BALLYKETT GREEN ENERGY LIMITED

BALLYKETT WINDFARM

CO. CLARE

ALTERNATIVE GRID CONNECTION ROUTES

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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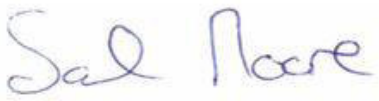
Date 29th February 2024	Signature 	Signature 

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BALLYKETT WIND FARM
ALTERNATIVE GRID CONNECTION ROUTES

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

CONTENTS

1 INTRODUCTION

This EIAR has been prepared by Jennings O'Donovan & Partners Limited, on behalf of Ballykett Green Energy Limited. This EIAR assesses the Development as a whole, and all direct and indirect effects, cumulative impacts and interactions, including all relevant ancillary and subsidiary elements of the Development. In this EIAR (Appendix 3.1) the Development is considered the construction of Grid Route Connection (GRC) Option 2 and Option 3.

1.1 BACKGROUND

BF Consulting were contracted to undertake a detailed review of GCR options for the proposed Ballykett Wind Farm. Three grid connection cabling route options were considered and assessed as part of the initial design process to determine which route would be brought forward as part of the planning application. All three Grid Connection Route options that were considered during the iterative design phase are shown on Figure 1.1 and are as follows:

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

All three grid routes were considered viable options. However, it was decided only to seek planning permission for Option 1 due to the shorter distance (1.7km) and related lower potential environmental effects. Options 2 and 3 will not form part of the planning application at this time. This EIAR (**Appendix 3.**1) assesses grid route Options 2 and 3.

2 PROJECT DESCRIPTION

2.1 PROJECT DESCRIPTION

Option 2 - UGC from Moneypoint Substation to Ballykett Wind Farm utilising sections of UGC in public road, primarily regional and local roads. [9.1km].

Option 3 - UGC from Moneypoint Substation to Ballykett Wind Farm utilising sections of UGC in public roads. [UGC: 11km].

2.2 SITE LOCATIONS AND ENVIRONS

The townlands through which proposed grid connection Option 2 and 3 will transect are the townlands of Ballykett, Tullabrack West, Moyadda Beg, Parknamoney, Rapepark, Kilrush, Kilrush Demesne, Ballymacurtaun, Kilcarrol, Dysert, Clooneylissaun, Ballymacrinay, Carrowdotia North and Carrowdotia South.

2.3 SITE INFRASTRUCTURE AND CONSTRUCTION

Connection will be sought from the grid system operators by application to ESB Networks Limited. Ballykett Green Energy has assessed possible connection options for the Development and found that a Grid Connection can be accommodated via parallel twin underground 20kV cables to the ESBN 400kV Moneypoint substation. The overall length of the Grid Connection between the substation and the existing Moneypoint 400kV substation is up to 11km, of which, 230m is within the Site of the Development, with the remainder being located in the R483, L2038, R473, Monovana Road, L6150 and N67 road network. The Grid Connection can be summarised as follows:

- **UGC Option 2** - UGC twin 20kV circuit from Moneypoint to Ballykett WF utilising sections of UGC in public road, primarily regional roads, and private lands (approx 9.1km).
- **UGC Option 3** – UGC twin 20kV circuit from Moneypoint to Ballykett WF utilising sections of UGC in public road, primarily regional roads, and private lands (approx 11km).

The routes of the above Grid Connections are provided in **Figure 1.1.** The Grid Connection route assessment report carried out by BFA Consulting can be found in **EIAR Appendix 2.2**.

The Grid Connection will be constructed to the requirements and specifications of ESB Networks Limited. The three conductors will be laid in separate ducts which will be laid in accordance with the ESBN functional specifications for 20kV Networks Ducting/Cabling (Minimum Standards). The width of a 20kV cable trench with a trefoil formation will be 600mm. The depth of the trench for 20kV cables is 0.925m. A separate duct will be provided within the trench for fibre optic communications. Refer to ESBN Cable ducting Specifications in **Appendix 2.2**.

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

- All relevant bodies i.e. ESB Networks Limited, Gas Networks Ireland, Eir, Clare County Council, Uisce Éireann etc. will be contacted and up to date drawings for all

existing services will be sought so that the grid connection ducting does not damage or interfere with existing services. This will be rechecked by the Contractor prior to excavations taking place.

- Immediately prior to construction taking place, the area where excavation is planned will be surveyed by CATSCAN (sub-surface survey technique to locate any below-ground utilities) and all existing services will be verified. Temporary warning signs will be erected.
- Clear and visible temporary safety signage will be erected all around the perimeter of the live work area to visibly warn members of the public of the hazards of ongoing construction works.
- A silt fencing filtration system will be installed on all existing drainage channels for the duration of the cable construction to prevent contamination of any watercourse.
- A 13-tonne rubber tracked 360-degree excavator will be used to excavate the trenches to the dimensions of 600mm wide by 0.925m deep.
- Once the trench is excavated, a 50mm depth base layer of sand (in road trench) or 15 Newton CBM4 concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck into the trench.
- uPVC ducts will be installed on top of the compacted base layer material in the trench.
- Once the ducts are installed, couplers (a device used for joining pipes) will be fitted and capped to prevent any dirt entering the unjointed open end of the duct.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to record the exact location of the ducts.
- The co-ordinates will be plotted on as-built record drawings for the Grid Connection cable operational phase.
- When ducts have been installed in the correct position on the trench base layer, sand (in road trench) or Lean-mix CBM4 (CL1093) (off road trench) will be carefully installed in the trench around the ducts so as not to displace the duct and will be compacted.
- Timer spacer templates will be used during installation so that the correct cover of duct surround material is achieved above, below and at the sides of the duct in the trench.
- A red cable protection strip will be installed above duct surround layer of material and for the full length of the cable route.
- A layer of Lean-mix CBM4 (CL1093) (in road) will be installed on top of the duct surround material to a level 300mm below the finished surface level.
- Yellow marker warning tape will be installed for the full width of the trench, and for the full length of the cable route, 300mm from the finished surface level.

- The finished surface of the road will then be reinstated on a temporary basis to the requirements of the Guidelines for Managing Openings in Public Roads, 2017 (Department of Transport).
- When trenching and ducting is complete, the installation of the Grid Connection cable will commence between the Electrical Substation and the existing 110kV substation at Tullabrack or 400kV substation at Moneypoint.
- The underground cable will be pulled through the installed ducts from a cable drum set up at one joint bay and using a winch system which is set up at the next joint bay, the cable will be pulled through.
- The cables will be jointed together within the precast concrete cable junction box (Joint Bay).
- The finished surface above each cable joint bay is reinstated on a permanent basis to the requirements of the Guidelines for Managing Openings in Public Roads, 2017 (Department of Transport).

2.3.1 Joint Bays

Joint Bays are pre-cast concrete chambers where individual lengths of cables will be joined to form one continuous cable. A joint bay is constructed in a pit.

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

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

2.3.2 Trench Layout

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

2.3.3 Joining Ducts

All joining ducts shall be laid in accordance with ESB Networks specifications. . Once the ducts have been installed and backfilled with lean-mix concrete and with Clause 804 stone

the duct run will be thoroughly cleaned by pulling the appropriate size of ESB Networks Limited approved duct brush through the duct.

Details of the construction methodology are summarised below:

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

2.3.4 Directional Drilling Works

Grid Connection Options 2 and 3 to Moneypoint 400kV would require 7 or 9 watercourse crossings respectively. It is envisaged all watercourse crossings carrying Grid Connection ducts will be routed within the existing road and verges and no directional drilling work is anticipated to be carried out in the event that option 2 or 3 are utilised.

3 POPULATION & HUMAN HEALTH

3.1 BASELINE DESCRIPTION

A Grid Connection between the Development and the national grid will be necessary to export electricity from the Development. If Options 2 or 3 are undertaken it is intended that the Development will connect to the national grid via the existing Moneypoint 110kV Substation (Moneypoint Substation), located in the townland of Carrowdotia South, Co. Clare. The Moneypoint Substation is located approximately 5.6km southeast of the Development at its closest point. Any Grid Connection route between Ballykett Windfarm and Moneypoint 400kV ESB substation would be underground (UGC), utilising sections of cabling in public roads, primarily regional and local public roads**.** The length of Grid Connection Option 2 is c. 9.1km long and the length of Grid Connection Option 3 is equal to c. 11km.

The Townlands and DED's associated with the two grid connection options are outlined in Table 3.1. Option 2 and 3 falling within Clooncoorha Kilrush Urban, Kilrush Rural and Killimer Rural DED's.

Table 3.1: DEDs and townlands that will be affected as a result of the Development and all associated works.

Element of the Development	District Electoral Division (DED)	Townlands
Option 2 - (Moneypoint)	Clooncoorha Kilrush Urban Killimer Kilrush Rural	Ballykett Tullabrack West Tullabrack East Tullabrack Moyadda Beg Parknamoney Rapepark Ballymacurtaun Kilcarrol Feagarroge Dysert Clooneylissaun Ballymacrinan Carrowdotia North Carrowdotia South
Option 3 - (Moneypoint)	Clooncoorha Kilrush Urban Killimer Kilrush Rural	Ballykett Tullabrack West Tullabrack East Tullabrack Moyadda Beg Parknamoney Rapepark Ballymacurtaun Kilcarrol Feagarroge Dysert Clooneylissaun Ballymacrinan Carrowdotia North Carrowdotia South

3.2 ASSESSMENT OF POTENTIAL IMPACTS

3.2.1 Population and Settlement PATTERNS

The predicted effect on the immediate settlement patterns and social patterns is also **slight to non-existent**.

3.2.2 Economic Activity

Employees involved in the construction of the Development will most likely use local shops, restaurants and hotels/accommodation. Therefore, overall, there will be a **slight, positive impact** on employment in the Study Areas.

3.2.3 Employment

There will be a **slight positive short-term** impact on employment in the area.

3.2.4 Land use and Topography

EIAR Chapter 8: Soils and Geology concludes that providing the mitigation measures proposed are fully implemented and best practice, as described, is followed on Site, it is not expected that there will be any significant impacts associated with the Development. It is recommended that suitable monitoring programmes are proposed and implemented to see that there is adherence to the CEMP and to the mitigation measures outlined here during construction, operation and Decommissioning of the Development.

3.2.5 Tourism

Overall effects of the Development with regards to tourism are considered to be, **slight, negative** during the construction, operational and Decommissioning phases.

3.2.6 Human Health

Electromagnetic fields from wind farm infrastructure, including the Grid Connection to the Moneypoint 400kV substation, are very localised and are considered to be **imperceptible, long-term** impact.

3.2.7 Property Value

The Development will have a medium-long-term, imperceptible impact on property values.

3.3 CUMULATIVE EFFECTS

The cumulative effects of the Project can be predicted to be a **small, short-term negative** impact on tourism and amenity during construction. There is predicted to be a **short-term, moderate positive** effect in terms of employment from the Project.

3.4 MITIGATION MEASURES

See **EIAR Chapter 5: Population & Human Health – Section 5.5 Mitigation Measures and Residual Effect**.

3.5 STATEMENT OF SIGNIFICANCE

The Development has been assessed as having the potential to result in effects of a **slight positive, long-term impact** overall. Cumulative effects are predicted as unlikely.

4 BIODIVERSITY

4.1 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

4.1.1 Purpose of the Report

The purpose of this report is to:

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

4.1.2 Relevant Legislation and Policy

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

- The Wildlife Acts 1976 – 2022 as amended
- The Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) as amended
- The Birds Directive (Council Directive 2009/147/EC) as amended

- European Communities (Birds and Natural Habitats) Regulations 2011 - 2021
- Flora (Protection) Order, 2022 (S.I. No. 235 of 2022)

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

- EPA Guidelines on the Information to be contained in Environmental Impact Assessment Reports (2022).
- European Commission (2017) Environmental Impact Assessment of Projects. Guidance on the preparation of the Environmental Impact Assessment Report. (Directive 2011/92/EU as amended.
- NRA (2009). Guidelines for Assessment of Ecological Impacts of National Road Schemes.
- CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine. Chartered Institute of Ecology and Environmental Management, Winchester.
- Fossitt (2000). A Guide to Habitats in Ireland. Heritage Council, Kilkenny.
- Smith *et al.* (2011). Best Practice Guidance for Habitat Survey and Mapping in Ireland.
- Northern Ireland Environment Agency, Natural Environment Division (2021) Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland. Belfast: Department of Agriculture, Environment and Rural Affairs (Northern Ireland).[1]
- Scottish Natural Heritage (2019). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation.
- EUROBATS 'Guidelines for consideration of bats in wind farm projects' Revision 2014.
- Bat Conservation Trust 'Bat Survey Good Practice Guidelines' 2012 (BCT Guidelines).
- Bat Conservation Ireland (2012). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8 December 2012 Bat Conservation Ireland, www.batconservationireland.org.
- Marnell, F., Kelleher, C. & Mullen, E. (2022). Bat Mitigation Guidelines for Ireland. V2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage. Dublin, Ireland.
- England, N. (2014). Bats and onshore wind turbines Interim guidance. Rodrigues, L., Bach, L., Dubourg-Savage, M., Karapandža, B., Kovač, D., Kervyn, T., Minderman, J. (2015).

[1] Survey work was conducted prior to the release of (NIEA, 2021) thus the survey strategy was based on (NatureScot, Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation, 2021). Mitigation measures outlined within the report take cognisance of the 2021 guidance.

- Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. and Fuller, R. (2013). *Bird Atlas 2007-11*: *The breeding and wintering birds of Britain & Ireland*. BTO Books, Thetford.
- Gilbert, G., Stanbury, A. and Lewis, L. (2021). Birds of Conservation Concern in Ireland 4: 2020-2026. *Irish Birds,* Volume 43, 1-22.
- Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2013). *Raptors: a field guide to survey and monitoring (3rd Edition*). The Stationery Office, Edinburgh.
- Percival, S.M. (2003). *Birds and Wind Farms in Ireland: A Review of Potential Issues and Impact Assessment*. Sustainable Energy Ireland.
- Scottish Natural Heritage (2016). *Assessing Connectivity with Special Protection Areas (SPAs).* Version 3. Scottish Natural Heritage.
- Scottish Natural Heritage (2017). *Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms*. Version 2. Scottish Natural Heritage.

4.1.3 Desk Study

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

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

For bats, a data search was conducted in October 2022 to revise existing information from the footprint of the proposed Redline Boundary. The following information sources were examined:

- Known bat records within a 10km radius of the proposed wind farm development site from the Bat Conservation Ireland database
- Adhoc and observational bat records from the National Bat Database held by the National Biodiversity Data Centre (www.biodiversityireland.ie)
- Review of Ordnance Survey mapping and aerial photography of the proposed Redline Boundary and its environs (i.e. 200m plus rotor radius of the Redline Boundary of the proposed Development)

- Records of designated sites within a 15km radius of the proposed wind farm development site where bats form part or all of the reason for designation (https://www.npws.ie/protected-sites)
- Collation of data on known caves within a 4km radius of the proposed wind farm development site from the Cave Database for the Republic of Ireland, compiled by Trinity College (http://www.ubss.org.uk/search_irishcaves.php)
- Review of bat survey data from Ecological Impact Assessments from proposed and permitted developments within the wider environs of the site.

