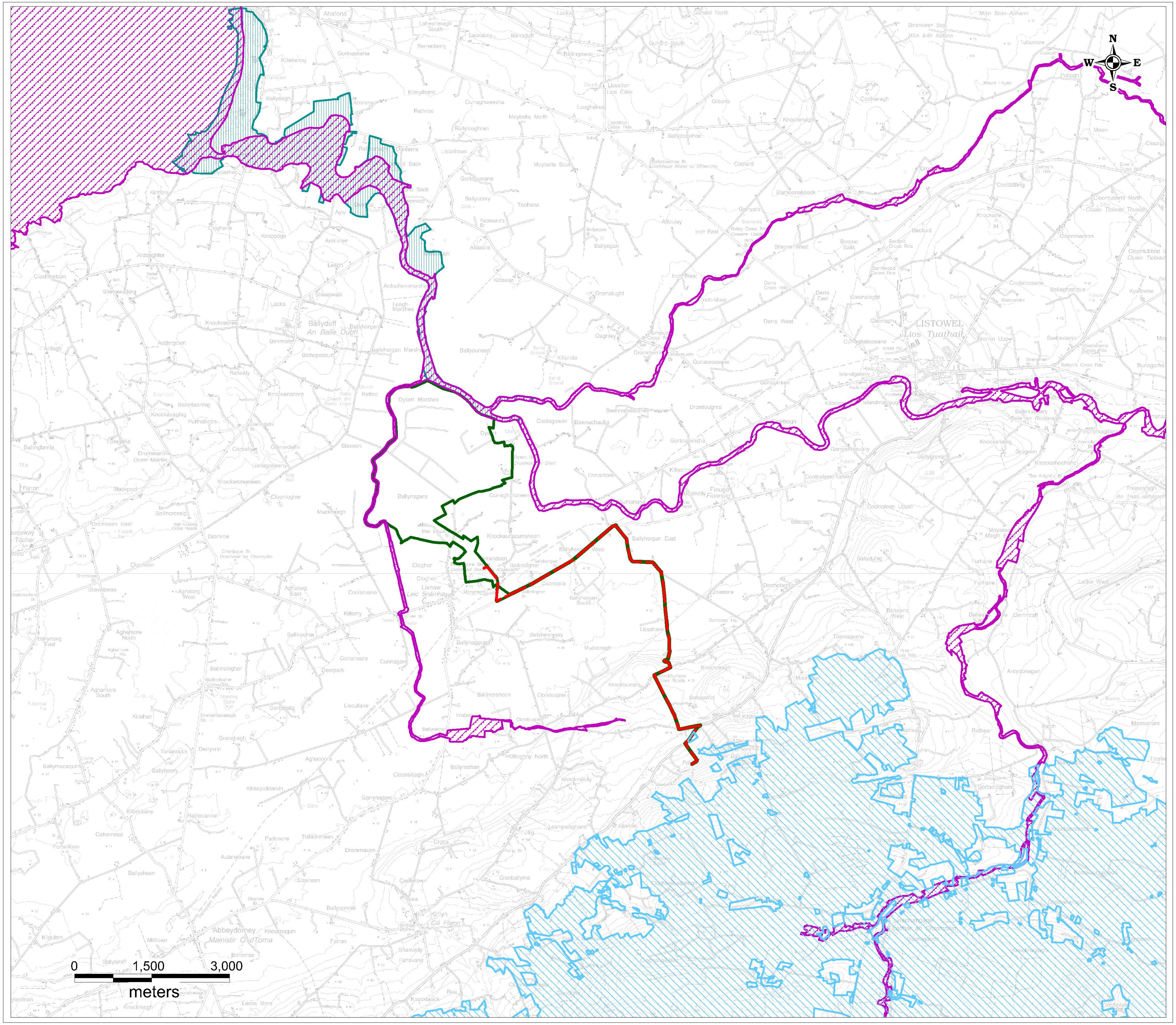
The site drains to the Lower River Shannon SAC via the Brick River. Therefore, the proposed wind farm site is hydraulically connected to this designated site. Refer to the Ecology Chapter for further details relating to these designated sites. A designated site map for the area is shown as Figure 9-8.

9.4.15.2 Grid Connection Routes

The proposed grid connection route encroaches onto the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161) along the N69. This site is an SPA under the E.U. Birds Directive of special conservation interest of Hen Harrier. The mix of forestry and open areas within this site provide an optimum habitat for the Hen Harrier, which is listed on Annex I of the Birds Directive. The proposed grid connection route is located within this designated site and therefore has the potential to adversely impact on the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

All surface waters draining the grid connection route flow downstream into the Lower River Shannon SAC and the Cashen River Estuary pNHA.

A map of local designated sites is shown as Figure 9-8.



Legend

- EIAR Site Boundary
- Clohane Grid Route
- Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA
- Lower River Shannon SAC
- Cashen River Estuary pNHA

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Job: Ballynagare WF, Co. Kerry	
Title: Designated Sites Map	
Figure No: 9-8	
Drawing No: P1531-0-1021-A3-908-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:70,000	Drawn By: GD
Date: 07/10/2021	Checked By: MG

9.4.16 Water Resources

9.4.16.1 Wind Farm Site

There are no mapped Public Water Supply Schemes (PWS) or National Federation Groundwater Schemes (NFGWS) in the area of the site. The closest mapped PWS is the Ballyheigue PWS, located approximately 9km southwest of the site.

A search of private well locations (accuracy of 1 – 50m only) was undertaken using the GSI well database (www.gsi.ie). The GSI maps several boreholes (GSI name: 0813SWW082, 0813SWW083 and 0813SWW105) in the centre of the site, in the townland of Ballynagare. Depth to rock in these boreholes is reported to range from 16m to 32m. Further south near the R557 and to the east of the proposed borrow pit, a GSI mapped borehole (GSI name: 0811NWW010) has a poor yield class and is used for agricultural and domestic purposes. Depth to bedrock at this locality is reported to be ~15m.

To overcome the poor accuracy problem of other GSI mapped wells it is assumed that every private dwelling in the area has a well supply and this impact assessment approach is described further below.

The private well assessment undertaken assumes the groundwater flow direction in the aquifer is towards the Brick and Feale Rivers. Using this conceptual model of groundwater flow, dwellings that are potentially located down-gradient of the proposed development footprint are identified. The groundwater flow direction in the area of the site is in a northerly direction towards the Upper Feale Estuary.

There are no private dwelling houses located down-gradient of the proposed turbine locations. Due to the relatively low bulk permeability of subsoils present on much of the site, the low recharge characteristics and the low groundwater gradients (flat topography), groundwater travel times are expected to be extremely slow. Several dwellings however are located downgradient of the substation, borrow pit and southern construction compound. Soils in this area are mapped as till derived from Namurian sandstones and shales. Despite the absence of peat in this area, these subsoils are still of low permeability, with an estimated groundwater recharge of only 22.5%.

It is also proposed that piling will take place on site and therefore this limits the potential for impact on groundwater levels, and groundwater quality as there will be no significant excavation dewatering. The piles themselves will be drilled into relatively low permeability anoxic environment, so their ability to leach and change local groundwater chemistry will be very low.

There are no surface water abstractions mapped downstream of the site. The closest mapped abstractions are located on the Feale_090 surface water body, upstream of the site and include the Dromin: Scartleigh and Listowel WTP abstractions.

9.4.16.2 Grid Connection Route

A total of 21 no. groundwater wells, were identified within 2 km of the proposed grid route. None of these wells are used as group water schemes but rather for private use.

Due to the shallow nature of the grid connection trench works impacts on groundwater flows and levels are not anticipated, however the potential for impacts on groundwater quality from fuels and other chemicals during the construction phase exists. This assessment applies to any groundwater wells that exist along the proposed grid connection route. All individual groundwater wells are not identified or audited, but this is not considered necessary considering the very shallow depth of the works and the lack of potential for any significant impact. The proposed grid connection trench is shallow in nature, and will not intercept the bedrock groundwater table, as excavations are within the carriageway of the existing public road network. The construction works along the grid connection trench are transient and temporary. The works are similar in nature to water pipe laying works, or underground electricity cable works which are completed along roads across the country. Standard mitigation measures in respect of normal construction site risks to groundwater quality are outlined in Section 9.6.2.

There are no surface water abstractions located along the proposed grid routes. The closest mapped surface water abstraction are the Dromin, Scartleigh and Listowel WTP abstractions located on the Feale_090 surface water body near Listowel. There is also an abstraction located upstream of the Trien Grid Route on the Smearlagh_030 SWB referred to as the Lyreacrompane RWSS. Meanwhile, the Cappagh River surface water abstraction is located upstream of Grid Route Option A on the Brick_010 SWB.

9.4.17 Receptor Sensitivity

Due to the nature of wind farm developments and grid connections, being near surface construction activities, effects on groundwater are generally negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the Proposed Development would be from cementitious materials, hydrocarbon spillage and leakages. These are common potential risks on all construction sites (such as road works and industrial sites), which can be omitted by way of mitigation. All potential contamination sources are to be carefully managed at the site during the construction, operational and decommissioning phases of the development and mitigation measures are proposed below to deal with these potential risks.