For birds, a desktop study was conducted prior to the commencement of the field surveys. The following principal information sources were examined:

- Ordnance Survey Ireland (OSI) aerial photography and 1:50000 mapping, and other sources of online aerial imagery (to assess physical features and habitats which may potentially support important bird species)
- Review of Bird Atlases: (Sharrock 1976; Lack 1986; Gibbons *et al*. 1993; Balmer *et al*. 2013).
- Review of Birds of Conservation Concern in Ireland (BoCCI) 2020-2026 (Gilbert et al. 2021).
- Review of BirdWatch Ireland I-WeBS (Irish Wetland Bird Surveys) site information.
- General ornithological information available from BirdWatch Ireland (www.birdwatchireland.ie).
- Irish Bird Reports and the journal *Irish Birds*, published by BirdWatch Ireland.
- Review of the 2015 National Survey of Breeding Hen Harrier in Ireland Report (Ruddock *et al*. 2016).

4.1.4 Consultation

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

- National Parks and Wildlife Services of the Department of Housing, Local Government and Heritage (response received 27th October 2022 – see **Table 1.6, Chapter 1**)
- BirdWatch Ireland (no response received)
- An Taisce (no response received)
- Irish Peatland Conservation Council (response received 10th January 2023 – see **Table 1.6, Chapter 1**)

4.1.5 Field Surveys

4.1.5.1 Habitats, vegetation and flora

The 2 no. Grid Connection cable routes were surveyed in October 2022 and April 2023. This comprised a survey by car, with stops at intervals to review habitats and flora present alongside the roads and at watercourse crossing points.

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

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

During the surveys, a search for Invasive Alien Species (IAS) listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 – 2021 was conducted[2]. Invasive alien species which are widespread in Ireland include Japanese knotweed and Rhododendron.

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

4.2 BASELINE ECOLOGICAL CONDITIONS

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

Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are designated under the EU Habitats Directive as amended and EU Birds Directive as amended respectively and are collectively known as 'European Sites' or 'Natura 2000' sites. The potential for significant effects on the integrity of European Sites is fully assessed in the AA Screening Report and Natura Impact Statement that accompanies this application. As per

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

EPA Guidance 2022, *"a biodiversity section of an EIAR, for example, should not repeat the detailed assessment of potential effects on European sites contained in documentation prepared as part of the Appropriate Assessment process, but it should refer to the findings of that separate assessment in the context of likely significant effects on the environment, as required by the EIA Directive".* Section 6.4.2 of this EIAR provides a summary of the key assessment findings with regard to European Designated Sites.

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

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

All designated sites that could potentially be affected were identified using a source-pathway - receptor model. To provide context for the assessment, European and national sites within a distance of 15km surrounding the Development Site have been considered The distance of 15km follows guidance from the Department of Environment, Heritage and Local Government (2010) and would be a conservative distance in many cases. However, sites that were further away from the proposed Development were also considered and no potential for impact was identified due to the absence of direct and indirect connections.

The grid connection routes Options 2 & 3 run alongside the N67 for approximately 500m at Moneypoint Power Station and are adjacent to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA – the designated area includes all the shoreline which adjoins the road and extends onto part of the actual N67 road (see npws.ie/protected-sites). The cable route, however, is along the eastern side of the road (with shoreline to west of road) where there is a grass verge of approximately 7.5m at its narrowest point (see Grid Route Assessment by BFA consulting – **EIAR Appendix 2.2**).

4.2.1.1 ***European designated sites***

The nearest designated European sites to the grid routes are the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. Both of these sites include Poulnasherry Bay, which receives drainage from the Ballykett area via the Moyasta River. Both these designated sites are hydrologically connected to Grid Route Options 2 and 3.

Table 4.1: Relevant European sites, reasons for designation, distances from subject site and summary of connectivity.

European Site	Reasons for designation (information correct as of 10th January 2023) (*denotes a priority habitat)	Distance from proposed Ballykett Wind Farm Site and summary of connectivity
	SPECIAL AREAS OF CONSERVATION	
Lower River Shannon SAC (site code 002165)	Sandbanks which are slightly covered by sea water all the time [1110] Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Coastal lagoons [1150] Large shallow inlets and bays [1160] Reefs [1170] Perennial vegetation of stony banks [1220] Vegetated sea cliffs of the Atlantic and Baltic coasts [1230] Salicornia and other annuals colonising mud and sand [1310] Atlantic salt meadows (Glauco-Puccinellietalia maritimae) [1330] Mediterranean salt meadows (Juncetalia maritimi) [1410] Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation [3260] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) [6410] Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) [91E0] Margaritifera margaritifera (Freshwater Pearl Mussel) [1029] Petromyzon marinus (Sea Lamprey) [1095] Lampetra planeri (Brook Lamprey) [1096] Lampetra fluviatilis (River Lamprey) [1099] Salmo salar (Salmon) [1106] Tursiops truncatus (Common Bottlenose Dolphin) [1349] Lutra lutra (Otter) [1355] According to this SAC's site Conservation Objectives document (Version 1.0. Department of Arts, Heritage and the Gaeltacht, 07 August 2012), for each of the listed QIs, the Conservation Objective is to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected.	Grid Connection route Options 2 & 3 to the ESB 400kV Moneypoint substation will cross multiple watercourses which drain to the Shannon system. The two routes run alongside the N67 for approximately 500m at Moneypoint Power Station (all of the shoreline here and part of the road carriageway is included within the SAC). It is concluded that hydrological connectivity exists between the Project area and the SAC.
	SPECIAL PROTECTION AREAS	
River Shannon and River	Cormorant (Phalacrocorax carbo) [A017] Whooper Swan (Cygnus cygnus) [A038]	Grid Connection route Options 2 & 3 to the ESB

European Site	Reasons for designation (information correct as of 10th January 2023) (*denotes a priority habitat)	Distance from proposed Ballykett Wind Farm Site and summary of connectivity
Fergus Estuaries SPA (site code: 004077)	Light-bellied Brent Goose (Branta bernicla hrota) [A046] Shelduck (Tadorna tadorna) [A048] Wigeon (Anas penelope) [A050] Teal (Anas crecca) [A052] Pintail (Anas acuta) [A054] Shoveler (Anas clypeata) [A056] Scaup (Aythya marila) [A062] Ringed Plover (Charadrius hiaticula) [A137] Golden Plover (Pluvialis apricaria) [A140] Grey Plover (Pluvialis squatarola) [A141] Lapwing (Vanellus vanellus) [A142] Knot (Calidris canutus) [A143] Dunlin (Calidris alpina) [A149] Black-tailed Godwit (Limosa limosa) [A156] Bar-tailed Godwit (Limosa lapponica) [A157] Curlew (Numenius arquata) [A160] Redshank (Tringa totanus) [A162] Greenshank (Tringa nebularia) [A164] Black-headed Gull (Chroicocephalus ridibundus) [A179] Wetland and Waterbirds [A999] According to this SPA's site Conservation Objectives document, Conservation Objectives Series: River Shannon and River Fergus Estuaries SPA 004077. Version 1.0, 17th September 2012, Department of Arts, Heritage and the Gaeltacht), for each of the listed SCIs, the Conservation Objective is to maintain the favourable conservation condition of the species for which the SPA has been selected.	400kV Moneypoint substation will cross multiple watercourses which drain to the Shannon system. The two routes run alongside the N67 for approximately 500m at Moneypoint Power Station (all of the shoreline here and part of the road carriageway is included within the SPA). The Grid Route Options do not provide suitable ex-situ habitat to support any of the SCIs of the SPA. It is concluded that hydrological connectivity exists between the Project area and the SPA.

4.2.2 Habitats and Vegetation

Note: technical details on the grid route options, including the numbering of watercourses, are given in **EIAR Appendix 2.2**, 'Technical Note' by BFA Consulting.

UGC Options 2 & 3

On leaving the Site, both options run within the local road to Tullabrack and then turn onto the R483 in a south-southwest direction approximately 1km. The R483 is a substantial carriageway with grassy verges both sides and low hedging. A small watercourse (no. 1)

is crossed and then a somewhat larger watercourse (no. 2) running beneath Cavanagh's bridge, which is a substantial stone arch bridge (see **Plate 4.1**).

Both options then veer southeast onto a local road leading towards the N68 (distance of c.1.5km). This road, which runs through agricultural land, is edged by narrow grassy verges and low hedging, mostly hawthorn, blackthorn and scattered ash (see **Plate 4.2**). A minor watercourse (no. 3) is crossed. Both options cross the N68 and run for a few hundred metres towards the R473 before diverging eastwards and westwards as separate routes.

Option 2 continues for approximately 500m on the R473 and then turns onto a local road running in a southeast direction. After crossing over watercourse no. 4, there is a stretch through an area of woodland to both sides of the road, part of which appears to be prone to flooding. The woodland along the road has a wet character and is mainly willow, alder and birch with some ash (see **Plate 4.3**) but the majority has been planted with conifers. The Coillte Kilrush Forest Recreation Area occurs to the south side of the road. The road is edged by narrow grassy strips. The route then veers in a southerly direction and passes through agricultural land though fields are largely unmanaged on the eastern side of the road. After passing through tall conifer plantation for several hundred metres, the route runs south through improved agricultural lands (crossing two minor watercourses no. 6 & no. 7) for approximately 1km before merging with Option 3 at the Ballymacrinan junction) for the final stretch towards Moneypoint.

Option 3 runs eastwards along the R473 for approximately 1.5km, crossing one watercourse (no. 8), before running southwards on a local road for approximately 2km. This is mainly through improved agricultural fields, with low hedging and narrow grassy verges along road. Two watercourses (no. 9 & no. 10) are crossed. At the south end of this stretch (coming to a T-junction) the road passes through an area of bog that is partly wooded with willow and birch (see **Plate 4.4**). Option 3 then runs on local roads first in an east direction for approximately 500m, and then southwards for c. 1km. These roads are edged by grassy strips with low intermittent hedging. The final stretch is along a further local road which runs west towards the road junction at Ballymacrinan where the route merges with Option 2. At the Ballymacrinan junction, there is a stand of mixed woodland to the southeast.

The final stretch for both Options is along several hundred metres of a local road, with residences along much of the western side. This local road joins the N67 and there is an approximate 500m stretch south-eastwards towards the Moneypoint facility. The road is just above the shoreline, with grassy strips to both sides (see **Plate 4.5**).

Plate 4.1. Grid Options 2 & 3 run along the R483 for a stretch and pass over Cavanagh's Bridge, which is a substantial stone arch structure (April 2023).

Plate 4.2. On leaving the R473, Option 2 follows a local road through an agricultural landscape. Typically, the local roads are edged by grassy verges and low hedging, with ash the principal tree standard (April 2023).

Plate 4.3. The Option 2 route passes through an afforested area – while mainly conifer plantation, there are strips of woodland with a wet character along both sides of the road (April 2023).

Plate 4.4. A small section of the Option 3 route is through an area of bog that is partly wooded (April 2023).

Plate 4.5. Both Options run along the N67 leading towards the Moneypoint facility for approximately 500m. The road is above the shoreline, with grassy verges along both sides. Looking southeast (April 2023).

4.3 ASSESSMENT OF POTENTIAL IMPACTS

4.3.1 The 'Do-Nothing' Impact

Without the development proceeding, the ecology of the grid rout options 2&3 would be expected to remain fairly similar as at present.

4.3.2 Potential Impacts on European Conservation Sites

In the absence of mitigation, likely or possible significant effects could not be excluded during the construction, operational and/or Decommissioning stages of the proposed Development on the following sites:

- Lower River Shannon SAC (code 002165)
- River Shannon and River Fergus Estuaries SPA (code 004077)

Impacts of potential concern may arise as a result of contaminants originating within the project area, and especially during the construction phase, reaching the relevant designated site and causing harmful effects on the qualifying interests and/or the Special Conservation

Interests of the designated site. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Mitigation is therefore required to minimise this risk.

4.3.3 Potential Impacts on National Conservation Sites

4.3.3.1 Proposed Natural Heritage Areas

In the absence of mitigation, impacts of potential concern may arise as a result of contaminants originating within the site of the proposed grid route Options reaching the bay via the Moyasta River and causing potential harmful effects on the ecology of the bay. Of particular concern would be the effect of particles on infaunal species and particularly filter feeding invertebrates. Feeding and roosting bird species could be adversely affected by surface deposits, including hydrocarbons. The significance of any effect would be dependent on the magnitude and duration of a pollution event. Mitigation is therefore required to minimise this risk. The issue of potential effects on the interests of Poulnasherry Bay pNHA, which is an integral part of the Shannon estuarine system, is assessed in the NIS.

A further five of the sites (Clonderalaw Bay, Scattery Island, Tarbert Bay, Ballylongford Bay, Beal Point) are located within or along the Shannon system, and could theoretically (in absence of mitigation) receive water ladened with contaminants emanating from the Development Site. It is considered, however, that there is no realistic potential for the interests of these sites to be affected in any significant way as any contaminants entering the drainage network at the proposed Development Site and subsequently the Shannon system would be completely attenuated by the dilution, dispersal and settlement that would occur within the Shannon estuarine system.

For the remaining listed pNHA sites, ecological or hydrological connectivity with the Site for the proposed grid route Options has not been identified.

4.3.4 Impacts on Habitats, Vegetation and Flora

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

- permanent loss of habitat
- temporary loss of habitat
- disturbance to habitats
- changes to existing habitats

4.3.4.1 *Disturbance to habitats*

The laying of the grid connection cable will cause localised disturbance to marginal vegetation alongside the roads due to trenching works and use of plant machinery. The amount of disturbance would vary depending on the exact line of the trench, but may affect grassy verges and roadside banks or ditches. However, hedging or trees are not expected to be removed to facilitate the works. Generally, there are no habitats of significant ecological interest alongside the roads for any of the two grid Options.

While a 500m (approx.) section of Options 2 & 3 runs alongside the N67 and is adjacent to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA (see **Ballykett Wind Farm EIAR - Figure 6.5**), it is noted that the component of the SAC and SPA closest to the grid route is the actual road which is not of ecological interest (this appears to be an anomaly, as the boundary mapping for the designated areas is at the former high tide mark (as shown on OS 1:10,560 mapping - see www.npws.ie/maps-and-data) which has since been built upon. Trenching and cable laying within the grassy margin along the eastern side of the road (see details in **EIAR Appendix 2.2**) would not have any effect on the designated shoreline area to the other side of the road as there are no watercourses or drains to be crossed.

Overall, the disturbance caused to habitats as a result of the works associated with the grid connection is not considered a significant effect for any of the 2 options. After trenching and the works are complete, full recovery of the marginal vegetation is likely to take place within 1-2 years.

4.4 CUMULATIVE EFFECTS

Other developments or proposed developments (larger than one-off houses) within 10 km of the proposed Development are listed in **Table 2.2** of **Ballykett Wind Farm EIAR - Chapter 2**. These include agricultural facilities, a solar energy development, refurbishment of the existing Moneypoint – Oldstreet 400kV overhead line, a waste water treatment works, amenity facilities (9-hole pitch and putt course) and an apartment development. All of these projects have been rigorously assessed for environmental and ecological effects and where such effects are identified, mitigation has been incorporated into the planning. As the proposed Development, with mitigation in place, will not be likely to result in any significant effect on terrestrial ecological interests at the Development Site or in the wider area, it will not contribute to any possible cumulative impact when considered with the various other projects within a 10 km radius.

The surveys undertaken for the Aquatic Ecology study (**Chapter 7**) have shown that the local watercourses have Moderate to Poor water quality and considers that current forestry and agricultural activities are having negative effects on water quality within the catchment. With respect to hydrology, the proposed Development, with mitigation in place (as detailed **in Chapter 9 Hydrology and Hydrogeology**), is not considered likely to significantly contribute to such cumulative effects in terms of water quality.

4.5 MITIGATION MEASURES

See **EIAR Chapter 6: Biodiversity** – **Section 6.5 Mitigation Measures**.

4.6 STATEMENT OF SIGNIFIANCE

With the implementation of mitigation through avoidance principles, pollution control measures, surface water drainage measures and other preventative measures which have been incorporated into the project design in order to minimise potential significant adverse impacts on water quality and biodiversity at the site of the proposed grid route Option 2&3, the potential for adverse impacts on downstream designated sites is reduced to Imperceptible or Not Significant.

Following surveys for bats within and surrounding the Site, it is considered that the proposed Development will not have a significant long term negative effect on the local bat populations in the area.

5 AQUATIC ECOLOGY

5.1 INTRODUCTION

This appendix contains the additional survey work carried out by Aquafact for the assessment of Option 2 and Option 3 of the Grid Connection Route (GCR) from the proposed Ballykett wind farm Development Site to the Moneypoint power station. Based on the findings of the assessment, the optimal GCR was identified as Option 1 because it involves the shortest distance connecting the Site to the existing Tullabrack 110Kv sub-station. Also, it does not cross any additional watercourses from the site and most of the works will take place in the local roads. Therefore, this Option was addressed in the relevant Chapters of this EIAR, and the other two options will be outlined herein.

5.2 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

5.2.1 Assessment Methodology Aquatic Biodiversity

The general approach used for the evaluation of ecological receptors and assessment of significant likely effects for this current assessment is based on the '*Guidelines for Ecological Impact Assessment in the UK and Ireland*' (Chartered Institute of Ecology and Environmental Management, 2018). The evaluation of ecological receptors contained within this report uses the geographic scale and criteria defined in the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (National Roads Authority, 2009).

5.2.2 Desktop Study

A desktop study review was carried out of existing data and records on the National Biodiversity Data Centre (NBDC) and National Parks and Wildlife Service (NPWS) websites for fish, protected aquatic species and habitats (including Annex II species and aquatic Annex I habitats), and invasive species listed under the Third Schedule of S.I No. 477 of 2011, European Communities (Birds and Natural Habitats) Regulations 2011 (as amended)) on watercourses, at or hydrologically connected (*i.e.,* downstream) to the proposed Development.

5.2.3 Field Surveys

Surveys of watercourses at and within a potential Zone Of Influence (Zol) of the Development were undertaken on the 8th of November 2022 for the proposed GCR's. The surveys were limited to this timeframe as Autumn and Spring are the best times to survey for freshwater invertebrates. The surveys identified and mapped aquatic habitats, determined fisheries value and potential, and determined presence or suitability for Annex listed species or invasive alien species. The aquatic habitat assessment conducted at all sites was based on the Environment Agency's *'River Habitat Survey in Britain and Ireland Field Survey Guidance Manual 2003*' (Environment Agency, 2003) and the Irish Heritage Council's *'A Guide to Habitats in Ireland*' (Fossitt, 2000). The EPA Biotic Index Biological River Quality Classification System (Q-value) (Toner *et al.,* 2005) (**Table 5.1**) has been used to monitor the ecological quality of streams and rivers in Ireland since 1971. It is routinely employed by the EPA. All sites were assessed in terms of:

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

- Riparian habitats and species composition

A Biosecurity protocol was rigidly followed to avoid the potential for transfer of invasive alien species to, or from the Site in accordance with guidance from *Invasive Species Ireland and Inland Fisheries Ireland* (IFI, 2010). A specific Biosecurity Method Statement was produced for the survey operation.

This aquatic ecology analysis will be referring to watercourses by the local river names identified using the "Indicative Flow" layer [e.g. the Gowerhass] on EPA maps website to assess potential effects on each stretch rather than the river catchment as a whole. For the Hydrology and Hydrogeology Chapter local river names have been included as well as the WFD river section ID [Moyasta_010 for example] which aligns with the overall WFD catchment or sub-catchment name.

Table 5.1: EPA Water Quality and Status Summary.

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

5.3 BASELINE DESCRIPTION

5.3.1 Aquatic Environment

The following nine watercourses could potentially be impacted by the construction of GCR Option 2 or Option 3 for the proposed Ballykett Windfarm: Moyasta (EPA Code: 27M04), Ballykett, (EPA Code: 27B52), Parknamoney (EPA Code: 27P01), Wood (EPA Code: 27W01), Moyne (EPA Code: 27M23), Ballynote East (EPA Code: 27B81), Mologha (EPA Code: 27M19), Moyadda Beg (EPA Code: 27M17), and Kilcarroll Stream (EPA Code: 27K06). GCR Option 2 crosses watercourses at 7 different points while GCR Option 3 crosses watercourses at 9 different points.

The 13 water sampling stations surveyed were at small streams/rivers that can be classified as FW2 depositing/lowland rivers under the Fossitt (2000) classification system. FW2 depositing/lowland rivers includes all watercourses where fine sediments are deposited on the riverbed. These types of streams are typically characterised by slow flowing water, low discharge and muddy substrates. In a natural state these types of streams and rivers erode their banks and meander across floodplains. Due to this, most have been modified to some extent to control water flow, facilitate navigation or prevent flooding and erosion (Fossitt, 2000). However, the sampling station S8 was classified as a ditch (FW4) and could not be sampled.

Within the proposed Development Site and along the GCR, the watercourses have been previously modified to receive input from man-made arterial drains, are culverted beneath roads or have been made available to provide cattle access for drinking water.

The water quality in the 9 watercourses surveyed is moderate to poor, as discussed below. Macroinvertebrate biodiversity is low and characterised by pollution tolerant taxa such as *Gammarus,* chironomids, and gastropods. The most likely source of the degraded water quality is diffuse pollution from agricultural run-off. Some of the survey stations (S2, S3 and S11) displayed characteristics of eutrophication, having an abundance of macrophytes such as *Potamogeton*. All streams are subject to seasonal fluctuations in discharge, velocity, temperature, species richness, and abundance, but eutrophication and agricultural pollution are a persistent issue degrading water quality in the area. The second (2nd) and third (3rd) Cycle reports for the *Shannon Estuary North Catchment* identified excess nutrient input from agricultural run-off as the dominant issue in the catchment, followed by alteration of hydromorphological (or physical) features of the waterbody (EPA 2018, EPA 2021).

None of the watercourses surveyed for the GCR were identified as suitable habitats for Annex II listed species, or species of high conservation value. The fine sediments on the streambed are unsuitable for freshwater pearl mussel (*Margaritifera margaritifera*) or spawning salmonids. There was no sign of otter tracks or spraint, river lamprey (*Lampetra fluviatilis*) or white-clawed crayfish (*Austropotamobius pallipes*). The streams are considered to be of low value local importance. The flora and fauna present in the streams are widespread, of low ecological significance and relatively tolerant to pollution.

The proposed wind farm Site and the three Grid Options are not located in areas designated as a Special Area of Conservation (SAC), Special Protection Area (SPA), or a National Heritage Area (NHA). However, GCR Options 2 and 3 are adjacent to two Natura 2000 sites at the southernmost extent of the proposed GCR. All of watercourses crossed by the alternate

GCR's (*i.e.,* Option 2 and Option 3), are hydrologically connected to the Natura 2000 sites. The streams are connected and drain into the Shannon estuary, which lies within two European sites: (i) The Lower River Shannon SAC (site code: IE002165), and (ii) the River Shannon and River Fergus Estuaries SPA (site code: IE004077). These sites are located approximately 7.8km downstream of the proposed site. The location of the SAC and SPA in relation to the proposed site is illustrated in **Figure 5.1** below.

The Site is located on the Moyasta river, approximately 5km upstream of Poulnasherry Bay. Grid connection Option 3 crosses watercourses at S1 (Ballykett (EPA Code: 27B52)) and S2 (Moyasta (EPA Code: 27M04)) that flow downstream into Poulnasherry bay. Poulnasherry Bay is a designated shellfish water body under the Quality of Shellfish Water Regulations (S.I 208 of 2008). Robust mitigation measures, as outlined in Chapter 9: Hydrology and Hydrogeology and Appendix 2.1 (CEMP, SWMP), will be put in place to prevent pollution in the form of suspended solids and dissolved substances entering the watercourses, and potentially transporting to Poulnasherry Bay. Poulnasherry Bay measures about 5km² and using a mean depth of 1m, this gives a total volume of 50,000m³ which is tidally refreshed twice a day. The Moyasta river is 24.75km in length and the Moyasta catchment is 26.12km². According to the EPAs River Flow Estimate tool the flow at the segment of the Moyasta river that enters Poulnasherry Bay is above the Q95 of 0.063m^3/sec for the majority of the time (the flow that is present 95% of the time, or across 95% of measurements). Q95 is often used as the precautionary flow when looking at capacity studies. The average flow at this section (Q50) is above 0.29m^3/sec.

The size of the River Shannon catchment is *ca.* 18,000 km² and land use is, to a large extent, agricultural/silviculture. Run off from such land use will bring in nutrients such as nitrogen (N), phosphorus (P), and humic acids into the river. Given the tidal exchanges as described above, there is sufficient dilution to prevent the potential effects of run-off (for which mitigation measures have been designed) from the proposed wind farm. With regard to flows in the Shannon Estuary, if all inflowing rivers are included along with the flows in the river, the total flow rate is 300m³ sec. In comparison, the flow of the Moyasta as presented above is >0.29m^3/sec at average. With Poulnasherry Bay having an estimated volume of 50,000m^3, which is tidally refreshed by the Shannon at a flow rate of 300m^3/sec, a flow rate of >0.29m^3/sec entering Bay would be massively diluted. Without mitigation in place there would only be a slight to moderate short-term significant effect.

With mitigation rigorously enforced, as outlined in **Chapter 2: Project Description, Appendix 2.1** (*i.e.,* CEMP, SWMP) and Chapter 9: Hydrology and Hydrogeology, it can be

concluded there would not be any significant effects on the designated shellfish water body as a result of the grid connection options.

5.3.2 Aquatic Habitat Assessment

Table 5.2 presents a list of the watercourses and the 13 survey station locations. Four stations were assessed for the Site survey (B1-B4) and 13 stations (S1-S13) were assessed for the Grid Connection Routes. EPA watercourse names, EPA codes and EPA segment codes are also presented. **Table 5.3 5.3** provides a summary of the stations surveyed and sampling undertaken at each location.

Figure 5.1 presents the locations of the sampling stations and the three GCR options.

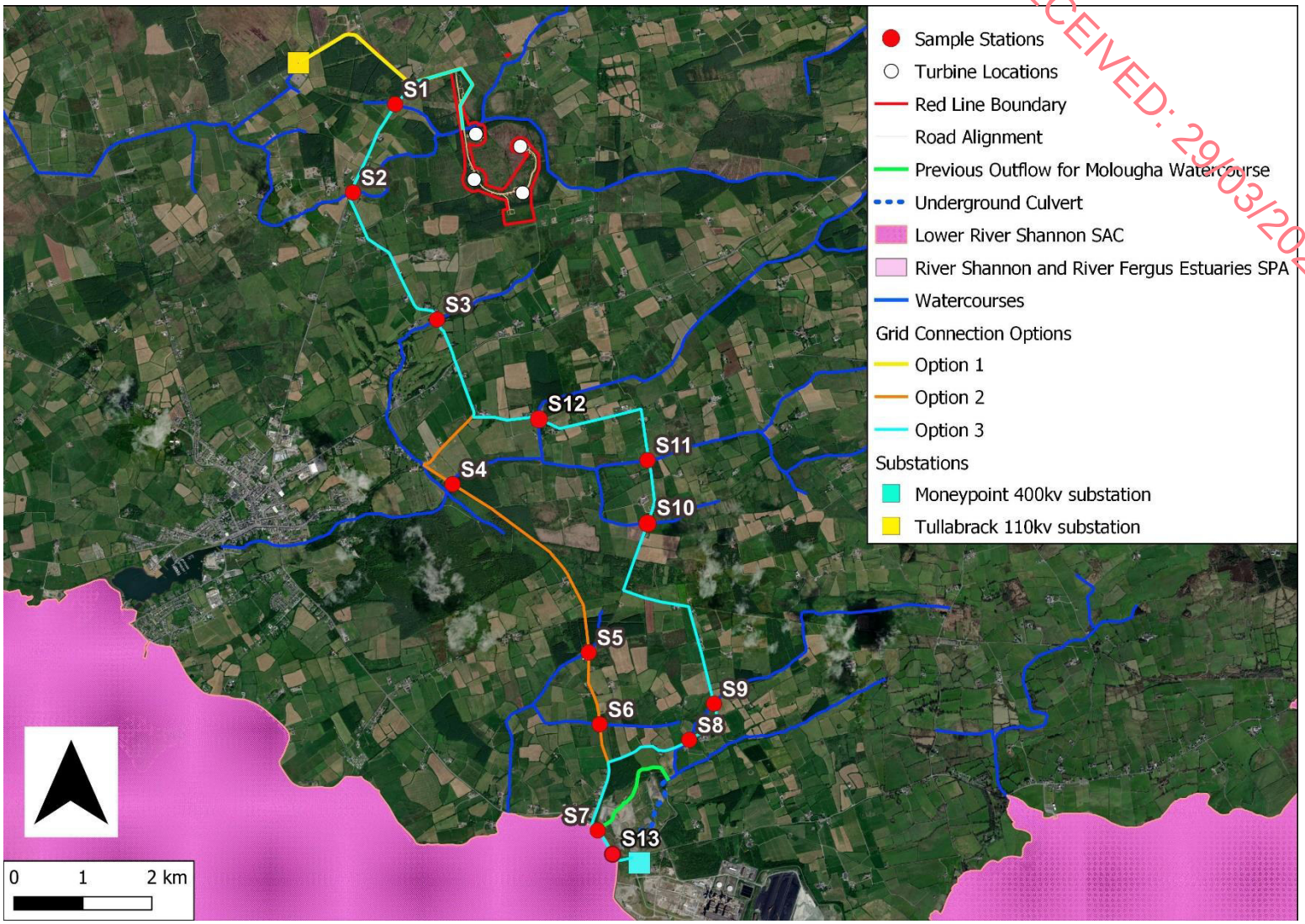

Figure 5.1: The three proposed Grid Connection Route options from the proposed Development Site to Tullabrack 110Kv substation (Option 1) and Moneypoint 400kV station (Options 2 & 3).