Based on criteria set out in Table 9-2 above, the Locally Important and Regionally Important Aquifers underlying the site can be classed as Sensitive to pollution. For the most part these aquifers are not classified as 'very sensitive' due to the low groundwater recharge occurring at the site. The site is covered by low permeability subsoils (cutover peat, alluvium and till) which act as a protective cover to the underlying bedrock aquifer. However in the area immediately to the south of the proposed borrow pit an area of bedrock outcrop is mapped, with higher recharge rates and extreme groundwater vulnerabilities. This area immediately to the south of the site is underlain by a Regionally Important Karstic Aquifer and can therefore be classified as Very Sensitive to pollution. Groundwater along much of the proposed grid routes are Not Sensitive to pollution because of the poor permeability of the underlying bedrock aquifer. However, the section of the grid routes overlying the Ballybunnion GWB can be classified as Very Sensitive, as this is a Regionally Important Aquifer with enhanced permeability. In general however, it is likely that any contaminants which may be accidently released during the construction works are more likely to travel to nearby streams within surface runoff.

Surface waters such as the Feale River and the Cashen River Estuary can be considered Very Sensitive to contamination. The Feale and its tributaries are known to be home to salmonids and grilse. The primary potential contamination is suspended solids and associated nutrients.

The designated sites that are hydraulically connected (surface water flow paths only) to the wind farm site and the proposed grid connection routes include the Cashen River Estuary pNHA and the Lower River Shannon SAC. Both of these sites are located in close proximity and immediately downstream of the Proposed Development. However due to the estuarine nature of these waters, they are significantly less sensitive (even without mitigation) compared to a freshwater habitat with regard to construction effects.

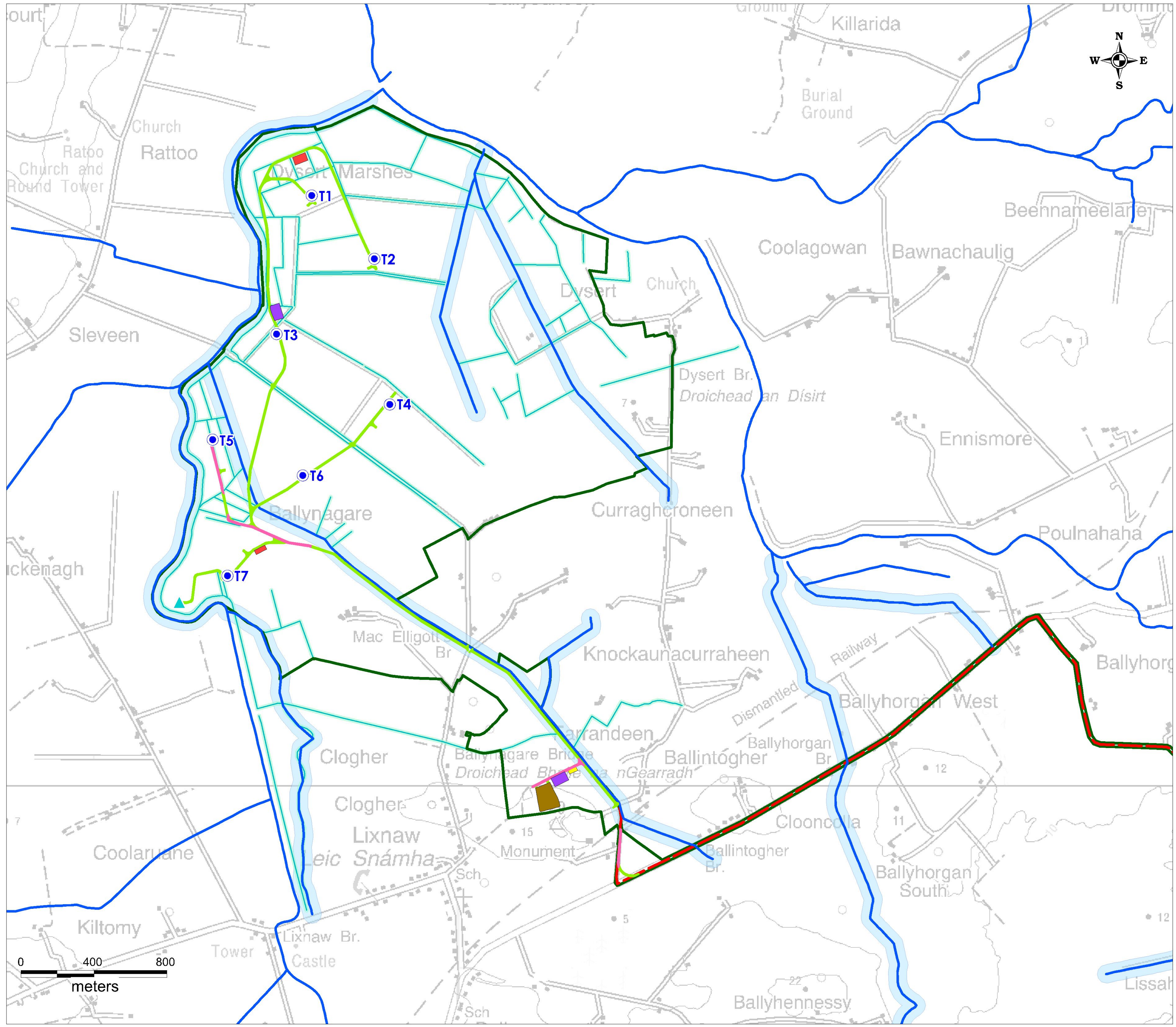
Comprehensive surface water mitigation and controls are outlined below to ensure protection of all downstream receiving waters. Mitigation measures will ensure that surface runoff from the developed areas of the site and the grid connection route will be of a high quality and will therefore not impact on the quality of downstream surface water bodies. Any introduced drainage works at the site will mimic the existing hydrological regime thereby avoiding changes to flow volumes leaving the site.

A hydrological constraints map for the site is shown as Figure 9-9. A self-imposed 50m buffer from EPA mapped streams was applied during the constraints mapping at the WF site, with a 10m buffer also applied to the main drains identified from site walkover surveys and inspection of aerial photography.

No key wind farm infrastructures (turbines, construction compounds or the substation) are located within 50m of EPA mapped surface waterbodies. In the south of the site, a proposed access road runs parallel with the Monument stream and is located within 50m of this waterbody. Towards the centre of the wind farm site, the proposed access roads are mapped to cross the Monument stream at 2 no. locations.

With respect to the main drains within the site, T5 and the northern construction compound located within the delineated 10m buffer zone. During site walkovers these drains were observed to have low flow volumes. The remainder of the key wind farm infrastructures are located outside of the 10m buffer zone. The large setback distance from sensitive hydrological features means they will not be impacted on by excavations/drains etc. It also allows adequate room for the proposed drainage mitigation measures (discussed below) to be properly installed up-gradient of primary drainage features within sub-catchments.

Based on EPA mapping, there will be a requirement for at least 5 no. watercourse crossings on both of the proposed grid routes. While no in-stream works are proposed, mitigation measures will ensure that surface runoff during the construction phase will be of a high quality and will not impact on the quality of downstream surface water bodies.



Legend

- EIAR Site Boundary
- Proposed Turbine Layout
- Clohane Grid Route
- Proposed Met Mast
- Proposed Substation
- Proposed Borrow Pit
- Proposed Construction Compound
- Existing Roads to be Upgraded
- Proposed New Roads
- Temporary Peat Storage Area
- Watercourses
- 50m Watercourse Buffer
- Main Drains
- 10m Main Drain Buffer

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Client: MKO	
Job: Ballynagare WF, Co. Kerry	
Title: Hydro-Constraints Map	
Figure No: 9-9	
Drawing No: P1531-0-1021-A3-909-0A	
Sheet Size: A3	Project No: P1531-0
Scale: 1:20,000	Drawn By: GD
Date: 18/10/2021	Checked By: MG

9.4.18 Development Interaction with the Existing Bog Drainage Network of the wind farm site

The general design approach to wind farm layouts in existing peat bogs and/or agricultural land is to utilise and integrate new drainage with the existing drainage infrastructure where possible.

9.4.19 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against effects on downstream surface water bodies (Brick and Feale Rivers).

There is an extensive land drainage network existing within the proposed development footprint. It is intended to integrate the proposed wind farm drainage with that existing drainage network. It also should be noted that drainage from the majority of the wind farm site is controlled by sluice gate outfalls to the River brick and the River Feale, i.e. surface water outfall can only occur at mid to low tide level within the Cashen Estuary.

Two distinct methods will be employed to manage drainage water within the proposed development. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features, minimising any works in or around existing artificial drainage features, and diverting clean surface water flow around excavations, construction areas and temporary storage areas. Where possible, the existing drainage network has been used to manage and divert clean water around the proposed wind farm footprint.

The second method involves collecting any drainage waters from works areas within the site that might carry silt or sediment, and nutrients, to route them towards settlement ponds (or stilling ponds) prior to controlled diffuse release downstream existing drains.