Table 5.2: Descriptions of the survey station locations and watercourse names for the grid connection route (GCR) options[3]

Grid Connection Route (Option 2 & Option 3) Survey Stations	EPA Name	EPA Code	EPA Watercourse Segment Code	Photograph of survey station
S1	BALLYKETT	27B52	27_1144	

[3] Two additional watercourse crossings, labelled WC#5 and WC#11 were included in Ballykett EIAR Appendix 2.2 -Grid Route Assessment, BFA 2023 (Appendix A). These watercourses are not noted on the EPA maps source, used to complete this study. This is most likely due to the fact that they are observed to be within or adjacent to areas of forest and appear to be artificial drains (and culverts) associated with forestry. As they were dry or unsuitable for survey they were not assessed further.

Grid Connection Route (Option 2 & Option 3) **Survey Stations**	**EPA Name**	**EPA Code**	**EPA Watercourse Segment Code**	**Photograph of survey station**
				
S2	MOYASTA 27	27M04	27_1158	

Grid Connection Route (Option 2 & Option 3) **Survey Stations**	**EPA Name**	**EPA Code**	**EPA Watercourse Segment Code**	**Photograph of survey station**
S3	PARKNAMONEY	27P01	27_967	
S4	WOOD 27	27W01	27_963	

Grid Connection Route (Option 2 & Option 3) **Survey Stations**	**EPA Name**	**EPA Code**	**EPA Watercourse Segment Code**	**Photograph of survey station**
S5	MOYNE 27	27M23	27_1023	
S6	BALLYNOTE EAST	27B81	27_1022	

Grid Connection Route (Option 2 & Option 3) **Survey Stations**	**EPA Name**	**EPA Code**	**EPA Watercourse Segment Code**	**Photograph of survey station**
S7 (previous location of outflow for Molougha watercourse)	MOLOUGHA	27M19	27_1024	
S8 (current location of Molougha watercourse)	MOLOUGHA	27M19	27_1191	

Grid Connection Route (Option 2 & Option 3) **Survey Stations**	**EPA Name**	**EPA Code**	**EPA Watercourse Segment Code**	**Photograph of survey station**
S9	MOLOUGHA	27M19	27_1191	
S10	MOYADDA BEG	27M17	27_1021	

Grid Connection Route (Option 2 & Option 3) **Survey Stations**	**EPA Name**	**EPA Code**	**EPA Watercourse Segment Code**	**Photograph of survey station**
S11	KILCARROLL STREAM	27K06	27_1019	
S12	WOOD 27	27W01	27_1016	

Grid Connection Route (Option 2 & Option 3) **Survey Stations**	**EPA Name**	**EPA Code**	**EPA Watercourse Segment Code**	**Photograph of survey station**
S13 (Culverted watercourse previously outflowing at S7)	MOLOUGHA	27M19	27_1024	

Proposed Grid Connection Route

Three Grid Connection Route options, listed below and shown in **Figure 5.1**, were assessed for the proposed Ballykett Windfarm. The results of the assessment support the conclusion that the optimal GCR is Option 1. It involves the shortest distance (*i.e.,* 1.7km), connecting the Development to the existing Tullabrack 110kV Substation. Additionally,, GCR Option 1 has the least potential environmental effects because it does not cross any watercourses.

- **UGC Option 1** – UGC single 38kV circuit from Tullabrack substation to the proposed Ballykett wind farm utilising sections of UGC primarily public roads, regional roads, and private lands. (approx. 1.7km). Does not cross or run adjacent to watercourses.
- **UGC Option 2** – UGC twin 20kV circuit from Moneypoint to the proposed Ballykett Wind Farm utilising sections of UGC in public road, primarily regional roads, and private lands (approx. 9.1km). This route includes seven watercourse crossing points.
- **UGC Option 3** – UGC twin 20kV circuit from Moneypoint to the proposed Ballykett wind farm utilising sections of UGC in public road, primarily regional roads, and private lands (approx. 11km). This route includes nine watercourse crossing points.

The survey work was preceded by a period of heavy rainfall and the watercourses were fast flowing, with higher-than-normal velocity and discharge. Multiple fields were waterlogged and slightly flooded. There were eight sampling stations along GCR Option 2, as shown in **Figure 5.1**. Six of these stations were at habitats classified as FW2 lowland depositing streams under the Fossit (2000) classification system. However, the sampling

station S5 was not accessible due to overgrowth of hedgerow as seen in the image in

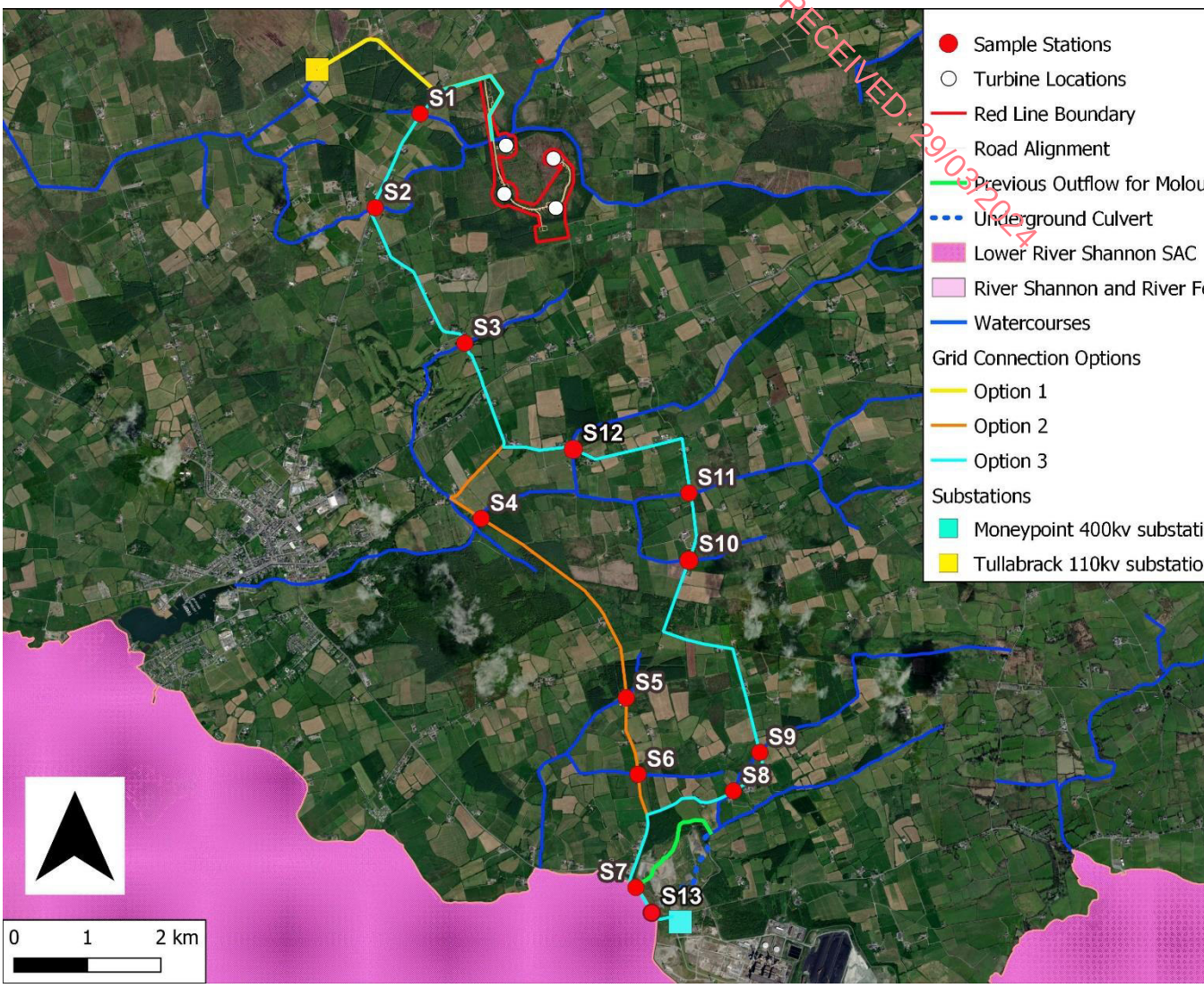

Figure 5.1: The three proposed Grid Connection Route options from the proposed Development Site to Tullabrack 110Kv substation (Option 1) and Moneypoint 400kV station (Options 2 & 3).

Table 5.2. The sampling station S6 was flooded at the time of the survey so a kick sampling could not be completed, but water chemistry was analysed. Also, S7 is the previous location of the Molougha watercourse outflow. At present there is no outflow pipe or discharge as the watercourse has been diverted to a constructed pond and culverted under the Moneypoint Power Station Ash Storage Area and on to an outflow pipe into the Shannon Estuary at S13. The discharge level is above the low tide line. As S13 is an intertidal outflow pipe located on the shore of the Shannon Estuary it was unsuitable to sample for freshwater macroinvertebrates or water chemistry as the location is not a freshwater site. There is an additional outflow pipe located in close proximity to the north of S13, however this is not in use. All of the watercourses that were sampled showed signs they are experiencing moderate to serious levels of pollution, with the main source most likely diffuse nutrient input from agricultural run-off. Heavy siltation was present at five of the sampled stations, the exception being S4 which had a mixture of stone/gravel.)

Eight of the ten watercourse stations crossed by Grid Option 3 are classified as FW2 *Lowland Depositing Streams* under the Fossitt (2000) classification system. The sampling station S8 is classified as FW4 *Ditch* under the Fossitt (2000) classification system and was unsuitable for water chemistry or kick sampling due to its small size, shallow nature and extremely slow flow. However, station S9 was located in close proximity, and upstream of S8. Like Grid Option 2, all the sampled watercourses are experiencing moderate to serious levels of pollution, and they are heavily modified and/or have modified banks. None of the stations are within the boundary of any Natura 2000 sites, although there is ecological connectivity between the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA via the watercourses and the Moyasta river.

The survey at sampling station S1 resulted in a score of Q2 indicating serious pollution; this corresponds with station B3 from the Aquatic Ecology Site Survey. It is a temporary stream which was dry during July and October surveys and most likely is only present after extended periods of rainfall. It was flowing during the November GCR survey. The Tubificid worms and Sphaeriid bivalves recorded are some of the only freshwater taxa capable of withstanding periods of drought and such a watercourse would not be expected to score highly.

All other stations across both GCR's received a score of Q3 indicating moderate pollution. Eutrophication from diffuse organic nutrient input is the most likely cause of pollution at all sampling stations.

The water chemistry results also indicate that the streams are experiencing excessive nutrient loading, and all watercourses sampled failed to meet surface water regulations for nitrate as N. The period of heavy rainfall preceding the sampling event may have increased run-off from agricultural land into the watercourses and may be a factor in the increased nitrates. All stations were in spate due to the increased precipitation, and the higher velocity flow and lower temperatures may have lowered BOD and suspended solids to levels acceptable for salmonid rivers. The scarcity of pollution-sensitive macroinvertebrates indicate that agricultural pollution has an ongoing and widespread effect on watercourses in the area.

In summary, none of the streams are considered to be suitable habitats for Annex II listed species due to pollution, siltation and morphological alterations. However, if either GCR Option 2 or Option 3 were used, then appropriate mitigation measures would be required to prevent an indirect adverse significant effect to the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA, which are ecologically connected through the streams and Moyasta river.

Table 5.3: Stations surveyed for Grid Connection Route options.

Stations surveyed	Photographed	Water Sampled	Kick Sampled
S1	✓	✓	✓
S2	✓	✓	✓
S3	✓	✓	✓
S4	✓	✓	✓
S5	✓	Inaccessible – not sampled	Inaccessible - not sampled
S6	✓	✓	Unsuitable – not sampled
S7	✓	Historic outflow – not sampled	Historic outflow – not sampled
S8	✓	Unsuitable – not sampled	Unsuitable – not sampled
S9	✓	✓	✓
S10	✓	✓	✓
S11	✓	✓	✓
S12	✓	✓	✓
S13	✓	Unsuitable – not sampled	Unsuitable – not sampled

5.3.3 Biotic Index (Q Value) Macro-invertebrate Assessment

Water quality was assessed using the Q-Value biotic index system. The Biological River Quality Classification System (Q-Scheme) has been in use in Ireland since 1971. For the purpose of this assessment, benthic invertebrates have been divided into five indicator groups according to the tolerance of pollution, particularly organic pollution.

In order to determine the biological quality of the river, the Q-scheme index is used whereby the analyst assigns a Biotic Index value (Q-Value) based on macroinvertebrate results. The Biotic Index is a quality measurement for freshwater bodies that range from Q1 – Q5 with Q1 being of poorest quality and Q5 being pristine/unpolluted (see **Table 5.4** below).

Table 5.4: Water Quality Assessment of Grid Connection Watercourses (Q Value and WFD Ecological Status).

Site No.	Current Q Value	WFD Ecological Status	Macrophytes	Comments	Latest EPA Q Value and WFD Status
S1	Q2	BAD		Intermittent stream, not expected to have sensitive species. Simuliidae and *Potamopyrgus* were the dominant taxa present.	
S2	Q3	POOR	Abundant	Heavily vegetated, deep muddy substrate, bordering pastoral land. Chironomidae, *Potamopyrgus* and Sphaeriidae were the dominant taxa present	Q1 BAD (last surveyed 1991)

Site No.	Current Q Value	WFD Ecological Status	Macrophytes	Comments	Latest EPA Q Value and WFD Status
S3	Q3	POOR	Abundant	Slightly vegetated, siltation present, cattle access to stream. Gammaridae and *Baetis rhodani* were the dominant taxa present.	
S4	Q3	POOR		Stone/gravel substrate, flow very fast, in flood during survey. Gammaridae, *Asellus* and *Hydropsyche* were the dominant taxa present.	Q3-4 MODERATE (last surveyed 2022)
S9	Q3	POOR		Heavily modified *e.g.*, bank reprofiled, course straightened, mud substrate, flow sluggish even when stream in spate. Chironomidae was the dominant species group that was present.	
S10	Q3	POOR		Siltation present, bordering transitional woodland scrub. Chironomidae and Sphaeriidae were the dominant taxa present.	
S11	Q3	POOR	Abundant	Macrophytes abundant, culvert, bordering pastoral land. Gammaridae, *Asellus* and Chironomidae were the dominant taxa present.	Q2-3 POOR (last surveyed 2022)
S12	Q3	POOR		Cattle access, recent trampling by livestock, heavily silted, bridge. Chironomidae was the dominant species group that was present.	Q4 GOOD (last surveyed 2005)

5.4 MITIGATION MEASURES

See **EIAR Chapter 7: Aquatic Ecology– Section 7.5 Mitigation Measures**.

5.5 CONCLUSION

After rigorous surveys, sampling and analysis of the alternative GCR options (Option 2 and Option 3) are also viable but would require mitigation measures to be implemented to ensure water quality is not impacted downstream.

5.6 STATEMENT OF SIGNIFIANCE

Implementation of the control measures outlined in the EIAR will result in a robust environmental management plan which will target and mitigate likely sources and pathways

of contaminant arising along the GCRs. The Grid Connection routes are not likely to significantly impact aquatic ecology.

6 SOILS AND GEOLOGY

6.1 PROJECT DESCRIPTION

Three possible Grid Connection route options have been proposed for the Development **(Ballykett Wind Farm EIAR - Figure 8.1b**). The 1.7km 38kV connection to Tullabrack 110kV substation is the most expedient option. Alternatively, a Grid Connection can be accommodated via parallel twin underground 20kV cables to the ESB 400kV Moneypoint substation. The overall length of the Grid Connection between the substation and the existing Moneypoint 400kV substation is 9.1km under option 2 and 11.0km under option 3. Both options include a length of 230m within the Development Site, with the remainder being located in the R483, L2038, R473, Monovana Road, L6150 and N67 road network. The Grid Connection options considered can be summarised as follows:

- **UGC Option 2** - UGC twin 20kV circuit from Moneypoint to Ballykett WF utilising sections of UGC in public road, primarily regional roads, and private lands (approx. 9.1km).
- **UGC Option 3** – UGC twin 20kV circuit from Moneypoint to Ballykett WF utilising sections of UGC in public road, primarily regional roads, and private lands (approx. 11km).

Watercourse Crossings

There are multiple watercourse crossings along the alternative Grid Connection route options (Option 2 and Option 3, **Appendix 8.2(b-c)**) that have been assessed by BFA Consulting (**Ballykett Wind Farm EIAR Appendix 2.2**) and determined that no new structures will be required for crossings along these grid connection routes. The effects of watercourse crossings are further detailed in **EIAR Chapter 9: Hydrology and Hydrogeology.**

6.2 BASELINE

6.2.1 Land use

Consultation with Corine (2018) Land Use maps (EPA) indicate the landcover along the alternate GCRs is primarily classified as 'Pastures.' Option 2 also passes though 'Mixed Forest'.

6.2.2 Bedrock Geology

The mapped geological formations underlying the two alternative Grid Connection options are the same as those mapped at the Site (GSI, Bedrock 100k) which are the sandstone and siltstones of the Central Clare Group and the Gull Island Formation.

6.2.3 Soils and subsoils

Consultation with available soil maps (GSI, EPA, Teagasc, **Ballykett Wind Farm EIAR - Figure 8.4b**) indicate a number of soil types along the other grid connection option including 'Cutover/cutaway peat' (Cut), 'Blanket Peat' (BktPt), Acid Shallow Well Drained Mineral' (AminSW), 'Acid Shallow Poorly Drained Mineral' (AminSP), 'Acid Poorly Drained Mineral' (AminPD), 'Acid Poorly Drained Mineral Soils with Peaty Topsoil' (AminPDPT), 'Acid Deep well drained mineral' (AminDW), 'Mineral Alluviul' (AlluvMIN), and 'Made ground' (Made).

Consultation with available subsoil maps (EPA, **Ballykett Wind Farm EIAR - Figure 8.5b**) indicate that the subsoils along both of the alternative Grid Connection Routes ranges from 'cutover peat' (Cut), 'blanket peat' (BktPt), 'Sandstone and shale till' (TNSSs), 'Rock at or near surface' (RcK), 'Alluvium' (A), 'Made ground' (Made), and 'Shales and sandstones sands and gravels' (GNSSs).

6.2.4 Designated Sites

A section of the proposed optional Grid Connection routes – option 2, and option 3 that connects to the Moneypoint 400kV Substation, runs parallel to an area of designated Special Areas of Conservation (SAC) of the Lower River Shannon (Site Name: 002165) as well as a Special Protected Area of the River Shannon and River Fergus Estuaries (Site Name: 004077).

6.3 POTENTIAL EFFECTS

All of the potential effects associated with the alternative Grid Connection route are the same as those outlined for the Tullabrack Grid Connection route in **EIAR Chapter 8: Soils and Geology Section 8.4**.

6.4 CUMULATIVE EFFECTS

The potential effects of the alternative Grid Connection Routes in terms of soils and geology are generally localised and the land take is temporary. There are **no significant cumulative effects** anticipated from other projects during the construction phase of the Proposed Development.

6.5 MITIGATION AND RESIDUAL EFFECTS

The mitigation and residual effect associated with the alternative Grid Connection route are the same as those outlined for the Tullabrack Grid Connection route in **EIAR Chapter 8: Soils and Geology Section 8.5**.

6.6 STATEMENT OF SIGNIFICANCE

This appendix assesses both Option 2 & 3. The significant potential effects that could specifically arise from the Grid connection routes Option 2 & 3 during the construction of infrastructure elements including the excavation activities associated with cable trenches, and temporary spoil storage and potential drill arisings.

Elements of the construction and operation of the GCR that may potentially impact on the soils and geological receptors have been identified and their pathways for impacts have been assessed.

Implementation of the control measures outlined in the EIAR will result in a robust environmental management plan which will target and mitigate likely sources and pathways of contaminant arising along the GCRs. The Grid Connection routes are not likely to significantly impact land and soils.

7 HYDROLOGY & HYDROGEOLOGY

7.1 INTRODUCTION

7.1.1 Development Description

7.1.1.1 Grid Connection Route Options

Three possible Grid Connection route options have been proposed for the Development. The 1.7km 38kV connection to Tullabrack 110kV substation is the most expedient option. Alternatively, a Grid Connection can be accommodated via parallel twin underground 20kV cables to the ESB 400kV Moneypoint substation. The overall length of the Grid Connection between the substation and the existing Moneypoint 400kV substation is 9.1km under option 2 and 11.0km under option 3. Both options include a length of 230m within the Development Site, with the remainder being located in the R483, L2038, R473, Monovana Road, L6150 and N67 road network. The Grid Connection options considered can be summarised as follows:

- **UGC Option 2** - UGC twin 20kV circuit from Moneypoint to Ballykett WF utilising sections of UGC in public road, primarily regional roads, and private lands (approx. 9.1km).
- **UGC Option 3** – UGC twin 20kV circuit from Moneypoint to Ballykett WF utilising sections of UGC in public road, primarily regional roads, and private lands (approx. 11km).

7.1.1.2 Watercourse Crossings

There are multiple watercourse crossings along the alternative Grid Connection route options (Option 2 and Option 3) outlined in the table below, that have been assessed by BFA Consulting (**Appendix 2.2**) and determined that no new structures will be required for crossings along these grid connection routes. Option 2 and Option 3 would traverse a combined 14 no. existing bridge or watercourse culvert crossings. The Grid Connection route will be constructed via trenching in the public roadway, or in the verge, in its entirety. The type of crossing and the approximate centre point coordinates for each of crossing along the Grid Connection route is outlined in **Table 7.1.** Cabling will be installed without the requirement of Horizontal Directional Drilling (HDD) and there will be no direct impact on watercourses. The watercourse crossings identified along Options #2 and #3 **(Ballykett Wind Farm EIAR - Figure 9.3b),** are as follows:

Table 7.1 Watercourse crossings on GCR Option 2 and Option 3.

ID	Grid Coordinated (ITM)	Category	Related GCR
WCC1	500833.86,658772.16	Culvert	Option 2 and Option 3
WCC2	500411.93,658003.79	Bridge	Option 2 and Option 3
WCC3	501154.28,656874.68	Culvert	Option 2 and Option 3
WCC4	501251.83,655430.63	Bridge	Option 2
WCC5	501970.86,654912.31	Culvert	Option 2
WCC6	502429.46,653927.16	Culvert	Option 2
WCC7	502515.66,653285.69	Culvert	Option 2
WCC8	502021.02,655985.51	Bridge	Option 3
WCC9	502997.96,655595.06	Culvert	Option 3
WCC10	502973.80,655045.75	Culvert	Option 3
WCC11	502850.72,654725.86	Culvert	Option 3
WCC12	503527.97,653436.02	Culvert	Option 3
WCC13	503169.86,653058.64	Box Culvert	Option 3
WCC14 (S13)	502591.6, 652145.05	Culvert	Option 2 and Option 3

The potential effects of any new watercourse crossings or upgrades of existing watercourse crossings are detailed in **Section** Error! Reference source not found. and **EIAR Chapter 9: Hydrology and Hydrogeology.**

7.1.2 Objective Led Approach

In the previous section there are two items in particular which will be linked strongly by objectives. For instance, qualifying the importance and sensitivity of an environmental attribute or receptor will align with relevant legal instruments. For example, to qualify surface water features, the EIAR will align with the objectives of the Water Framework Directive (WFD). This approach equates to qualifying all surface water features as very important and sensitive receptors and that any adverse impact will be viewed as potentially jeopardising the objectives of the WFD.

Similarly, when assessing the Site and prescribing mitigation measures, the EIAR will set out to achieve mitigation and residual impact in line with the same objectives. For example, mitigation will set out to minimise any potential for contaminants to reach sensitive receptors identified, will monitor the efficacy of mitigation measures applied, and where failing to achieve the objectives set, emergency response and mitigation measures are escalated until such time as the site stabilises and objectives of mitigation are being achieved once more.

7.2 BASELINE

7.2.1 Land use

Consultation with Corine (2018) Land Use maps (EPA) indicate the landcover along the alternate GCRs is primarily classified as 'Pastures'. Option 2 also passes though 'Mixed Forest'.

7.2.2 Regional and Local Hydrology

The longer Grid Connection options (Option #2 and Option #3) to the Moneypoint 400kV substation are located within two WFD sub-catchments and four WFD River Subbasins. These are detailed as follows:

- Sub Catchment: Wood_SC_010, River Sub Basins: Moyasta_10, Wood_20, Wood_10
- Sub Catchment: Cloon [Clare]_SC_010, River Sub Basin: Tonavoher_010

The southern portion of the Development works involving the Grid Connection routes to the Moneypoint 400kV substation is primarily hydraulically characterised by the Wood River, which discharges in to the Kilrush Marina and flows into the Mouth of the Shannon Estuary as well as the Tonavoher River that flows into Ballymacrinan Bay and the Lower Shannon Estuary transitional waterbody, **Ballykett Wind Farm EIAR - Figure 9.2b**. Watercourse crossing identified along the Grid Connection route options as part of the desk study analysis are presented in **Table 7.1.**

7.2.3 Surface Water Hydrochemistry

The Environmental Protection Agency (EPA) conducts an ongoing monitoring programme as part of Ireland's requirements under the WFD. The monitoring programme includes an assessment of biotic indices (biological quality ratings ranging from 1-5) known as Q-Values.

Table 7.2: EPA Monitoring Points and Latest Available Q-Values

Station ID	RS27W010100
Station Name	Bridge 1.5km u/s Kilrush
WFD Waterbody Code	IEMRRS27W010100
Type	River
Latest Monitoring Year	2019
Latest Status	Good
Latest Q-Value	4
Distance from the Proposed EIAR Boundary	0 metres (along GCR option)
Easting	101295
Northing	155391
Local Authority	Clare County Council

Assessment for the Wood River, which drains the river subbasin where works will take place for Option 2 and Option 3 Grid Connection routes, **Ballykett Wind Farm EIAR - Figure 9.4b**, has been continually monitored since 1971. The most recent assessment of the Wood River by the EPA was carried out on 2nd July 2019 which indicated that the river has a Q-Value of 4 "*Good*", "*Unpolluted"* water quality under the current cycle of the WFD. During the most recent assessment, it was noted that 'rubbish continues to be dumped at Station where ecological quality remained moderate'. This station is located closest to the proposed Grid Connection route works. According to the EPA's WFD database for Status 2013-2018, the Wood River currently holds a 'Poor' status, similar to the previous three assessment cycles. In consultation with the WFD Cycle 2 Sub catchment Assessment, the River Wood is 'At Risk' due to "poor biological status" where 'significant pressures from agriculture were identified'. Further downstream before entering the Kilrush Marina, the River Wood encounters additional pressures, including, urban run-off, forestry and other anthropogenic pressures along with agriculture.

7.2.4 Wells

Mapping and searches of the EPA Water Framework Directive (WFD) and GSI well databases confirms that there are a number of mapped wells located within 20km of the Grid connection used for agriculture and domestic use and they are presented in **Table 7.3**.

Table 7.3: Closest Wells, Springs, Boreholes to Grid Connection Routes

Type	Year	ID	Townland	Distance	Direction	Route
Dug well	1962	0815NEW032	Tullabrack	c.065km	East	2 & 3
Dug well	1962	0815SEW035	Breaghva	c.0.2km	Northeast	2 & 3
Borehole	1970	0815SEW047	Ballykett	c.0.00km	Through	2 & 3
Borehole	1962	0815SEW037	Ballykett	c.0.00km	Through	2 & 3
Dug well	1972	0815SEW036	Ballykett	c.0.00km	Through	2 & 3
Borehole	1973	0815SEW039	Moyadda	c.1.22km	East	2 & 3
Dug well	1969	0815SEW041	Kilcarrol	c.0.08km	South	Option 3
Dug well	1962	0815SEW007	Dysert	c.0.28km	West	Option 3
Borehole	1964	0815SEW013	Kilrush	c.0.30km	East	Option 2
Borehole	1964	0815SEW010	Kilrush	c.0.30km	East	Option 2
Borehole	1962	0815SEW025	Dysert	c.0.05km	Through	Option 2
Dug well	1962	0815SEW007	Dysert	c.0.05km	Through	Option 2
Dug well	1962	0815SEW005	Ballymacrinan	c.0.05km	Through	2 & 3
Borehole	1982	0815SEW056	Carrowdothia South	c.0.2km	vicinity	2 & 3

In addition, all Water Framework Directive (WFD) groundwater bodies have been identified as Drinking Water Protected Areas (DWPA) due to the potential for qualifying abstractions of water for human consumption as defined under Article 7 of the WFD. The DWPA designation applies to all groundwater bodies nationally, regardless of the productivity status of the underlying aquifer.

The Kilrush GWB (IE_SH_G_123) underlies the entire EIAR Site boundary and surrounding areas. The EPA notes that Locally important aquifers are capable of supplying locally important abstractions (e.g. smaller public water supplies, group schemes), or good yields (100-400m^3/d). In the bedrock aquifers, groundwater predominantly flows through fractures, fissures, joints or conduits.

Given that the existing GSI groundwater well database is an incomplete dataset, it is conservatively assumed that all dwellings located within 2km of the EIAR Site boundary have the potential to maintain a groundwater well for abstraction.

7.2.5 Hydrogeology – Bedrock Aquifer

The underlying bedrock within the EIAR Site boundary is that of Namurian Undifferentiated rock units with sandstone, siltstone and mudstone. Consultation with GSI Groundwater maps indicates that the entire Grid Connections 2 & 3 is underlain by a bedrock formation underlying the Site and is classified as a 'Locally Important Aquifer – Bedrock' which is Moderately Productive only in Local Zones, see **Ballykett Wind Farm EIAR - Figure 9.9a** and **Figure 9.9b**. There are no mapped karst features within 32km of the Development.

7.2.6 Groundwater Vulnerability & Recharge

Consultation with the GSI Groundwater Map Viewer (2023) indicates that both the Grid Connections 2 and 3 to the existing Moneypoint Power substation are underlain by aquifer vulnerability ratings ranging from 'Moderate' to 'Extreme Vulnerability' including 'X' which is described as "Rock at or near Surface or Karst" **Ballykett Wind Farm EIAR - Figure 9.10b – Groundwater Vulnerability**.