During the construction phase all runoff from wind farm works areas (i.e. dirty water) will be collected and treated to a high quality prior to being released to downstream drains. A detailed drainage plan showing the layout of the proposed drainage systems is shown in the design drawings included in Appendix 4-4 of the EIAR.

9.5 Characteristics of the Proposed Development

The proposed development comprises of the following:

- Construction of 7 no. wind turbines with the following maximum and minimum parameters:
  - Overall ground to blade tip height in the range of 170m maximum to 169.5m minimum
  - Hub height of 95m
  - Rotor diameter in the range of 150m maximum to 149m minimum
- Turbine hardstand areas;
- Provision of 1 no. permanent meteorological mast with a maximum height of 110 metres to 100 metres minimum110 metres;
- Upgrade of existing roads and access junctions;
- Provision of new site entrances, roads and hardstand areas;
- 2 no. peat storage areas;
- 2 no. construction compounds;
- 1no. borrow pit;
- All site drainage works;
- 1 no. onsite 38kV substation, control building and plant, associated security fencing and wastewater holding tank;
- All associated underground electrical and communication cabling connecting the turbines to the proposed on-site substation;
- Connection of the proposed 38kV on-site substation via underground cable in the public road network to the entrance of the existing Clahane 110kV substation at the junction with the N69 public road, in the townland of Pallas;
- All ancillary site and ground works, apparatus and signage.

The main characteristics of the proposed Ballynagare Wind Farm that could impact on water and hydrogeology are:

- Opening of the proposed borrow pit, which will involve the stripping of topsoil/subsoil and the rock breaking/ripping and/or blasting, and subsequent processing, of 144,000m^3 of suitable rock to create aggregate for use on-site in access tracks and hardstand construction. Runoff and discharge from the borrow pit has the potential to impact on surface water quality.
- Establishment of the northern site compound, which will involve minor regrading of peat and the placement of the construction compound using a floated technique where possible. Welfare facilities will be provided at the site compounds. Wastewater effluent will be collected in a wastewater holding tank and periodically emptied by a licenced contractor.
- Construction of the site access tracks and upgrade of existing tracks will use both founded and floated techniques. Floating tracks will be used at the site for the majority of new tracks, as well as upgrading of existing tracks. This will involve the use of aggregate, sourced from the on-site borrow pit and imported from local quarries where required. Construction of these access tracks has the potential to impact on surface water quality.
- Construction of the crane hardstand areas and turbine assemblage areas. This too will involve the use of aggregate, sourced from the onsite borrow pits and imported from local quarries where required. Construction of these areas has the potential to impact on surface water quality.

- With the exception of T7, all turbines and their associated crane hardstand areas are likely to require a piled foundation as a result of the depth of peat and soft lacustrine deposits present.
- Settlement ponds where constructed will be volume neutral, i.e. all material excavated will be used to form side bunds and landscaping around the ponds. There will be no excess material from settlement pond construction. The material will also be reinstated during decommissioning.
- Volumes of peat/subsoil to be removed at the 7 no. turbine locations is estimated to be 5,576m^3 peat and 6,013m^3 of non-peat subsoils.
- Construction of the on-site substation and parking area will likely be completed using a floated technique, and will also involve the use of approximately 695m^3 of concrete, aggregate and building materials. Welfare facilities will be provided at the substation. Wastewater effluent will be collected in an underground concrete holding tank and periodically emptied by a licenced contractor for the operational phase of the wind farm. Construction of the sub-station and associated parking area has the potential to impact on surface water quality.
- Grey water will be supplied by rainwater harvesting and water tankered to site where required. Bottled water will be used for potable supply.
- Construction of the turbine foundations, which will require large volumes of concrete (approximately 550m^3 per turbine foundation plus approximately 50m3 of lean-mix concrete for the blinding layer), placing demand on local concrete batching plants / quarries. Concrete could impact on surface water and groundwater quality.
- Cabling between turbine locations and the site substation. This will involve the excavation of a shallow trench (approximately 1.2m deep), placement of ducting and backfilling with aggregate, lean-mix concrete and excavated material, as appropriate (depending on the location of the cable trench). These works have the potential to impact on surface water quality.
- Cabling between the site substation and the Clahane 110 kV Substation. This will involve the excavation of a shallow trench along the public road, placement of ducting and backfilling with lean-mix concrete and compacted engineered fill. These works have the potential to impact on surface water quality.

9.6 Likely Significant Effects and Mitigation Measures

The potential impacts of the Proposed Development and mitigation measures that will be put in place to eliminate or reduce them are set out below.

9.6.1 Do Nothing Scenario

If the Proposed Development were not to proceed the proposed Ballynagare Wind Farm would not be able to supply the electricity generated to the national grid. The opportunity to generate renewable energy and electrical supply to the national grid would be lost. Local peat harvesting, agricultural activities and other existing land-use practices would continue at the site.

Surface water drainage carried out in the agricultural lands and the peat bog will continue to function and may be extended in some areas.

9.6.2 Construction Phase – Likely Significant Effects and Mitigation Measures

9.6.2.1 Earthworks (Removal of Vegetation Cover, Excavations and Stock Piling) Resulting in Suspended Solids Entrainment in Surface Waters

Construction phase activities including access road construction, construction compound, turbine base/hardstanding construction, met mast construction, substation construction and cable route works will require varying degrees of earthworks resulting in the excavation of peat, soil and mineral subsoil where present. Excavation of the grid route trench, ~2m (w) x 1.2m (h), will also require excavation of soils/subsoils.

Potential sources of sediment laden water include:

- Drainage and seepage water resulting from road and turbine base excavation;
- Stockpiled excavated material providing a point source of exposed sediment;
- Construction of the grid connection cable trench resulting in entrainment of sediment from the excavations during construction; and,
- Erosion of sediment from emplaced site drainage channels.

These activities, if unmitigated, will likely result in the release of suspended solids to surface water and could result in an increase in the suspended sediment load, resulting in increased turbidity which in turn could affect the water quality and fish stocks of downstream water bodies, including the Brick River, Feale River and the Cashen River Estuary. Potential effects on all watercourses draining the site and the proposed grid routes could be significant if left unmitigated.

Pathways: Drainage and surface water discharge routes.

Receptors: Down-gradient rivers (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems. All the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-Mitigation Potential Impact: Indirect, negative, significant, temporary, medium probability impact.

Proposed Mitigation Measures:

<u>**Wind Farm Site**</u>: The key mitigation measure during the construction phase is the avoidance of sensitive aquatic areas, by application of suitable buffer zones (i.e. 50m to main watercourses, and 10m to main drains). With the exception of the met mast and the proposed substation location, all of the key proposed infrastructures within the site are located significantly away from the delineated 50m watercourse buffer zone. However many of the proposed access roads cross mapped drains/streams requiring control measures, which are outlined further on in this section. These control measures will be implemented at the proposed watercourse and drain crossings and where the roads run parallel and in close proximity to drains.

<u>**Grid Route**</u>: As stated in Section 9.4.5, the proposed grid connection route contains several watercourse crossings. It is proposed to limit any works in any areas located within 50m of any watercourse/waterbody including the stockpiling of excavated soils and subsoils.

There are a total of 5 no. culvert/bridge crossings along the proposed grid route to the Clahane 100kV substation. All the crossings along the proposed route are existing bridges and culverts along the public road. No in-stream works are required at any of these crossings, however due to the proximity of the streams to the construction work at the crossing locations, there is a potential for surface water quality impacts during trench excavation work.

Mitigation measures are outlined below.

A constraint/buffer zone will be maintained for all crossing locations, whereby all watercourses will be fenced off. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The setback distance from sensitive hydrological features means that adequate room is maintained for the proposed drainage mitigation measures (discussed below) to be properly installed and operate effectively. The proposed buffer zone will:

- Avoid physical damage to watercourses, and associated release of sediment;
- Avoid excavations within close proximity to surface watercourses;
- Avoid the entry of suspended sediment from earthworks into watercourses; and,
- Avoid the entry of suspended sediment from the construction phase drainage system into watercourses and downstream drains.

Mitigation by Design:

- Source controls:
  - 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 similar/equivalent or appropriate systems.
  - Small working areas, covering stockpiles, weathering off stockpiles, cessation of works in certain areas or other similar/equivalent or appropriate measures.
- In-Line controls:
  - 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, sediment traps, pumping systems, settlement ponds, temporary pumping chambers, or other similar/equivalent or appropriates systems.
- Treatment systems:
  - Temporary sumps, temporary storage lagoons, sediment traps, and settlement ponds, and proprietary settlement systems such as Siltbuster, and/or other similar/equivalent or appropriate systems.

It should be noted for the wind farm site, that an extensive network of peat management and agricultural drains already exists, and these will be integrated and enhanced as required and used within the wind farm development drainage system. The integration of the existing drainage network and the proposed wind farm network is relatively simple. The key elements being the upgrading and improvements to water treatment elements, such as in line controls and treatment systems, including silt traps, and settlement ponds.