Table 7.4: Groundwater Vulnerability Ratings

Vulnerability Rating	Thickness of unsaturated zone (m)
Rock at or Near Surface (X)	0
Extreme (E)	0 to 3
High (H)	3 to 5
Moderate (M)	5 to 10
Low (L)	>10

7.2.7 Water Framework Directive Water Body Status & Objectives

The Water Framework Directive (WFD) surface water body status (2016 – 2021) and the associated objectives assigned for the surface water network both within and surrounding the Site have been reviewed with available data on the EPA Map Viewer online database (2022).

The Moyasta River, which drains the proposed Site and the Grid Connection Route has a WFD Status of "*Moderate*". The Risk status for the Moyasta River is "Under Review". Both Options 2 & Options 3 cross the river Wood_010, this river has a WFD Status of "*Poor*" and is "At Risk". It also crosses the Tonavoher_010, this river has a WFD Status of "*Moderate*" and is "Under Review".

7.2.8 Groundwater Body Status

The Kilrush (EU_Code: IE_SH_G_123) groundwater body underlying Option 2 and Option 3 and the wider region has been assigned "*Good Status*" under the Water Framework Directive (WFD) 2016-2021 cycle. This classification is based on an assessment of the chemical and quantitative status of the GWB. The Kilrush GWB has been categorised as "Under Review" for the WFD objectives of 2027, although no significant pressures have been identified.

7.2.9 Designated Sites & Habitats

The Grid Connection Route Option 2 & 3 are not positioned within or immediately upstream of any designated or protected area (SPA, SAC, NHA).

The nearest downstream designated areas include the following, approximately 8.1km to the west of the Site.

- Lower River Shannon SAC (EU Site C ode: IE0002165) for Habitats. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland.
- River Shannon and River Fergus Estuaries SPA (EU Site Code: IE0004077), is a SPA under the E.U. Birds Directive, for special conservation interest for multiple wetland & waterbird species.
- Both Option 2 and Option 3 GCRs run parallel to the Shannon Estuary alongside the SAC for a short distance close to Moneypoint

7.2.10 Water Resources

There are no mapped drinking water lakes or rivers along any Grid Connection Route Options 2 & 3. There are no National Federation of Group Water Schemes (NFGWS) or GSI Public Supply Source Protection Areas located along any Grid Connection Route Options 2 & 3.

7.2.11 Receptor Sensitivity

- Water Framework Directive (WFD) status (2013-2018) generally ranging from "*Good*" to "*Poor*", with some sections ranging to Poor. The principal objective of the WFD is to achieve good status or higher in all waters and to ensure that status does not deteriorate in any waters.
- The down-stream designations (sensitive protected areas e.g., SAC, SPA) associated with the catchment and the sensitive habitats and species associated with same.
- As outlined in Section 7.2.2 the Grid connection routes pass through Sub Catchment: Cloon [Clare]_SC_010 which is designated river for Freshwater pearl mussel species. the Grid Connection does not cross the Cloon River area designated for FPM. The Grid routes pass over the Tonavoher Stream. The Tonavoher stream is included in the Cloon River Catchment but has no hydrological connectivity to the Cloon River.
- Designated Shellfish areas exist in the Shannon Estuary catchment; downstream of the site in the Mouth of the Shannon (HAs 23;27) Code: IE_SH_060_0000
    1. West Shannon Ballylongford; Code: IE_SH_060_0000
    2. West Shannon Poulnasherry Bay; Code: IEPA2_0021
    3. West Shannon Carrigaholt; Code: IEPA2_0022
    4. West Shannon Rinevella; Code: IEPA2_0023

7.3 ASSESSMENT OF POTENTIAL EFFECTS

7.3.1 Construction Phase Potential Effects

7.3.1.1 Release of Suspended solids and increased run off

Minimal land take is associated with the Grid Connect route, considering all proposed works will traverse already existing public roadways (i.e., site access tracks to be constructed as part of the Development,) public and local road networks. However, the Grid Connection Routes (Options 2 and 3) crossing points of existing culverts are considered the most vulnerable areas to surface water quality deterioration through the release of elevated suspended solids. The potential release of elevated suspended solids to surface waters is considered to be a **direct and indirect, adverse, large** in scale **moderate to significant**, effect of the Development. This potential impact is considered to be **unavoidable** and **conforms to baseline** conditions.

7.3.1.2 Watercourse crossings

GCR Option 2 and Option 3 would traverse a combined 14 no. existing bridge or watercourse culvert crossings (**Table 7.1**). These locations have previously been surveyed and no upgrading works are required with reference to BFA Consulting Technical Note (**Appendix 2.2**). Both alternative option routes will be constructed via trenching adjacent to the public roadway, or in the verge, in its entirety. This is considered **a likely, adverse, significant, but temporary** effect of the Development which contrasts to baseline conditions.

7.3.1.3 Release of Nutrients

Release of Suspended Solids

- Excavation and construction activities, such as stockpiling material and vehicular movements of plant machinery introduce the risk of solids being entrained in runoff. Runoff contaminated with suspended solids will add turbidity to the receiving surface water body, can block fish gills and smother spawning grounds, reduce light penetration for flora growth, and promote bacteria and algae production. Nutrients that are associated with the solids (inorganic nutrients such as phosphorus and organic such as hydrocarbons, humic acid, sulphates, fugitive hydrocarbons and sewage if present) can lead to eutrophication of the water environment and eventually to fish-kills due to lowering of oxygen supply. Some ecological receptors such as Freshwater Pearl Mussels are particularly sensitive to perturbations in water quality, and in particular suspended solids.
- The degree to which inorganic solids are entrained in runoff is related to the particle sizing of the soil components. Smaller inorganic particles (e.g., clay) will be easily entrained and will remain in suspension for a longer period than larger particles (silt / sand) and will require lower flow rates and longer retention rates to settle out of the

water column when given the opportunity. Peat, comprising mostly of organic matter, will behave in a similar manner to a fine-grained soil whereby much of the material will remain in suspension for a relatively long period of time, but will also dissolve and degrade within the water body, dramatically impacting on water quality.

- Release of suspended solids can be attributed to enhanced nutrient enrichment. This is highly dependent on the type of soil, for example peat released in water will disintegrate and most of the constituents of the peat material (carbon) will eventually dissolve into the water column and / or be consumed by micro-organisms. However, peat and other soils / subsoils will contribute varying degrees of loading of various compounds and nutrients, including Nitrogen (N) and Phosphorous (P) compounds, which are attributed to Nutrient Enrichment, or excessive loading of N and P in waters leading to eutrophication and potentially profound adverse impacts on ecological attributes downstream of the Site.
    - Given the historical land use of the Site, i.e., agricultural forestry, there is likely to be trace amounts of fertiliser in the vicinity of the afforested site. Teagasc (2017) has stated routine fertiliser application is undertaken following chemical analysis of foliar (tree leaf) samples. If thresholds aren't met, fertiliser is applied manually between the months of April and August, avoiding drains and a 25m buffer zones to waterlogged and aquatic areas. Ground Rock Phosphate (GRP) is used in two forms: Granulated Rock Phosphate (c. 11% P) and Ungranulated Rock Phosphate (c. 14% P), in application process, given there are no adverse environmental impacts, e.g., deterioration in water quality status.
    - Peat soils behave differently to mineral soils, when it comes to some nutrients such as phosphorous. High organic matter soils (OM > 20%, i.e., peat) do not adsorb P in the same way that mineral soils do. Therefore, P does not bind to peat soil particles, however mineral soils associated with forestry do have the capacity to build up or increase the store of phosphorous they hold.

7.4 CUMULATIVE EFFECTS

The potential effects of the alternative Grid Connection Routes in terms of hydrology and hydrogeology are localised and the potential release of suspended solids/nutrients and watercourse crossings are **Significant** and **temporary,** However with mitigation measures outlined in Section **Error! Reference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.**. There are **no significant cumulative effects** anticipated from other projects during the construction phase of the Proposed Development.

7.5 MITIGATION MEASURES AND RESIDUAL EFFECTS

7.5.1 Construction Phase

7.5.1.1 Release of Suspended Solids and Increased Runoff Proposed Mitigation Measures – GCR

With reference to general excavation practices discussed above, excavation of cable trenches in close proximity to surface water features (Options 2 and 3 only), require special consideration in terms of managing movements, spoil arising from excavations, and entrainment of solids and contaminants in surface water runoff. Mitigation measures outlined above will ensure the effect arising from earthwork activities to the surrounding receptors are minimised to a **direct, adverse**, **neutral to slight** effect of the Project.

7.5.1.2 Watercourse Crossings Proposed Mitigation Measures

GCR Option 2 and Option 3 would traverse a combined 14 no. existing bridge or watercourse culvert crossings. However, these have previously been surveyed and no upgrading works are required with reference to BFA Consulting Technical Note (refer to **Appendix 2.2**). Trench in verge or carriageway will be employed. Mitigation measures outlined above will ensure the effect arising from the construction of any new watercourse crossing is minimised to a **direct, adverse, slight** effect of the Project.

7.5.1.3 Release of Nutrients

Inorganic nutrients such as nitrogen and phosphorus compounds (if present in excavated sediment and as discussed in **Section 7.3.1.4** with commercial forestry) will be controlled by the attenuation of the suspended solids. The controlled attenuation of suspended solids in settlement ponds and check dams etc. will result in inorganic nutrients (if present in elevated concentrations) such as phosphorus and nitrogen being absorbed and retained by the solids in the water column. This will allow for a reduction of peak inorganic discharges in a controlled and stable run off rate. It is noted that the baseline surface water chemistry indicates elevated Ammoniacal Nitrogen and Phosphate.

It is considered that there is a low risk of mobilising trace metals that may naturally be present in low concentrations in the baseline environment. The potential for mobilising trace metals is most likely to result from enhanced water percolation associated with excavated bedrock substrate. To mitigate against this potential impact, water quality should be monitored for trace metal concentrations prior to, during and after the construction phase.

Mitigation by avoidance and the implementation of physical control measures will ensure that contaminant concentrations, particularly elevated suspended solids entrained in run-off are

reduced to below the relevant legislative screening criteria. The overall impact is anticipated to be **direct, negative, imperceptible**, and **temporary**.

7.5.2 Development Decommissioning and Restoration Phase/s

7.5.2.1 Decommissioning of Infrastructure

In regard to cable ducting, for the Grid Connection routes, cable joint bays will be left in-situ and cabling will be left in situ as they will be an ESBN asset.

This is considered a **direct, neutral** effect of the Development, which contrasts to the baseline conditions.

7.6 STATEMENT OF SIGNIFICANCE

This Appendix comprehensively assesses both Option 2 & 3. The significant potential effects that could specifically arise from the Grid connection routes Option 2 & 3 during the construction of infrastructure elements including the excavation activities associated with cable trenches, and works in close proximity to surface water or drainage network including watercourse crossings and culverts. Decommissioning and restoration phase effects and mitigation are similar to the construction phase and have been encompassed as such.

Elements of the construction and operation of the GCR that may potentially impact on the hydrogeological and water environment receptors have been identified and their pathways for impacts have been assessed.

Implementation of the control measures outlined in the EIAR will result in a robust environmental management plan which will target and mitigate likely sources and pathways of contaminant arising along the GCRs. The Grid Connection routes are not likely to significantly impact groundwater quantities, quality or availability.

Table 7.6: Summary of Potential Effects on Receiving Environment from the Proposed Development in the Absence of and with Mitigation Measures.

		Qualifying Criteria Pre-Mitigation									Qualifying Criteria With Mitigation	
Effect / Impact Description	**Phase**	**Type**	**Quality**	**Scale**	**Significance**	**Extent**	**Context**	**Probability**	**Duration / Frequency**	**Mitigation Applied**	**Quality**	**Significance**
Increased Runoff	Construction	Direct and Indirect *	Adverse	Large	Moderate to Significant	Development Footprint, Localised	Conforms to baseline e.g. forestry operations)	Unavoidable	Temporary	Yes; **Section 9.4.1.1**	Adverse	Neutral to Slight
Release of Suspended Solids	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to baseline e.g. forestry operations)	Unavoidable	Temporary	Yes; **Section 9.4.1.1**	Adverse	Neutral to Slight
Watercourse Crossings - Mapped Rivers	Construction	Direct and Indirect *	Adverse	Small to Moderate	Moderate to Profound	Localised (Potentially Regional)	Conforms to Baseline e.g. existing bridges and roads in area.	Unavoidable	Permanent	Yes; **Section 9.4.1.2**	Adverse	Slight
Release of Horizontal Directional Drilling Materials	Construction	Direct	Adverse	Small	Slight	Localised (Potentially Regional)	Contrast to Baseline	Likely	Long Term to Permanent	Yes; Section 9.4.1.3	Adverse	Neutral to Slight

8 NOISE

8.1 ASSESSMENT OF POTENTIAL EFFECTS

It is not possible to specify the precise noise levels of emissions from the construction plant and equipment until such time as a contractor is chosen and construction plant has been selected. However, **Table 8.1** indicates typical construction related noise levels for this type of Development activity. Predictions are made for the nearest receptor to the Development and receptors at varying distances from the Grid Connection.

Table 8.1: Typical Noise Levels from Construction Works

Activity	L_{Aeq} at 10m
Grid Connection: Trenching Tracked excavator 14t, pneumatic breaker, vibratory roller 71t, tractor	70-74dBA
Horizontal directional drilling: Drill Rig (diesel), mud pump, diesel generator /tractor	69-71dBA*

*Recent measurements (2022) taken by author of HDD

The difference in noise levels between two locations can be calculated as:

$$\mathbf{L}_{p2} - \mathbf{L}_{p1} = 10 \log (R_2 / R_1)^2 - (A_{atm} + A_{gr} + A_{br} + A_{mis})$$

$$= 20 \log (R_2 / R_1) - (A_{atm} + A_{gr} + A_{br} + A_{mis})$$

where:

L_{p1} = sound pressure level at location 1

L_{p2} = sound pressure level at location 2

R_1 = distance from source to location 1

R_2 = distance from source to location 2

and where:

A_{atm} = Attenuation due to air absorption

A_{gr} = Attenuation due to ground absorption

A_{br} = Attenuation provided by a barrier

A_{mis} = Attenuation provided by miscellaneous other effects

In the calculations attenuation by A_{atm}, A_{gr} and A_{mis} is taken as 3dBA where distances are more than 200m from a source and as zero within 200m -amelioration by barriers is not accounted for.

Table 8.2 gives the noise levels predicted from construction activity at varying distances. The main noise sources are assumed to be the construction of the Turbine Foundations, Turbine Hardstands, Grid Connection. The construction of the site access tracks, the new Electrical Substation, however the noise levels associated with this activity will be lower and of shorter duration than other works. The main road traffic noise will be associated with the delivery of ready-mix concrete for Turbine Foundations.

Road traffic is dealt with under a sub-heading within this section.

The maximum construction noise levels associated with the Development and Grid Connection are listed in **Table 8.2.** At receptor locations further away, noise levels will be less than that predicted. Works associated with Decommissioning will be no more than the levels predicted in **Table 8.2**.

Table 8.2: Predicted Construction Noise Levels

Receptor	Activity taken as 100% per hour	Distance of Activity (m)	LAeq dB 1hr range
Grid Connection: Trenching Receptors at varying distances	Tracked excavator 14t, pneumatic breaker, vibratory roller 71t, tractor	20 40 80	64-68 58-62 52-56

Cable laying and trenching will move along the grid route from the Electrical Substation to the national grid at Moneypoint 400KV which means maximum levels will pertain no more than one day equivalent (8 hours) at any single receptor. The Grid Connection extends up to 9.1km or 11km for the Moneypoint Option (depending on which route is chosen). The construction of the grid connections Option 2 or 3 are planned to be completed in approximately 17weeks for Option 2 and 20 weeks for Option 3. This work will generate a maximum of 12 HGV trips and 5 LGV on a daily basis for the duration of the UGC works. In terms of trenching and trucking the noise generated by this temporary activity is insignificant.

Construction noise levels are based on continuous operation. In practice, most plant will operate at a maximum level for short intervals. If required, an acoustic barrier can be provided which can be placed close to the source giving maximum attenuation (refer to BS 5228 for guidance on screening / barrier effects). When a noise source is completely obscured from a receptor by an acoustic barrier a minimum 10dBA reduction is obtained.

8.1.1 Assessment of Construction Noise

The highest predicted noise levels are from the Grid Connection and delivery of concrete for Turbine Foundations. These maximum noise levels are expected to persist for no more than 3 days at any receptor. All predicted noise levels are well within NRA guidelines given as acceptable and are considered slight. Construction noise is a temporary activity.

All other identified activities will have lower noise levels.

Ground vibration from rock breaking will be below the threshold of sensitivity to humans of 0.2mm/s peak particle velocity at all receptors[4]. The effects of noise and vibration from onsite construction activities are therefore considered not significant.

8.1.2 Description of Effects

The criteria for description of effects for all construction noise activity and the potential worst-case effects, at the nearest receptors is given below.

Quality	Significance	Duration
Negative	Not Significant	Temporary

8.2 MITIGATION MEASURES AND RESIDUAL EFFECTS

See **EIAR Chapter 10: Noise – Section 10.5 Mitigation Measures and Residual Effect.**

8.3 CUMULATIVE EFFECTS

The are no potential cumulative effects of the alternative Grid Connection Routes in terms of noise.

8.4 STATEMENT OF SIGNIFICANCE

The noise levels predicted at the nearest receptors are orders of magnitude below the level at which risk of hearing damage, or indeed negative health effects are possible.

Noise during construction and Decommissioning of the Development will be managed to comply with current best practice, legislation and guidelines so that effects are not significant.

[4] Wiss, J. F., and Parmelee, R. A. (1974) Human Perception of Transient Vibrations, "*Journal of Structural Division*", ASCE, Vol 100, No. S74, PP. 773-787

9 LANDSCAPE & VISUAL AMENITY

9.1 BASELINE

The Wind Energy Development Guidelines (2006) provide guidance on wind farm siting and design criteria for a number of different landscape types. The site of the proposed Development is considered to be located within a relatively complex landscape setting that is more consistent with the 'Hilly and Flat Farmland' landscape type than other landscape types from the Wind Energy Development Guidelines.

9.2 ASSESSMENT OF POTENTIAL EFFECTS

The works associated with the connection of the electrical substation to the national electricity grid will be with a Grid Connection to Moneypoint 400kV ESBN substation, laid within roads and road verges, rather than across greenfield land. The physical impact of this will equate to a modest, relatively narrow trench that will then be fully infilled to pre-existing surface levels.

As the construction stage of the Development is estimated to take approximately 15 months, construction-stage impacts are considered short-term, by the EPA Guidance terms (i.e., effects lasting from one to seven years).

In respect of the Wind Energy Guidelines (2006), the grid layout of the proposed Development is in keeping with that recommended for "Hilly and Flat Farmland" landscape type.

In summary, the magnitude of construction-stage effects on the physical landscape of the Site are deemed to be High-medium, with a Negative quality of effect and short-term in duration.

9.3 CUMULATIVE EFFECTS

9.4 MITIGATION MEASURES & RESIDUAL EFFECT

Outside of those landscape and visual mitigation measures that formed part of the iterative design process of this Development over a number of years, and which are embedded in the assessed Project, other specific landscape and visual mitigation measures are not considered necessary / likely to be effective.

9.5 STATEMENT OF SIGNIFICANCE

Based on the landscape, visual and cumulative assessment contained herein, it is considered that there will not be any significant effects arising from the proposed Development.

10 AIR AND CLIMATE

10.1 BASELINE

10.1.1 Existing Air Quality Conditions

Generally, Ireland is recognised as having some of the best air quality in Europe. However, from time to time, and under certain weather conditions, it is possible to experience some air pollution in the larger towns and cities. The most recent published report on air quality in Ireland is the '*Air Quality in Ireland 2021*' report published by the EPA in 2022[5]. This report provides an overview of the ambient air quality in Ireland in 2021. The measured concentrations are compared with both EU legislative standards and WHO air quality guidelines[6] for a range of air pollutants. The closest monitoring site (National Network) to the Development within the same air quality zone is Askeaton, Co. Limerick. Askeaton monitoring site is located approx. 32km southeast of the Site. Results from the monitoring campaign during 2021 show:

- No levels above the EU limit value (in **EIAR Table 12.1**) were recorded at any of the ambient air quality network monitoring sites in Ireland in 2021.
- WHO guideline values were exceeded at a number of monitoring sites for fine particulate matter ($PM_{2.5}$) and (PM_{10}), ozone (O_3), NO_2. WHO guideline values for Sulphur dioxide (SO_2) were exceeded at one monitoring station. PAHs exceeded the European Environment Agency reference level at 3 monitoring sites.
- Askeaton exceeded WHO 24-hour mean guideline (15µg/m^3 24-hour mean) for ($PM_{2.5}$) on 8 occasions in 2021 and exceeded the annual mean (5µg/m^3) guideline with a mean of (5.7µg/m^3) for 2021. Askeaton did not exceed any WHO guidelines for any other parameter in 2021.
- The annual mean PM_{10} and $PM_{2.5}$ levels for Askeaton were (8.7 µg/m^3) and (5.7 µg/m^3) respectively. These values are below the limit values set out by Directive 2008/50/EC as per EIAR **Table 12.1**.

10.2 ASSESSMENT OF POTENTIAL EFFECTS

Dust Emissions

[5] https://www.epa.ie/publications/monitoring--assessment/air/EPA-Air_Quality_in-Ireland-Report_2021_-interactive-pdf.pdf [Accessed 27/09/2022]
[6] https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health [Accessed 22/02/2022]

The main potential source of effects on air quality during construction is dust. There is potential for the generation of dust from excavations and from construction including construction of the trench for the cable ducting for the Grid Connection.

The potential nuisance issues arising from this are dependent on the terrain, weather conditions, (i.e., dry and windy conditions), and the proximity of receptors. Potentially dust generating activities are as follows:

- Earth moving and excavation plant and equipment for handling and storage of soils and subsoils.
- Vehicle movements over dry surfaces such as Site access tracks and public roads.

The potential effect from dust becoming friable and a nuisance to workers and local road users, if unmitigated, is considered, a slight, negative, short-term, direct effect during the construction phase.

If unmitigated, there would also be dust deposition arising from mud on public roads, resulting from traffic leaving the construction Site. Impacts from dust deposition at sensitive receptors would give rise to nuisance issues for residents of those properties. The effect would be short-term, temporary and slight negative impact on sensitive receptors.

Exhaust Emissions

Emissions from plant and machinery, including trucks, during the construction of the Development are a potential effect. The engines of these machines produce emissions such as carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), and particulate matter (PM_{10} and $PM_{2.5}$).

Particulate matter ("PM") less than ten micrometres in size (PM_{10}) can penetrate deep into the respiratory system increasing the risk of respiratory and cardiovascular disorders. PM_{10} arises from direct emissions of primary particulate such as black smoke and formation of secondary particulate matter in the atmosphere by reactions of gases such as sulphur dioxide (SO_2) and ammonia (NH_3). The main sources of primary PM_{10} are incomplete burning of fossil fuels such as coal, oil and peat and emissions from road traffic, in particular diesel engines. Other sources of particulates include re-suspended dust from roads. Natural particulate matter includes sea-salt and organic materials such as pollens.

Nitrogen oxides (NO_x), include the two pollutants, nitric oxide (NO) and nitrogen dioxide (NO_2). Anthropogenic (human) activities such as power-generation plants and motor vehicles

are the principal sources of nitrogen oxides through high temperature combustion. Nitrogen oxides are an important air pollutant by themselves but can also react in the atmosphere to contribute to the formation of tropospheric ozone (ozone in the air we breathe) and acid rain. Short-term exposure to nitrogen dioxide is associated with reduced lung function and airway responsiveness, and increased reactivity to natural allergens. Long-term exposure is associated with increased risk of respiratory infection in children.

The construction phase is likely to result in an increase in exhaust emission from construction vehicles and transport vehicles associated with the site works. The impact on air quality from an increase in exhaust emissions will be a short-term, slight negative effect.

10.3 CUMULATIVE EFFECTS

Potential cumulative effects on the climate between the Project and other developments in the vicinity were also considered as part of this assessment. The other developments considered as part of the cumulative effects assessment are described in **Ballykett Wind Farm EIAR** - **Appendix 1.2**. and in **Ballykett Wind Farm EIAR** - **Chapter 2**, **Table 2.2 in Section 2.3.3**.

During the construction phase of the Project and other consented developments within 20 kilometres that are yet to be constructed, there will be minor exhaust emissions from construction plant and machinery and dust emissions from construction activities. In a worst-case scenario if any of these developments were constructed at the same time as the Project in Ballykett, there would be short-term slight negative cumulative impact on climate due to exhaust and dust emissions.

10.4 MITIGATION MEASURES & RESIDUAL EFFECT

See **EIAR Chapter 12: Air and Climate – Section 12.2.8** and **12.3.7**.

10.5 STATEMENT OF SIGNIFICANCE

The Development has been assessed as having no significant direct or indirect effects on air quality or the climate during the construction, operation or Decommissioning phases of the Development.

11 CULTURAL HERITAGE

11.1 BASELINE

The 100m wide corridors centred on the two Grid Connection route options to Moneypoint 400kV Substation (Options 2 and 3) contains five recorded archaeological sites but three of these have been listed as 'redundant records' by the Archaeological Survey of Ireland. The other two archaeological sites within the 100m wide corridor are an extant ringfort (CL057-026----) located within a pasture field adjacent to the western side of a section of the public road that both route options follow and a levelled earthwork (CL067-016----) in a field on the north side of the roadway which Option 3 follows. Details and mapping for each of the identified constraints within the environs of the Grid Connection routes, including available published inventory entries, are presented below.

A review of the first edition 6-inch OS map of 1842 revealed that the existing road network which form the Grid Connection route options were present at that time apart from a c.600m long section in Ballykett townland which is depicted on the 25-inch map of 1898, indicating that this section was constructed as a localised road realignment in the second half of the 19th century. These cartographic sources show a dispersed settlement pattern along the roadsides which appear to comprise small farm buildings. There are road crossings over two watercourses depicted on the OS maps and no bridges at either location have been listed as Protected Structures or included in the National Inventory of Architectural Heritage. The proposed Grid Connection methodology at these two locations will comprise cable ducts laid within the road carriageway and will not require works within the watercourses or any interventions to bridge structures.

The National Monument Service's Historic Environment Viewer inventory entries for the three redundant records within the 100m wide corridor note that they are not scheduled for inclusion in the next edition of the Record of Monuments and Places. Two of these entries relate to quern stones (CL067-074---- and CL067-075----) that have incorporated into modern structures within private residences and these objects are not listed in the Sites and Monuments and Places or in the Record of Monuments of Places. The other entry relates to a modern golf course feature that does not comprise an archaeological site (CL057-061----).

While there is no published inventory description for the ringfort (CL057-026----) and earthwork (CL067-016----) within the 100m corridor centred on these grid route options, and their depiction on historical OS maps as well as reviews of aerial/satellite imagery were carried out as part of the desktop study. The location of the ringfort was also inspected from

the roadside during field surveys carried out as part of the assessment (see **Section 14.2.14**). The detail on the 6-inch OS map (1842) shows that the section of road that forms the grid route was not present at this time while the ringfort is depicted as a circular enclosure. The detail on the 25-inch OS map (1898) shows that the section of road forming the grid route was constructed along the eastern side of the ringfort during the second half of the 19th century. The depiction of the ringfort enclosure on this map indicates that the construction of this section of road resulted in the truncation of the outer edge of its eastern enclosing element. A review of Ordnance Survey of Ireland and Google aerial/satellite imagery showed that the ringfort remains extant as an overgrown enclosure along the eastern side of a pasture field that is located adjacent to the roadside. An inspection of its location revealed that the construction of the road in the late 19th century truncated the eastern side of the ringfort enclosure to a likely depth of 3m below its existing level in the adjacent field.

The levelled earthwork (CL067-016----) in Thomastown townland is located within a field on the north side of the road that forms part of Option 3. A review of historic OS maps revealed that the earthwork was depicted as a circular enclosure, measuring c.28m in diameter, on all editions and is shown contained within the south end of the field. The OS maps also show the existing roadway to the south of its location, and the mapping detail indicates that its construction avoided the depicted extent of the earthwork. There is no surviving surface trace of the earthwork within the field, and it appears to have been levelled during the 20th century.

Table 11.1: Archaeological sites within 100m corridor centred on Options 2 and 3

Designation	Name/Class	Townland	Inventory Description Extracts	Observations
CL057-026----	Ringfort	BALLYKETT	None published	A review of modern OSI aerial images revealed that this site comprises an extant, overgrown ringfort measuring c.35m in diameter located adjacent to the west side of the public road forming part of the grid connection route. The 1842 OS map does not show this section of the road while it is depicted on the 1898 OS map indicating that it was part of a c.600m long realignment constructed in this area during the second half of the 19th century. The cartographic detail on the 1898 OS map indicates that the construction of this short section of new road appears to have slightly truncated the outer section of the east side of the ringfort enclosure.
CL057-061----	Redundant Record	PARKNAMONEY	Listed as 'Potential site – aerial photo' in the SMR (1992) and the RMP (1996). Although not indicated on any OS map a small oval feature (c. 15m E-W; c. 10 N-S) was visible on an aerial photograph (OS 4/2674). On inspection in 2002 this was found to be a golf green. Several other identical features are visible in the same field on the OS ortho photography (2005), accessed 11 March 2015.	Modern golf course feature
CL067-074----	Redundant Record	CLOONEYLISSAUN	Not listed in the SMR (1992) or in the RMP (1996). This record was created for 5 quern stones noted in the newly built boundary wall of a house. These are archaeological objects.	The quern stones are located within a boundary wall adjacent to the west side of the roadside that does not extend into the road corridor
CL067-075----	Redundant Record	DYSERT	Not listed in the SMR (1992) or in the RMP (1996). This record was created for 2 quern stones noted in the boundary wall of a house. These are archaeological objects.	The quern stones are located within a boundary wall adjacent to the west side of the roadside that does not extend into the road corridor
CL067-016----	Earthwork	Thomastown	None published	A review of historic OS maps revealed that the earthwork comprised a circular enclosure (c.28m diameter) and is shown contained within the south end of a field to the north of the road that Option 3 follows. The OS maps also show the existing roadway and the mapping detail indicates that its construction avoided the earthwork. There is no surviving surface trace of the earthwork within the field, and it appears to have been levelled during the 20th century.