The main elements of interaction with existing drains will be as follows:

- Apart from interceptor drains (using existing drains where possible), which will convey clean runoff water to the downstream drainage system there will be no direct discharge (without treatment for sediment reduction) of runoff from the proposed wind farm drainage into the existing site drainage network. This will reduce the potential for any increased risk of sediment transport/erosion;

- Silt traps will be placed in the existing drains upstream of any streams where construction works is taking place, and these will be diverted into proposed interceptor drains, or culverted under/across the works area; and,
- Drains running parallel to the existing roads requiring widening will be upgraded. Velocity and silt control measures such as check dams, sandbags, oyster bags, straw bales, flow limiters, weirs, baffles, silt fences will be used during the upgrade construction works.

Water Treatment Train:

If the discharge water from construction areas fails to be of a high quality, then a filtration treatment system (such as a 'siltbuster' or similar equivalent treatment train (sequence of water treatment processes) will be used to filter and treat all surface discharge water collected in the dirty water drainage system. This will apply for all of the construction phase.

Silt Fences:

Silt fences will be emplaced within drains down-gradient of all construction areas. Silt fences are effective at removing heavy settleable solids. This will act to prevent entry to watercourses of sand and gravel sized sediment, released from excavation of mineral sub-soils of glacial and glacio-fluvial origin, and entrained in surface water runoff. Inspection and maintenance of these structures during construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase. Double silt fences will be emplaced within drains down-gradient of all construction areas inside the hydrological buffer zones.

Silt Bags:

Silt bags will be used where small to medium volumes of water need to be pumped from excavations. As water is pumped through the bag, most of the sediment is retained by the geotextile fabric allowing filtered water to pass through.

Pre-emptive Site Drainage Management:

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

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

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

- Consultancy Service: Met Eireann provide a 24-hour telephone consultancy service. The forecaster will provide interpretation of weather data and give the best available forecast for the area of interest.

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

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

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

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

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

Management of Runoff from Peat and Subsoil Storage Areas:

It is proposed that excavated peat will be used for landscaping where required. Peat and subsoil excavation will occur at 7 no. turbine locations.

During the initial construction of floating roads, silt fences, straw bales and biodegradable geogrids will be used to control surface water runoff from works areas.

Where required temporary peat/subsoil storage areas will be sealed with a digger bucket and vegetated as soon possible to reduce sediment entrainment in runoff.

Management of Runoff from the Grid Connection Cable Route and existing road upgrade areas:

Where construction of the grid cable connection route is undertaken along sections of proposed access road or existing roads requiring upgrade, the proposed wind farm drainage infrastructure (as outlined above) will be in place to manage and control runoff from the trench excavation area. Where the cable trench is to be constructed along public roads surface water control measures such as silt fences will be employed when work is required within hydrological buffer zones.

Timing of Site Drainage Construction Works:

Construction of the wind farm site drainage system will only be carried out during periods of low rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses.

Monitoring:

An inspection and maintenance plan for the on-site drainage system will be prepared in advance of commencement of any works. Regular inspections of all installed drainage systems will be undertaken, especially after heavy rainfall, to check for blockages, and ensure there is no build-up of standing water in parts of the systems where it is not intended. Inspections will also be undertaken after tree felling.

Any excess build-up of silt levels at dams, the settlement pond, or any other drainage features that may decrease the effectiveness of the drainage feature, will be removed.

During the construction phase field testing and laboratory analysis of a range of parameters with relevant regulatory limits and EQSs will be undertaken for each primary watercourse, and specifically following heavy rainfall events (i.e. weekly, monthly and event based).

Residual Impact: The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be Negative, indirect, imperceptible, short term, low probability impact on downgradient rivers, water quality and dependent ecosystems.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water quality will occur.

9.6.2.2 Potential Impacts on Groundwater Levels during Excavation Works & from Proposed Borrow Pit

Dewatering of borrow pit and other deep excavations (i.e. turbines bases) have the potential to impact on local groundwater levels. However, temporary reductions in groundwater levels by short duration and transient dewatering works will be localised and of small magnitude due to the nature and permeability of the local subsoil and bedrock geology. Any effects will be temporary and will be contained within the development wind farm site boundary.

No groundwater level impacts will occur from the construction of the grid connection underground cabling trench due to the shallow nature of the excavation (~1.2m), the excavation of the trench within the existing road carriageway and the unsaturated nature of the subsoil to be excavated.

Pathway: Groundwater flow paths.

Receptor: Groundwater levels.

Pre-Mitigation Potential Impact: Indirect, negative, significant, temporary, imperceptible unlikely effects on local groundwater levels within the wind farm site boundary.

Impact Assessment

The proposed borrow pit is located in bedrock that has been classified as a Regionally Important Aquifer by the GSI. This is a karst bedrock aquifer with preferential groundwater flow paths through enlarged conduits which form along faults, bedding planes and/or fractures. Groundwater flow direction will be towards the Cashen River Estuary.

The topographical and hydrogeological setting of the proposed borrow pit means that some groundwater dewatering may be required during the construction phase of the development. In addition, direct rainfall and surface water runoff will inflow into the borrow pit and will require water volume and water quality control management. For the avoidance of doubt we would generally define dewatering as a requirement to permanently drawdown the local groundwater table by means of over pumping, e.g. as would be required for the operation of a bedrock quarry in a valley floor. We consider that a bedrock quarry is different in scale and operation from the proposed operation of a temporary shallow borrow pit.

The proposed borrow pit stands at an elevation of approximately 10mOD, on an area of ground which slopes to the north. An existing quarry, Lixnaw quarry, is located immediately to the south of the proposed borrow pit. Inspection of aerial photographs show that this quarry is subject to groundwater ingress, with the floor of the quarry often flooded, with large standing pools of water covering the quarry floor. Therefore some dewatering is likely to be required at the proposed borrow pit location but due to the shallow nature of the works, no significant dewatering will occur. The pit will be shallow, and the potential for any groundwater level impacts to extend significant distances from the pit is negligible. The GSI do not map any major fault lines, which may act as large scale regional flow paths, within the vicinity of the proposed borrow pit. A well in the townland of Ballintogher to the east of the proposed borrow pit is reported to have a poor yield class.

Any groundwater level impact resulting from potential dewatering at the borrow pit will be small in relation to any changes to the local hydrogeological regime which resulted from dewatering at Lixnaw Quarry.

Relevant environmental management guidelines from the EPA quarry 2006 guidance document – "Environmental Management in the Extractive Industry" in relation to groundwater issues will be implemented during the construction phase.

The proposed underground cable trench depth will only be approximately 1.2 m in depth and therefore no impacts on the local groundwater table or flows will occur.

Residual Effects: Due to separation distances between proposed development works and water wells and local stream and rivers, and the relatively shallow nature of the proposed borrow pit works, and also the prevailing geology of the proposed development site the potential for water level drawdown impacts at receptor locations is considered negligible. The residual effect is considered to be – Negative, imperceptible, direct, short term, unlikely impact on groundwater levels.

Significance of Effects: : For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on groundwater levels will occur.

9.6.2.3 Excavation Dewatering and Potential Impacts on Surface Water Quality

Due to the low topography of the site and its proximity to the Cashen River Estuary, groundwater seepages will likely occur in turbine base excavations and the borrow pit. This will create additional volumes of water to be treated by the drainage management system.

Inflows will likely require management and treatment to reduce suspended sediments. No contaminated land was noted at the wind farm site or along the grid routes therefore pollution issues (resulting from previously contaminated soils/subsoils) will not occur in this respect. The main potential significant effects are as a result of turbidity and suspended solids on downstream surface water in the Brick River, Feale River and the Cashen River Estuary.

Due to the shallow nature of the grid trench within the carriageway of public roads, no inflows of significance will occur.

Pathway: Overland flow and site drainage network.

Receptor: Down-gradient surface water bodies (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems.

Pre-Mitigation Potential Impact: Indirect, negative, significant, temporary, low probability impact to surface water quality.

Proposed Mitigation Measures

Mitigation by Design:

Management of excavation seepage and subsequent treatment prior to discharge into the drainage network will be undertaken as follows:

- Appropriate interceptor drainage, to prevent upslope surface runoff from entering excavations will be put in place;
- If required, pumping of excavation inflows will prevent build-up of water in the excavation;
- The interceptor drainage will be discharged to the site constructed drainage system or onto natural vegetated surfaces and not directly to surface waters;
- The pumped water volumes will be discharged via sedimentation ponds adjacent to excavation areas, or via specialist treatment systems such as a Siltbuster unit;
- There will be no direct discharge to surface watercourses, and therefore no risk that hydraulic loading or contamination will occur; and,
- Daily monitoring of excavations by a suitably qualified person will occur during the construction phase. If high levels of seepage inflow occur, excavation work will be immediately stopped and a geotechnical assessment undertaken.

Residual Effects: The potential for the release of suspended solids to watercourse receptors is a risk to water quality and the aquatic quality of the receptor. Proven and effective measures to mitigate the risk of releases of sediment have been proposed above and will break the pathway between the potential sources and the receptor. The residual effect is considered to be - Negative, indirect, imperceptible, short term, unlikely impact on surface and groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on the surface water quality will occur.