Archaeological sites within environs of Moneypoint grid connection route options

11.2 IMPACT ASSESSMENT

There are five recorded archaeological sites within a 100m wide corridor centred on the Grid Connection route options to Moneypoint 400kV Substation and three of these have been designated as redundant records by the Archaeological Survey of Ireland. Two of these redundant records relate to quern stones within boundary walls of modern dwellings adjacent to the road while the other is a modern golf course feature. The excavation of the cable trench within the roadway will have no predicted effects on these redundant records. The only known archaeological sites within the corridor comprise an extant ringfort (CL057-056----) which is located adjacent to a section of the road that both route options follow and a levelled earthwork (CL067-016----) in a field to the north of the roadway forming Option 3. The construction of the existing road adjacent to ringfort CL057-056----during the late 19th century was within a cut area that likely truncated ground levels down into natural subsoils. There is no visible surface trace of earthwork CL067-016---- within the field to the north of Option 3

and it appears to have been levelled in the 20th century. There is one undesignated historic masonry bridge located within the public road network that Option 3 follows. The proposed Grid Connection methodology at its location will comprise the cable duct being laid within the road carriageway and this will not require works within the watercourse or interventions to the bridge structure. In addition, the Grid Connection works will not require any works within any other watercourses and will not have the potential to effect any potential underwater archaeological remains. The construction of Options 2 and 3 will, therefore, not result in any predicted direct effects on any known cultural heritage constraints.

11.3 STATEMENT OF SIGNIFICANCE

The Development has been assessed as having no significant direct effects on any known cultural heritage constraints during the construction, operation or Decommissioning phases of the Development.

12 MATERIAL ASSETS INCL. ROADS

Grid Options to Moneypoint:

- **Option 2:** The on-site substation will connect via 2 no. 20kV underground cables to the existing Moneypoint 400kV substation. The approximate length of this grid connection route is 9.1km. The connection method for this option would be an MV connection to Moneypoint via a new 110/MV transformer. The new transformer can likely be connected within the existing Moneypoint facility.
- **Option 3:** The on-site substation will connect via 2 no. 20kV underground cables to the existing Moneypoint 400kV substation. The approximate length of this grid connection route is 11km. The connection method for this option would be an MV connection to Moneypoint via a new 110/MV transformer. The new transformer can likely be connected within the existing Moneypoint facility.

Each proposed Grid Connection option will be located entirely along public roads/verges. and constructed and installed according to the requirements and specifications of EirGrid and ESB Networks.

Mullan Grid undertook a grid study in November 2022. This found that the most likely connection method for the proposed Ballykett wind farm appears to be an underground cable connection to the Tullabrack 110kV.. The report also identified that an alternative connection point could be a MV connection to Moneypoint 400kV substation.. EirGrid confirmed in a customer clinic that there is a spare 110kV bay in Moneypoint for the connection of new generation.

12.1 ASSESSMENT OF POTENTIAL EFFECTS

12.1.1 Landuse – Agriculture

The construction of the Grid Connection Route Options 2 & 3 will require relatively localised excavation and enabling works within the curtilage of the public road network, with no excavation or enabling works envisaged in private lands. Full reinstatement will occur where such excavation or enabling works are undertaken.

12.1.2 Landuse – Forestry

The construction of the Grid Connection Route Options 2 & 3 will require relatively localised excavation and enabling works within the curtilage of the public road network. There is no loss of forestry associated with the grid route works.

12.1.3 Telecommunications

The construction of the Grid Connection Route Options 2 & 3 will require relatively localised excavation and enabling works within the curtilage of the public road network. There will be no impact to telecommunication links.

12.1.4 Electricity Networks

This section describes the transmission network and the anticipated connection option. It is not proposed to utilise any elements of the distribution network.

The nationwide electricity transmission system allows for the transport of large volumes of electricity from generation stations, including wind farms, to bulk supply points near the main population centres where it interconnects with the distribution system.

Grid Connection Options 2 & 3 will be located entirely along public roads/verges. and constructed and installed according to the requirements and specifications of EirGrid and ESB Networks.

Due to the fact that all on-site internal cabling will be underground as will the Grid Connection from the onsite substation to the Moneypoint 400kV substation, there will be no impact on the existing overhead electricity network.

The Development will contribute directly and in the long term to the electricity network by strengthening it through additional renewable energy generation.

If connected to the Moneypoint 400kV substation (Option 2 and 3), the underground cable is likely to connect via a new transformer within the confines of the Moneypoint facility and thus will have a slight, positive short-term effect in terms of upgrading of critical infrastructure.

12.1.5 Air Navigation

The construction of the Grid Connection Route Options 2 & 3 will require relatively localised excavation and enabling works within the curtilage of the public road network. There will be no impact to air navigation from Grid Route Options 2 and 3.

12.1.6 Quarries

The crushed stone for construction of the grid route Options will come from licenced quarries in the locality such as:

- Derrynalecka Quarry, Derrynalecka

- Glenmore Quarry, Glenmore
- Hehir Quarry, Bollyneaska
- Letterkelly Quarry, Letterkelly
- Liscormick Quarry, Liscormick
- Nagle Stone Quarry, Liscannor
- Luogh and Lisacannor Stone Company Ltd. Luogh Quarry, Doolin
- Ryans Quarry (Roadstone Ltd), Ennis
- Bunratty Quarry (Roadstone Ltd), Bunratty
- Bobby O'Connell and Sons Ltd Ballycar Quarry, Ardnacrusha
- Esker Readymix, Athenry

The use of imported material will have a slight, permanent negative effect on non-renewable resources of the area as a result of denudation of existing natural resource reserves for other economic activities. This effect is considered to be imperceptible in the long-term.

12.1.7 Utilities

Gas Networks Ireland have responded to a consultation request illustrating there are no existing services along the grid route options.

BFA Consulting survey of the Grid Connection Route, reviewed the locations of existing services and separation distances were identified see **Ballykett Wind Farm – Appendix 2.2.**

12.1.8 Waste

Excavated Materials

An estimated 11,100m^3 and 9,100m^{3}of material will be excavated along the Grid Connection Route Option 2 and 3 respectively and will be transported by an authorised waste permit holder to a local licensed waste disposal facility.

The effects of this are not likely to be significant however there will be a slight to moderate effect in terms of waste material volume generated and the need to send this material for suitable disposal at a waste reception facility licenced for disposal of hazardous bituminous materials.

12.2 CUMULATIVE EFFECTS

12.2.1 Landuse – Agriculture

Due to the localised nature of the proposed construction/decommissioning works, there is no potential for significant cumulative effects in-combination with other local developments on the agricultural land use as all effects are directly within the grid route options (public roads).

There will be no cumulative impacts relating to the proposed grid route options and surrounding projects in relation to Landuse -Agriculture during the construction, operation or decommissioning phase.

12.2.2 Landuse – Forestry

Due to the localised nature of the proposed construction works which will be kept within the proposed grid route options (public roads) there is no potential for significant cumulative effects in-combination with other local developments on commercial forestry.

There will be no cumulative impacts relating to the proposed grid route options and surrounding projects in relation to Landuse-Forestry during the construction, operation or decommissioning phase.

12.2.3 Telecommunications

There will be no cumulative impacts relating to the proposed grid route options and surrounding projects in relation to telecommunications during the construction, operation or decommissioning phase.

12.2.4 Electricity Networks

There will be no cumulative impacts relating to the proposed grid route options and surrounding projects in relation to existing electricity transmission networks during the construction, operation or decommissioning phase.

12.2.5 Air Navigation

There will be no cumulative impacts relating to the proposed grid route options and surrounding projects in relation to air navigation during the construction, operation or decommissioning phase.

12.2.6 Quarries

The very nature of a quarry is that it will be subjected to cumulative effects as it is the source of stone for almost all developments in the area.

Therefore, there will be cumulative impacts relating to the Development and surrounding projects in relation to quarries during the construction phase. This will primarily be in the form of depletion of existing natural resource reserves in the locality.

Potential negative cumulative effects on quarries are none / imperceptible during the operational and Decommissioning phases.

12.2.7 Waste

There will be no cumulative impacts relating to the proposed grid route options and surrounding projects in relation to waste during the construction, operation or decommissioning phase.

12.3 MITIGATION MEASURES & RESIDUAL EFFECT

See **EIAR Chapter 15 Material Assets** – Section 15.9.4 and 15.10.6.

12.4 STATEMENT OF SIGNIFICANCE

The Development has been assessed as having no significant direct effects on any known material assets during the construction, operation or Decommissioning phases of the Development.

13 TRAFFIC AND TRANSPORT

13.1 BASELINE DESCRIPTION

13.1.1 Sensitive Receptors

The construction of the underground gird connection(UGC) route Options 2 and 3 will require works to be carried out on the public road network which may impact on sensitive receptors listed in **Table 13.2.** The works on the public road network and their potential impact on sensitive receptors are listed in **Table 13.1.** Daily volumes of HGV and LGV traffic generated by the construction of grid route Options 2 and 3 are outlined in **Table 13.3**. The construction of the UGC will generate a maximum of 12 HGV trips and 5 LGV on a daily basis for the duration of the UGC works. Traffic volumes associated UGC works will be distributed throughout the day corresponding with the removal of excavated material from trenches during the morning period, deliveries of materials throughout the day and trench reinstatement during the afternoon.

Table 13.1: Works Location and Potential Impact on Sensitive Receptors

Construction Activity	Potential impact on Sensitive Receptors	Impact of works on Sensitive Receptors and Public Road Users
Construction of alternative 20kV Grid Connection between Site and Moneypoint 400kV Substation.	Medium Impact / Medium Term	Increased journey times due to traffic management and traffic diversions over a 24 week period during which traffic management measures will be in place. Local access to be maintained for local residents and farmers in area. Increased Noise and vibration due to construction works involving saw cutting, excavation, trench reinstatement and surfacing.

Table 13.2: Sensitive Receptors

Receptor	Sensitivity	Reason for Inclusion
Hospitals, Medical Centres	High	Medical centres are likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs and construction activities. Access will be required at all times for general and emergency access
Private dwellings located along the Turbine Delivery Route the construction haul route and Grid Connection route.	High	There are numerous residential properties which front directly on to the Grid Connection route options Residents of these properties are likely to require unrestricted access to the roads in order to access their place of employment and/or local services. These properties are also likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs etc.
Care Homes	High	Care Homes are likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs and construction activities.

Receptor	Sensitivity	Reason for Inclusion
		Access will be required at all times for general and emergency access
Schools	High	Schools are likely to be highly sensitive to changes in traffic density, noise and vibration from HGVs and construction activities during school hours. Access will be required at all times
Churches	Moderate	Churches are likely to be sensitive to noise and vibration from HGVs and construction activities during church services. Access will be required at all times.
Hotels and B&B's	Moderate	Hotels and B&Bs are likely to be sensitive to noise and vibration from HGVs and construction activities. Access will be required at all times.
Businesses and Shops	Moderate	Businesses and Shops are likely to be sensitive to noise and vibration from HGVs and disruption from construction activities during business hours. Access will be required at all times.
Farms	Low	Farm operations may be sensitive to noise and disruption from construction activities
Public Amenities	Low	Entrance to public amenities may be sensitive to disruption from construction activities

It is estimated that during the construction of grid route Option 2 or Option 3, approximately 1090 loads or 1320 loads of material (concrete, stone, tarmac, cables, spoil) will be delivered and removed from the Site respectively. The movements and timelines associated with the grid connection works are outlined in **Table 13.3.**

Table 13.3: Grid Connection Traffic Volumes - HGV Trips

Materials	Quantity	No. Of Deliveries	Timeframe (Week)	Maximum Loads / Day	Vehicle Type
Grid Connection works Option 2	9.1km	1090	12-29	12	OGV1 / OGV2
Grid Connection works Option 3	11km	1320	12-32	12	OGV1 / OGV2

13.2 ASSESSMENT OF POTENTIAL IMPACTS

13.2.1 Works on the Grid Connection

The construction of the grid connection will be carried out under a number of phased operations which will involve traffic management. The first phase of the works will involve the excavation of a 0.6m wide cable trench, construction of 1.6m wide x 2.9m long joint bays, installation of cable ducting, backfilling of trench and temporary reinstatement of road surfacing. The second phase of the works will involve installing the electrical cable in the ducting. During the cable installation traffic management will be required at the joint bays to

allow cable pulling and jointing. The final phase of the works will involve permanent reinstatement of the road surfacing and surface dressing. The phased works will require traffic management to be removed and reinstalled a number of times over the course of the project. The works will be carried out under a road opening licence and Traffic Management Plan approved by Clare County council. A TMP has been prepared for the Ballykett wind farm development and is submitted with this application (see **EIAR Appendix 16.2**). These works have the potential for a slight, negative, temporary effect on residents, businesses and road users due to increased noise and vibration resulting from construction activities and increased journey times and delays due to temporary traffic management. However, these effects will be confined to a relatively short 17 to 20 week period during the construction phase, prior to the delivery of turbine components and hence are not predicted to have a significant effect. The trenches and joint bays will be reinstated in accordance with the "Guidelines for Managing Openings in Public Roads", 2017 and to requirements of Clare County Council, as may be set out in the road opening license.

13.3 MITIGATION MEASURES & RESIDUAL EFFECT

See **EIAR Chapter 16: Traffic and Transport – Section 16.7**

13.4 CUMALATIVE EFFECTS

The cumulative effects of the traffic associated with the construction of grid route Options 2 and 3 when combined with unrelated planned and proposed developments in the area will be similar to the cumulative effects of traffic generated by the construction of grid route Option 1 between Tullabrack Substation to Ballykett Wind Farm. The cumulative effects of grid route Option 1 have been assessed in **EIAR Chapter 16: Traffic and Transport – Section 16.7.**

13.5 STATEMENT OF SIGNIFICANCE

This assessment has identified no potentially significant effects, given the mitigation measures embedded in the design and recommended for the implementation of the Development.

Legend

- Grid Route Option 1
- Grid Route Option 2
- Grid Route Option 3
- Redline Boundary
- Moneypoint Substation
- Substation

RECEIVED: 29/03/2024

Rev	Date	By	Comment

Client

Ballykett Green Energy Limited

Client Representative

JENNINGS O'DONOVAN & PARTNERS LIMITED
CONSULTING ENGINEERS

Project

Proposed Wind Farm
at Ballykett, Co. Clare.

Title

Proposed Grid Connection
Route Options

Drg. By	SB	**Drg No**	-
Checked By	SM	**Rev**	1
Stage	-	**Date**	05/01/'24
Scale	1:30,000 (A3)	**Figure**	1.1