9.6.2.4 Potential Release of Hydrocarbons during Construction and Storage

Accidental spillage during refuelling of construction plant with petroleum hydrocarbons is a significant pollution risk to groundwater, surface water and associated ecosystems, and to terrestrial ecology. The accumulation of small spills of fuels and lubricants during routine plant use can also be a pollution risk. Hydrocarbon has a high toxicity to humans, and all flora and fauna, including fish, and is persistent in the environment. It is also a nutrient supply for adapted micro-organisms, which can rapidly deplete dissolved oxygen in waters, resulting in death of aquatic organisms.

Hydrocarbon storage will not occur during grid route construction as the works are transient. Vehicles will be refuelled before reaching the grid route site.

Pathway: Groundwater flowpaths and wind farm site drainage network.

Receptor: Groundwater below the site and below the grid route. Downgradient surface water bodies (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems. All the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-Mitigation Potential Impact: Indirect, negative, slight, short term, medium probability impact to local groundwater quality. Indirect, negative, significant, short term, low probability impact to surface water quality.

Proposed Mitigation Measures:

Mitigation by Design

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser. The fuel bowser, a double-axel custom-built refuelling trailer will be re-filled off site (wind farm site and grid route), and will be towed around the site by a 4x4 jeep to where machinery is located. The 4x4 jeep will also carry fuel absorbent material and pads in the event of any accidental spillages. The fuel bowser will be parked on a level area in the construction compound when not in use and only designated trained and competent operatives will be authorised to refuel plant on site. Mobile measures such as drip trays and fuel absorbent mats will be used during all refuelling operations;
- Refuelling or maintenance of machinery will not occur within 100m of a watercourse;
- Fuels stored on site will be minimised;
- Any diesel or fuel oils stored at the temporary site compound will be bunded. The bund capacity will be sufficient to contain 110% of the storage tank's maximum capacity;
- The electrical control building will be bunded appropriately to the volume of oils likely to be stored, and to prevent leakage of any associated chemicals and to groundwater or surface water. The bunded area will be fitted with a storm drainage system and an appropriate oil interceptor;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- An emergency plan for the construction phase to deal with accidental spillages will be contained within the Environmental Management Plan. Spill kits will be available to deal with accidental spillages.

Residual Effects: The potential for the release of hydrocarbons to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of hydrocarbons have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be – Negative, indirect, imperceptible, short term, unlikely impact on surface water quality and groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water or groundwater quality will occur.

9.6.2.5 Groundwater and Surface Water Contamination from Wastewater Disposal

Release of effluent from welfare wastewater treatment systems on-site (wind farm and along the grid route) has the potential to impact on groundwater and surface waters if site conditions are not suitable for an on-site percolation unit. Impacts on surface water quality could affect fish stocks and aquatic habitats.

Pathway: Groundwater flowpaths and wind farm site drainage network.

Receptor: Down-gradient (of wind farm site) well supplies, groundwater quality and surface water quality in the River Brick, River Feale and associated tributaries encountered along the grid connection route.

Pre mitigation Potential Impact

Indirect, negative, significant, temporary, low probability impact to surface water quality.

Indirect, negative, slight, temporary, low probability impact to local groundwater.

Proposed Mitigation Measures

- During the construction phase, a self-contained port-a-loo with an integrated waste holding tank will be used at the wind farm site compound, will be maintained by the providing contractor, and removed from site on completion of the construction works. A self-contained port-a-loo will also be used during the construction of the grid route and will be maintained by the providing contractor;
- Water supply for the wind farm site office and other sanitation will be brought to the wind farm site and wastewater will be removed from site by a licensed contractor; and,
- No water or wastewater will be sourced on the wind farm site, nor discharged to the wind farm site.

Residual Effects: The potential for contamination resulting from wastewater disposal is a risk to surface water and groundwater quality. This is a risk is common across all construction sites containing welfare facilities. Proven and effective measures to mitigate the release of wastewater on site have been proposed above and will break the pathway between the potential source and each receptor. The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely impact to surface water quality.

Significance of Effects: For the reasons outlined above, no likely significant effects on surface water or groundwater quality will occur.

9.6.2.6 Release of Cement-Based Products

Concrete and other cement-based products are highly alkaline and corrosive and can have significant negative impacts on water quality. They generate very fine, highly alkaline silt (pH 11.5) that can physically damage fish by burning their skin and blocking their gills. A pH range of $\geq 6 \leq 9$ is set in S.I. No. 293 of 1988 Quality of Salmonid Water Regulations, with artificial variations not in excess of $\pm$ 0.5 of a pH unit. Entry of cement-based products into the site drainage system, into surface water runoff, and hence to surface watercourses or directly into watercourses represents a risk to the aquatic environment.

Peat ecosystems are dependent on low pH hydrochemistry. They are extremely sensitive to introduction of high pH alkaline waters into the system. Batching of wet concrete at the wind farm site/along the grid route and washing out of transport and placement machinery are the activities most likely to generate a risk of cement-based pollution. Placed concrete in turbine bases and foundations can have minor local impacts on groundwater quality over time. However, due to limited surface area of exposed concrete, the anoxic conditions below ground, and the high rate of dilution from the wider groundwater system relative to the small volumes of groundwater that would come in contact with the concrete, the potential for impacts are low.

Pathway: Wind farm site and grid route drainage network.

Receptor: Surface water hydrochemistry in downgradient surface water bodies including the River Brick, River Feale and the Cashen River Estuary and their associated dependent ecosystems. All the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-Mitigation Potential Impact: Indirect, negative, moderate, short term, medium probability impact to surface waters such as the River Brick, Feale River and Cashen River Estuary. Indirect, negative, imperceptible, long term, low probability impact to local groundwater quality.

Proposed Mitigation Measures

Mitigation by Avoidance:

- No batching of wet-cement products will occur on site/along the grid route works or near other ancillary construction activities. Ready-mixed supply of wet concrete products and where possible, emplacement of pre-cast elements, will take place;
- Pre-cast elements for culverts and concrete works will be used;
- No washing out of any plant used in concrete transport or concreting operations will be allowed on-site;
- Where concrete is delivered on site, only the chute need be cleaned, using the smallest volume of water possible. No discharge of cement contaminated waters to the construction phase drainage system or directly to any artificial drain or watercourse will be allowed. Chute cleaning water is to be directed into a dedicated concrete wash out pit. Decommissioning of this pit will occur at the end of the construction phase and water and solids will be tanked and removed from the site to a suitable, non-polluting, discharge location;
- All concrete will be placed in shuttering and will not be in contact with soils or groundwater until after it has set;
- Use weather forecasting to plan dry days for pouring concrete; and,
- Ensure pour site is free of standing water and plastic covers will be ready in case of sudden rainfall event.

No mitigation required for potential groundwater impacts as these are imperceptible at the outset.

Residual Effects: The potential for the release of cement-based products to groundwater and watercourse receptors is a risk to surface water and groundwater quality, and also the aquatic quality of the surface water receptors. Proven and effective measures to mitigate the risk of releases of cement-based products have been proposed above and will break the pathway between the potential source and each receptor. This will ensure that surface water runoff from the site will be equivalent to baseline conditions and will therefore have no potential impact on the status or ecology of downstream waters. The residual effect is considered to be - Negative, imperceptible, indirect, short term, unlikely impact to surface water quality and Negative, imperceptible, indirect, long term, unlikely impact to local groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water or groundwater quality will occur.

9.6.2.7 Morphological Changes to Surface Watercourses and Drainage Patterns

Diversion, culverting, road and grid cable crossing of surface watercourses can result in morphological changes, changes to drainage patterns and alteration of aquatic habitats. Construction of structures over watercourses has the potential to significantly interfere with water quality and flows during the construction phase.

Several drain and stream crossings are proposed within the wind farm site to facilitate the proposed and existing access roads.

There are a total of 5 no. culvert/bridge crossings along the proposed Grid route Option A to Clahane 100kV substation all of which will be subject to Horizontal Directional Drilling. Along the Trien Grid Route Option there are a total of 9 no. culverts/bridge crossings according to EPA mapping, 5 of which will be subject to Horizontal Directional Drilling. All the crossings along both potential grid routes are existing bridges and culverts along the public road and will avoid in-stream works.

Pathway: Site drainage network.

Receptor: Surface water flows and stream morphology in local watercourses encountered with the wind farm site (Monument Stream) and the tributaries of the Brick and Feale rivers encountered along the proposed grid connection routes.

Pre-mitigation Potential Impact: Negative, direct, slight, long term, high probability impact.

Proposed Mitigation Measures

Mitigation by Design

- All proposed crossings on the grid route will use existing bridges and culverts along the public road network. No in-stream excavation works are proposed and therefore there will be no impact on the stream at the proposed crossing locations;
- Within the wind farm site all proposed new stream crossings will be bottomless or clear span culverts and the existing banks will remain undisturbed. No in-stream excavation works are proposed and therefore there will be no direct impact on the stream at the proposed crossing locations;
- Any guidance / mitigation measures proposed by the OPW or the Inland Fisheries Ireland will be incorporated into the design of any proposed crossings. A 10m buffer is applied to main drains to allow for future OPW maintenance;
- As a further precaution near stream construction work will only be carried out during the period permitted by Inland Fisheries Ireland for in-stream works according to the Eastern Regional Fisheries Board (2004) guidance document "Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites", that is, May to September inclusive. This time period coincides with the period of lowest expected rainfall, and therefore minimum runoff rates. This will minimise the risk of entrainment of suspended sediment in surface water runoff, and transport via this pathway to surface watercourses;
- During the near stream construction work double row silt fences will be emplaced immediately down-gradient of the construction area for the duration of the construction phase. There will be no batching or storage of cement allowed in the vicinity of the crossing construction areas; and,
- All access road river/stream crossings will require a Section 50 application (Arterial Drainage Act, 1945, as amended). The river/stream crossings will be designed in accordance with OPW guidelines/requirements on applying for a Section 50 consent.

Residual Effects: With the application of the best practice mitigation outlined above, we consider the residual effect to be Negative, imperceptible, direct, long term, low probability impact on stream flows, stream morphology and surface water quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on stream morphology or stream water quality will occur at crossing locations.

9.6.2.8 Surface Water quality Impacts during Excavations along the Grid Route

Based on the EPA mapping, there will be a requirement for at least 5 no. watercourse crossings along both of the proposed grid connection routes. No in-stream works are required at any of these crossings, however due to the proximity of local streams to the construction work at these crossing locations, there is a potential for surface water quality impacts during trench excavation work due to runoff from the road surface.

Pathway: Runoff and Surface water flows.

Receptor: The Brick and Feale Rivers downstream of the grid connection routes and the tributaries encountered along both proposed grid routes.

Pre-Mitigation Potential Effect: Negative, moderate, indirect, temporary, likely effect on surface water quality.

Proposed Mitigation Measures

Mitigation by Design:

- Silt Fences/Roadside Drain Blocking: Silt fences will be placed down-gradient of the proposed cable route and directional drilling works during construction work. Silt fences are effective at removing larger particle sized solids. This will act to prevent entry to water courses of sand and gravel sized sediment released from excavation of mineral sub-soils of glacial and glacio-fluvial origin and entrained in surface water runoff. Inspection and maintenance of these structures during the construction phase is critical to their functioning to stated purpose. They will remain in place throughout the entire construction phase.
- Double silt fences will be placed down-gradient of all construction areas inside the hydrological buffer zones (i.e. near stream crossings).
- Any roadside drains will be temporarily blocked using sandbags in the area where trenching works is taking place.
- Surplus Excavated Spoil: Excavated spoil emanating from the cut for the trenches, where appropriate (i.e. when trenching within private tracks or the public road verge) will be used to backfill the trenches. Any excess will be disposed at an appropriate licenced facility. All excavated material emanating from trenches within the public road will be disposed at an appropriate licenced facility.
- Timing of Site Construction Works: Excavation of cable trench will not be undertaken during periods of high rainfall. This will minimise the risk of entrainment of suspended sediment in surface water runoff and transport via this pathway to surface watercourses.

Residual Effect: Due to the nature of the proposed grid route being within the corridor of public roads, the transient, spread out nature of the works, the requirement for no new watercourse crossings and the absence of instream works along with the proposed mitigation measures the effect will be negative, imperceptible, indirect, temporary, likely effect on surface water in the Brick and Feale Rivers and their associated tributaries.

Significance of Effects: For the reasons outlined above, and with the application of the mitigation measures no likely significant effects on surface water quality will occur.

9.6.2.9 Potential Impacts on Hydrologically Connected Designated Sites

Possible effects include water quality impacts which could be significant if mitigation is not put in place.

The Lower River Shannon SAC and Cashen River Estuary pNHA are located immediately downstream of the proposed wind farm site and the proposed grid route options. The wind farm site drains towards a deep perimeter drain which in-turn discharges into the Brick River which forms part of the Lower Shannon River SAC. To the north of the site, the Brick River discharges into the Cashen River Estuary pNHA. One proposed watercourse crossing along the Trien Grid Route Option crosses the Smearlagh River, which forms part of the Lower River Shannon SAC. All other watercourses along both grid route options drain into the Lower River Shannon SAC and the Cashen River Estuary further downstream.

In addition, along the N69, the Grid Route Option A travels through the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA (Site Code: 004161). This site is a SPA under the E.U. Birds Directive of special conservation interest for Hen Harrier. The mix of forestry and open areas within this site provide an optimum habitat for the Hen Harrier, which is listed on Annex I of the Birds Directive. The proposed grid connection route is located within this designated site and may adversely impact on the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

As stated above, without mitigation the construction activities at both the wind farm site and the along the grid connection route have the potential to adversely impact surface water quality and could affect the water quality and aquatic habitats within these sites of national and international conservation importance.
Pathway: Surface water flowpaths.

Receptor: Down-gradient water quality and designated sites (Lower River Shannon SAC and Cashen River Estuary pNHA) and the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA.

Pre-Mitigation Potential Impact: Indirect, negative, negligible, temporary, low probability.

Proposed Mitigation Measures

Mitigation measures implemented to protect downstream designated sites are the same as those implemented to protect surface water quality. These are outlined in Section 9.6.2.1 through to Section 9.6.2.8and include 9.6.2.3buffer zones and drainage control measures (i.e. interceptor drains, swales, settlement ponds) will ensure that the quality of runoff from proposed development areas will be very high.

Residual Effect: Construction activities at the wind farm site and along the grid connection route pose a threat to designated sites hydrologically linked with the proposed development. Proven and effective measures to mitigate the risk of surface and groundwater contamination have been proposed which will break the pathway between the potential source and the downstream receptor. These mitigation measures will ensure that surface water runoff from the site and the grid connection route will be equivalent to baseline conditions and will therefore have no impact on the status or ecology of the protected species and habitats within the designated sites. The residual effect is considered to be Negative, imperceptible, indirect, short term, unlikely impact to surface water quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on designated sites will occur.

9.6.2.10 Potential Groundwater and Surface Water Impacts due to Directional Drilling works

Due to the shallow nature of the grid connection works, there will be no impacts on groundwater flows and levels, however there is a potential for impacts on groundwater quality from fuels and other chemicals during the construction phase. Directional drilling may be required along public roads for the grid connection.

Horizontal Directional Drilling (HDD) methods may be required on four of the 5 no. major watercourse crossings identified along the proposed grid route. Mitigation measures are outlined below.

Pathway: Surface water and groundwater flow paths.

Receptor: Down-gradient water quality in the Brick and Feale Rivers downstream of the grid connection routes and the tributaries encountered along both proposed grid routes.

Pre Mitigation Potential Impact: Indirect, negative, slight, temporary, low probability impact on surface water quality. Indirect, negative, slight, temporary, low probability impact on groundwater quality.

Proposed Mitigation Measures

The following mitigation measures are proposed:

Mitigation by Avoidance:

A constraint/buffer zone will be maintained for all upgrade works locations, whereby all watercourses will be fenced off. In addition, measures which are outlined below will be implemented to ensure that silt laden or contaminated surface water runoff from the excavation work does not discharge directly to the watercourse.

The purpose of the constraint zone is to:

- Avoid physical damage to surface water channels;
- Provide a buffer against hydraulic loading by additional surface water run-off;
- Avoid the entry of suspended sediment and associated nutrients into surface waters from excavation and earthworks;
- Provide a buffer against direct pollution of surface waters by pollutants such as hydrocarbons; and,
- Provide a buffer against construction plant and materials entering any watercourse.

General Best Practice Pollution Prevention Measures will also include:

- Protection of the riparian zone watercourses by implementing a constraints zone around stream crossings, in which construction activity will be limited to the minimum, i.e. works solely in connection with duct laying at the stream crossing;
- No stock-piling of construction materials will take place within the constraints zone;
- No refuelling of machinery or overnight parking of machinery is permitted in this area;
- No concrete truck chute cleaning is permitted in this area;
- Works shall not take place at periods of high rainfall, and shall be scaled back or suspended if heavy rain is forecast;
- Plant will travel slowly across bare ground at a maximum of 5km/hr;
- Machinery deliveries shall be arranged using existing structures along the public road;
- All machinery operations shall take place away from the stream and ditch banks, although no instream works are proposed or will occur;
- Any excess construction material shall be immediately removed from the area and taken to a licensed waste facility;
- No stockpiling of materials will be permitted in the constraint zones;
- Spill kits shall be available in each item of plant required to complete the stream crossing; and,
- Silt fencing will be erected on ground sloping towards watercourses at the stream crossings if required.

Mitigation Measures relating to the use of a mixture of a natural, inert and fully biodegradable drilling fluid such as Clear Bore™ and water for directional drilling if required:

- The area around the Clear Bore™ batching, pumping and recycling plants shall be bunded using terram and sandbags in order to contain any spillages;
- One or more lines of silt fences shall be placed between the works area and adjacent rivers and streams on both banks;
- Accidental spillage of fluids shall be cleaned up immediately and transported off site for disposal at a licensed facility; and,

- Adequately sized skips will be used for temporary storage of drilling arisings during directional drilling works. This will ensure containment of drilling arisings and drilling flush.

Mitigation Measures relating to the use and storage of fuels and chemicals in terms of groundwater protection:

- Onsite re-fuelling of machinery will be carried out using a mobile double skinned fuel bowser, as described in Section 9.6.2.4. No maintenance of construction vehicles or plant will take place along the grid connection or temporary junction works areas;
- The plant used will be regularly inspected for leaks and fitness for purpose; and,
- Spill kits will be available to deal with accidental spillage.

Residual Effect: Due to the avoidance of instream works, the works being mainly carried out in the corridor of a public road along with the proposed mitigation measures the effect will be negative, imperceptible, indirect, temporary, likely effect on surface waters. The residual effects are considered to be indirect, negative, imperceptible, temporary, low probability impact on surface water quality and indirect, negative, imperceptible, temporary, low probability impact on groundwater quality.

Significance of Effects: For the reasons outlined above, and with the application of the mitigation measures no likely significant effects on surface water quality will occur.

9.6.2.11 Potential Effects on Local Groundwater Well Supplies

A baseline definition of groundwater flow at the study site is outlined in Section 9.4.9. Using this conceptual model of groundwater flow an impact assessment for local wells is undertaken below. This assessment is completed in accordance with "Wind farms and groundwater impacts - A guide to EIA and Planning considerations" (DoE/NIEA, 2015).

There are no public or group scheme groundwater supplies down-gradient of the wind farm site that can be impacted by the prosed wind farm development.

We have also completed an assessment of private wells within 1km of the wind farm site boundary, following the assumption that all dwellings are likely to have a private groundwater well. A number of private dwelling houses were identified along the local roads within the wind farm site. Some of these dwellings are located down-gradient (i.e., downslope) of the proposed wind farm infrastructure development (and in the proposed borrow pit and substation locations).

The biggest risk to wells will be from where deep excavations are required such as the borrow pits and turbines bases. Construction of the Wind Farm Site access road, Underground Cable Route trench and substation will not have the potential to effect local wells due to the shallow nature of the works.

Pathway: Groundwater flow paths.

Receptor: Down-gradient water supplies (groundwater wells).

Pre-Mitigation Potential Effects: Negative, indirect, negligible, short term, unlikely effect on down-gradient water supplies.

Impact Assessment:

The risk to any potential well source down-gradient of a key wind farm infrastructure from potential contaminant release (i.e., sediment, hydrocarbons, and cement-based compounds) within any excavation at this separation distance is negligible (i.e., >0.4k m). Due to the local hydrogeological regime at this site, with high rates of surface runoff and a high drainage density, it is unlikely that a pollutant will reach groundwater wells in the vicinity of the site.

Therefore, the risk posed to potential well sources at this distance from potential spills and leaks from excavations at the wind farm site is negligible.

Due to the shallow and transient nature of the grid cable works within the carriageway of public roads no effects on private groundwater well supplies will occur.

In addition, there are proposed mitigation measures (outlined above) that will minimise and prevent potential groundwater contamination from hydrocarbons and other chemicals (refer to Sections 9.6.2.4 (Controls for Hydrocarbons), 9.6.2.5 (Controls for Temporary Wastewater Facilities) & 9.6.2.6 (Controls for Cement Use).

Residual Effect: For the reasons outlined in the impact assessment above (separation distances, and prevailing geology, topography and groundwater flow directions), it has been assessed there is no potential to impact on local groundwater wells and water supplies.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on local groundwater well supplies will occur.

9.6.3 Operational Phase – Likely Significant Effects and Mitigation Measures

9.6.3.1 Progressive Replacement of Natural Surface with Lower Permeability Surfaces

Progressive replacement of the peat and vegetated surfaces with impermeable surfaces could potentially result in an increase in the proportion of surface water runoff reaching the surface water drainage network. The footprint comprises 7 no. turbine hardstandings, new and upgraded access roads, and the substation. During storm rainfall events, additional runoff coupled with increased velocity of flow could increase hydraulic loading, resulting in erosion of watercourses and impact on aquatic ecosystems.

The emplacement of the proposed permanent development footprint within the wind farm site, assuming emplacement of impermeable materials as a worst-case scenario, could result in an average total site increase in surface water runoff of 342m^3/month at the wind farm site. This represents a potential increase of 4.1% in the average daily/monthly volume of runoff from the study area in comparison to the baseline pre-development site runoff conditions. This is a very small increase in average runoff and results from a relatively small area of the site being developed, the proposed total permanent development footprint being approximately 7.13ha, representing ~1.2 % of the total wind farm site area of 594ha.

Table 9-19: Baseline Site Runoff V Development Runoff

Development Type	Wind Farm
Site Baseline Runoff/month (m^3)	678,942
Baseline Runoff/day (m^3)	21,901
Permanent Hardstanding Area (m^2)	71,300
Hardstanding Area 100% Runoff (m^3)	8,491
Hardstanding Area 95% Runoff (m^3)	8,149

Development Type	Wind Farm
Net Increase/month (m^3)	342
Net Increase/day (m^3)	11
% Increase from Baseline Conditions (m^3)	4.1

The additional volume in all outfall sub-catchments is low due to the fact that the runoff potential from the site is naturally high (96%). Also, the calculation assumes that all hardstanding areas will be impermeable which will not be the case as access tracks will be constructed of permeable stone aggregate. Therefore the increase in runoff from the proposed development will be negligible. This is even before mitigation measures will be put in place. Therefore, there will be no risk of exacerbated flooding down-gradient of the site.

Pathway: Site drainage network.

Receptor: Down-gradient rivers (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems.

Pre-Mitigation Potential Impact: Direct, negative, moderate, permanent, moderate probability impact on downstream surface water bodies (River Brick, River Feale, Cashen River Estuary).

Impact Assessment

As determined in Table 9-19 above there could be a potential increase in runoff of 4.1% in the average daily/monthly volume of runoff from the study area in comparison to the baseline pre-development site runoff conditions. This is a very small increase in average runoff and results from a relatively small area of the study area being developed, the proposed total permanent development footprint being approximately 7.13ha (within wind farm site), representing ~1.2% of the total study area of 594ha.

The increase in runoff from the development will therefore be negligible. This is even before drainage mitigation measures will be put in place. Therefore, there will be no risk of exacerbated flooding down-gradient of the site.

It should also be noted that downstream flood risk is largely controlled by coastal flooding of infinite volume (from the sea), so the finite volume of surface water contribution to drainage from the site has only a very minor role to play in flood risk downstream of the site.

Proposed Mitigation Measures

Mitigation by Design:

The operational phase drainage system will be installed and constructed in conjunction with the road and hardstanding construction work as described below:

- Runoff from individual turbine hardstanding areas will be not be discharged into the existing drain network but discharged locally at each turbine location through settlement ponds and drainage swales;
- Interceptor drains will be installed up-gradient of all proposed infrastructure to collect clean surface runoff (or existing drains will be utilised), in order to minimise the amount of runoff reaching areas where suspended sediment could become entrained;

- Swales/roadside drains will be used to collect runoff from access roads and turbine hardstanding areas of the site, likely to have entrained suspended sediment, and channel it to settlement ponds for sediment settling;
- Check dams will be used along sections of access road drains to intercept silts at source. Check dams will be constructed from a 4/40mm non-friable crushed rock; and,
- Settlement ponds, emplaced downstream of road swale sections and at turbine locations, will buffer volumes of runoff discharging from the drainage system during periods of high rainfall, by retaining water until the storm hydrograph has receded, thus reducing the hydraulic loading to existing drains.

Residual Effects: With the implementation of the proposed wind farm drainage measures as outlined above runoff from the site will be treated and discharged in accordance with prevailing drainage conditions at the proposed wind farm site. We consider that the residual effect is Negative, direct, negligible, long term, moderate probability impact.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no likely significant effects on surface water quality or quantity will occur.

9.6.3.2 Drainage at Sub-Station

A surface water drainage system will be installed at the proposed substation. This has the potential to discharge silt laden water to the receiving environment. A water supply for the substation will also be required. Rainwater will be harvested at the site to cater for water supply needs during operation. This has the potential to reduce water flows to local streams/rivers. An on-site wastewater system will be required during the operation of the substation. Effluent from this system could leak to ground or overflow and enter surface water at the site.

Pathway: Site drainage network, surface water quality, groundwater quality.

Receptor: Down-gradient rivers (River Brick, River Feale, Smearlagh River) and the Cashen River Estuary and their associated dependent ecosystems and the karstic Ballybunnion groundwater body.

Pre-Mitigation Potential Impact: Indirect, negative, slight, permanent, low probability impact.

Impact Assessment

Surface water drainage from the sub-station area will be managed in a dedicated drainage system. Rainwater will be harvested at the site to cater for water supply needs during operation, and wastewater will be held in a sealed on-site tank, and there will be no proposed discharge to ground at the sub-station site.

Proposed Mitigation Measures

The proposed new sub-station will be located in the south of the proposed wind farm site. It is proposed to drain the substation using shallow swales, with a stilling pond at the end of the swale run. The stilling pond will remain in place following the construction period. At the upslope side of the sub-station overland flows will be intercepted in channels and discharged diffusely over vegetated areas. A suitable permanent petrol and oil interceptor will be installed to deal with all substation surface water drainage.

A rainwater harvesting system will be used for toilet flushing at the Substation Control Building in Ballynagare Wind Farm. There will be a very small net loss of water to local drains but this will be imperceptible over the course of a year.

It is proposed to install a sealed underground holding tank for effluent (wastewater) from the substation building. The tank shall be routinely emptied by a licensed contractor. A level sensor will be installed in the tank which shall be linked to the on-site SCADA system. Should the level of the tank rise to a predetermined 'high' level a warning shall appear on the overall SCADA system for the site and automatic notification shall be sent to the facility manager. A formal service agreement will be entered into with a suitably permitted waste contractor, in relation to the servicing and de-sludging of the wastewater holding tank on site. There will be no discharge of wastewater to ground at the site, and therefore there is no potential to impact groundwater or surface water quality.

Residual Effects: With the implementation of the drainage regime at the substation, the pathway between the potential contamination source and the downstream receptors will be broken. These mitigation measures will ensure that no wastewater from the substation enters local surface waterbodies or groundwater flowpaths. We consider the residual effect to be indirect, negative, imperceptible, permanent, low probability impact on surface water and groundwater quality.

Significance of Effects: For the reasons outlined above, and with the implementation of the above mitigation measures, no significant effects on surface water quality or quantity, or groundwater quality will occur.

9.6.4 Decommissioning Phase – Likely Significant Effects

The potential impacts on the water environment during the decommissioning stage will be similar to those during the construction phase, and as such the proposed mitigation for the Decommissioning Phase are similar to those outlined in Section 9.6.2. Moreover, due to the relative long life of the wind farm infrastructure, it is likely that a revised/updated environmental assessment will be required at the time of decommissioning to account for any changes in baseline conditions at the wind farm site, and potential changes in assessment guidelines and legislation.

Potential impacts would be similar to the construction phase but to a lesser degree. There would be increased trafficking and an increased risk of disturbance to underlying soils at the wind farm site, during the decommissioning phase, in this instance, leading to the potential for silt laden run-off entering receiving watercourses from the wheels of vehicles. Any such potential impacts would be likely to be less than during the construction stage as the drainage swales would be fully mature and would provide additional filtration of runoff. Any diesel or fuel oils stored on site would be bunded. In the event of decommissioning of the Ballynagare Wind Farm, the proposed access tracks may be used in the decommissioning process.

Following decommissioning of the wind farm, turbine foundations, hardstanding areas and site tracks will be rehabilitated, i.e. left in place, covered over with local peat soil/scraw (i.e. peat vegetation sod) and allowed to re-vegetate naturally, if required. The internal site access tracks may be left in place, subject to agreement with Kerry County Council and the landowner. It is considered that leaving these areas in-situ will cause less environmental damage than removing and recycling them.

Removal of this infrastructure would result in considerable disturbance to the local environment in terms of disturbance to underlying soils and an increased sedimentation (if turbine foundations, access tracks and hardstandings are being reinstated there is a risk of silt laden run-off entering the receiving watercourses), erosion, dust, noise, traffic and an increased possibility of contamination of the local water table. However, if removal is deemed to be required all infrastructure will be removed with mitigation measures similar to those during construction being employed.

The substation will remain in place as it will be under the ownership of the ESB. There are no impacts associated with this.

The cabling along the grid route will also remain in place and as such there will be no impacts associated with this.

9.6.5 Do-Nothing Scenario

Commercial peat harvesting and local agricultural activities will continue at the proposed wind farm site. Surface water drainage carried out in areas of peat extraction and agriculture will continue to function and may be extended in some areas. Junction works areas would remain the same. The impact on hydrology and water quality would remain largely unaltered as a result.

9.6.6 Cumulative Impacts

Both the proposed wind farm site and the grid connection route are located in the Tralee Bay-Feale surface water catchment. However, in terms of hydrological cumulative impacts arising from the proposed wind farm infrastructure and the grid connection route, there will be no impacts as the proposed grid connection route is along the carriageway of public roads and there are no proposed in-stream works at any of the watercourse crossing locations as all the proposed crossing locations are at existing bridges or culverts.

A hydrological cumulative impact assessment regarding other wind farm developments within the Tralee Bay-Feale surface water catchment within a 25km radius of the proposed wind farm site was also undertaken. There are 160 no. turbines within 25km of the proposed site and within the Tralee Bay-Feale Catchment. A list of these other wind farm developments is shown in Table 9-20 below.

Table 9-20: Wind Farm Developments in the Tralee Bay-Feale surface water catchment (within 25km of the proposed Ballynagare wind farm site)

Catchment Area	Wind Farm Name	Status	No. of Turbines in Tralee Bay-Feale Catchment
Tralee Bay-Feale	Pallas WF	Operational	20
	Beenageeha WF	Operational	6
	Knocknagoum WF	Commissioning	26
	Ballincollig Hill WF	Operational	16
	Tursillagh WF	Operational	23
	Muingnaminnane WF	Operational	18
	Cloghboola WF	Operational	16
	Athea WF	Operational	16
	Dromada WF	Operational	19
Total			160

Therefore, the total number of turbines that could potentially be operating inside a 25km radius within the Tralee Bay-Feale surface water catchment, including the proposed 7 no. turbines at the proposed Ballynagare wind farm is 167.

The catchment area within a 25km radius of the site is ~950km^2 and therefore this equates to one turbine for approximately every ~6km^2 which is considered imperceptible in terms of potential cumulative hydrological impacts.

In relation to non-wind farm developments, the majority of local developments relate to the provision and/or alteration of one-off housing and agricultural developments. These developments are small scale and localised in nature and impacts on water quality or flows (surface water or groundwater) are not expected. Therefore, hydrological cumulative impacts with respect to the proposed Ballynagare wind farm are also not expected.

Regardless, implementation of the proposed drainage mitigation will ensure there will be no cumulative significant adverse impacts on the water environment during construction from the proposed development and the Ballynagare wind farm, and other wind farm developments and non-wind farm developments within the Tralee Bay-Feale surface water catchment.

During the operational phase of the proposed development all excavation and construction related work will have ceased and therefore there is no potential for water quality impacts from these sources. The proposed wind farm drainage system will retain rainwater within the proposed drainage system and therefore will improve overall surface water runoff quality prior to discharge. No cumulative adverse impacts on the water environment due to the proposed development are expected during the operational phase.

No significant cumulative impacts on the hydrology and hydrogeology environment are envisaged during the decommissioning stage.

9.7 Conclusion

As part of the baseline assessment, a comprehensive desk study has been undertaken as well as hydrological monitoring involving measurement of water quality and field chemistry and river and stream flows at the wind farm site and along the proposed grid connection routes.

Within the wind farm site, there are numerous manmade drains that are in place predominately to facilitate peat extraction and agricultural activities. The integration of the proposed wind farm infrastructure with the existing drainage, and natural drainage of the wind farm site, in a manner that avoids water quality and flooding impacts in downstream rivers and streams is a key component of the wind farm design. According to the WFD, surface water quality of the local rivers and the Cashen River Estuary is typically moderate to poor.

During each phase of the wind farm development (construction, operation and decommissioning) a number of construction related activities will take place on the proposed Ballynagare wind farm site which will have the potential to affect the hydrological regime or water quality at the site or its vicinity. These potential effects generally arise from sediment input from runoff and other pollutants such as hydrocarbons and cement-based compounds, with the former having the most potential for impact. These potential effects are similar to any construction site.

Surface water drainage measures, pollution control and other preventative measures have been incorporated into the project design to minimise significant adverse effects on water quality and downstream designated sites.

The surface water drainage plan will be the principal means of significantly reducing sediment runoff arising from construction activities and to control runoff rates. The drainage plan involves collecting any drainage waters from works areas within the site that might carry silt or sediment, and nutrients, to route them towards new proposed silt traps and settlement ponds (or stilling ponds) prior to controlled diffuse release into the existing field drainage network. There will be no direct discharges to any existing natural watercourse from the wind farm construction, operation or decommissioning works.

Preventative pollution measures which also include fuel and concrete management and a waste management plan have been incorporated into the Construction and Environmental Management Plan, which is presented in Appendix 4.2 of this EIAR.

Overall the proposal presents no likely significant effects to surface water (quality or flows) and groundwater (quality or quantity) provided the proposed mitigation measures are implemented.

No significant construction, operational or decommissioning stage cumulative effects on any of the regional surface water catchment or groundwater bodies will result from the proposed Ballynagare wind farm (including haul route works), the on-site substation, its associated grid connection route and other local developments.

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