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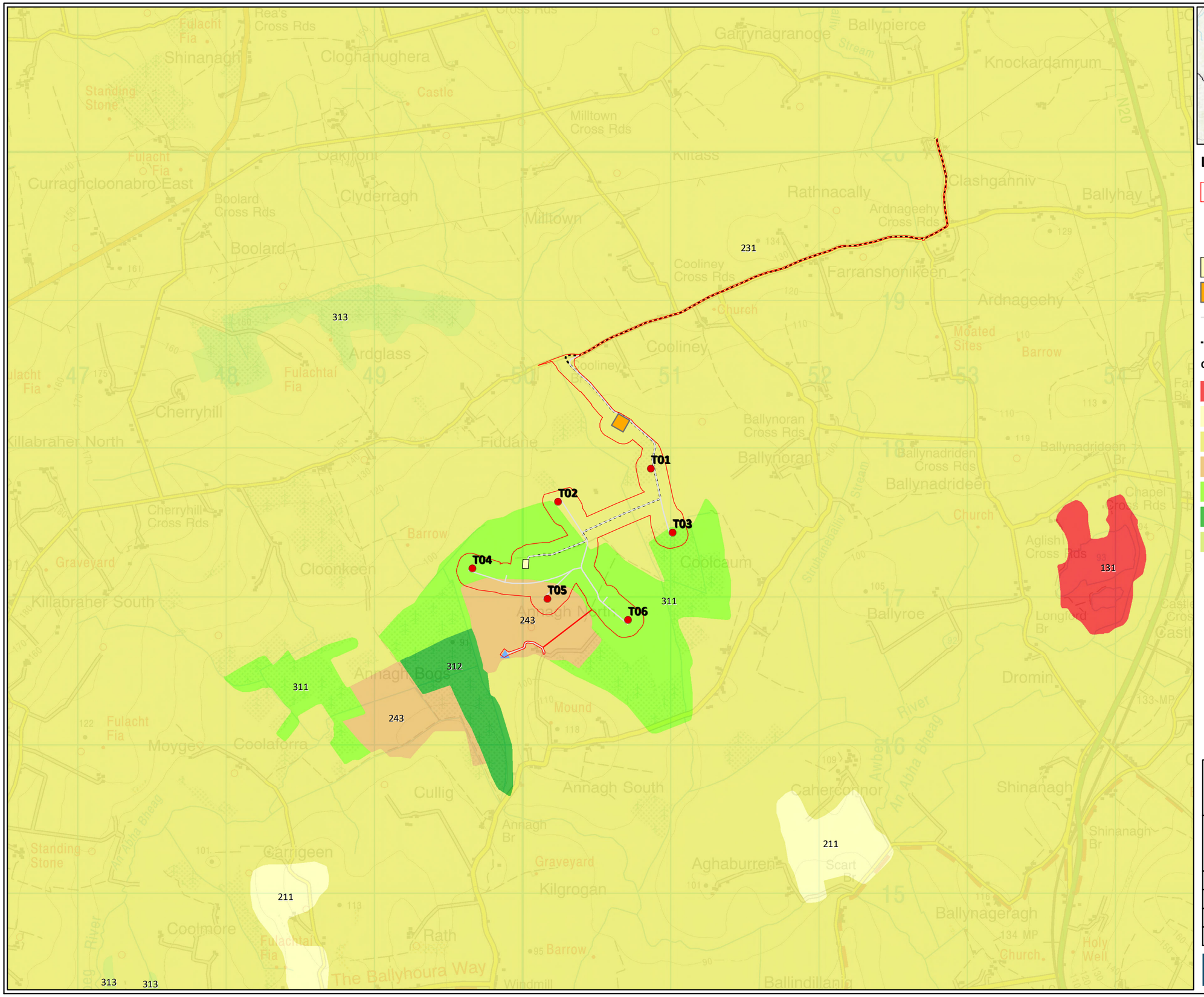

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Substation
- Construction Compound
- Site Internal Roads
- Underground Cable Route

CORINE Land Cover 2018

- 131 Mineral extraction sites
- 211 Non-irrigated land
- 231 Pastures
- 243 Agriculture with areas of natural vegetation
- 311 Broad-leaved forest
- 312 Coniferous forest
- 313 Mixed forest

TITLE:	Corine Land Cover		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	3.3		
CLIENT:	EMPower		
SCALE:	1:25000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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N W E S

0 0.5 1 2 Kilometers

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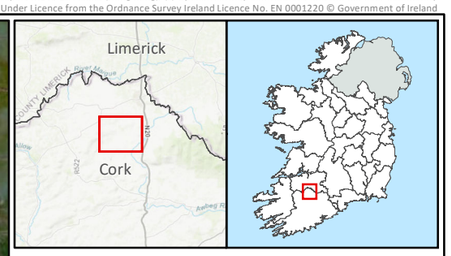

Legend

- Site Boundary
- Turbine Layout
- Underground Cable Route
- Construction Compound
- Substation
- Special Area of Conservation (SAC)

N W E S

0 0.5 1 2 Kilometers

TITLE:	Grid Connection		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	3.4		
CLIENT:	EMPower		
SCALE:	1:18000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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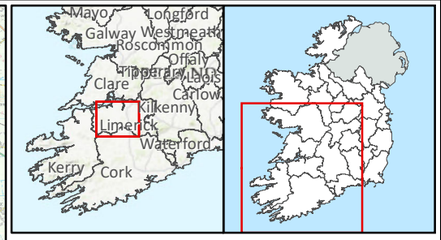
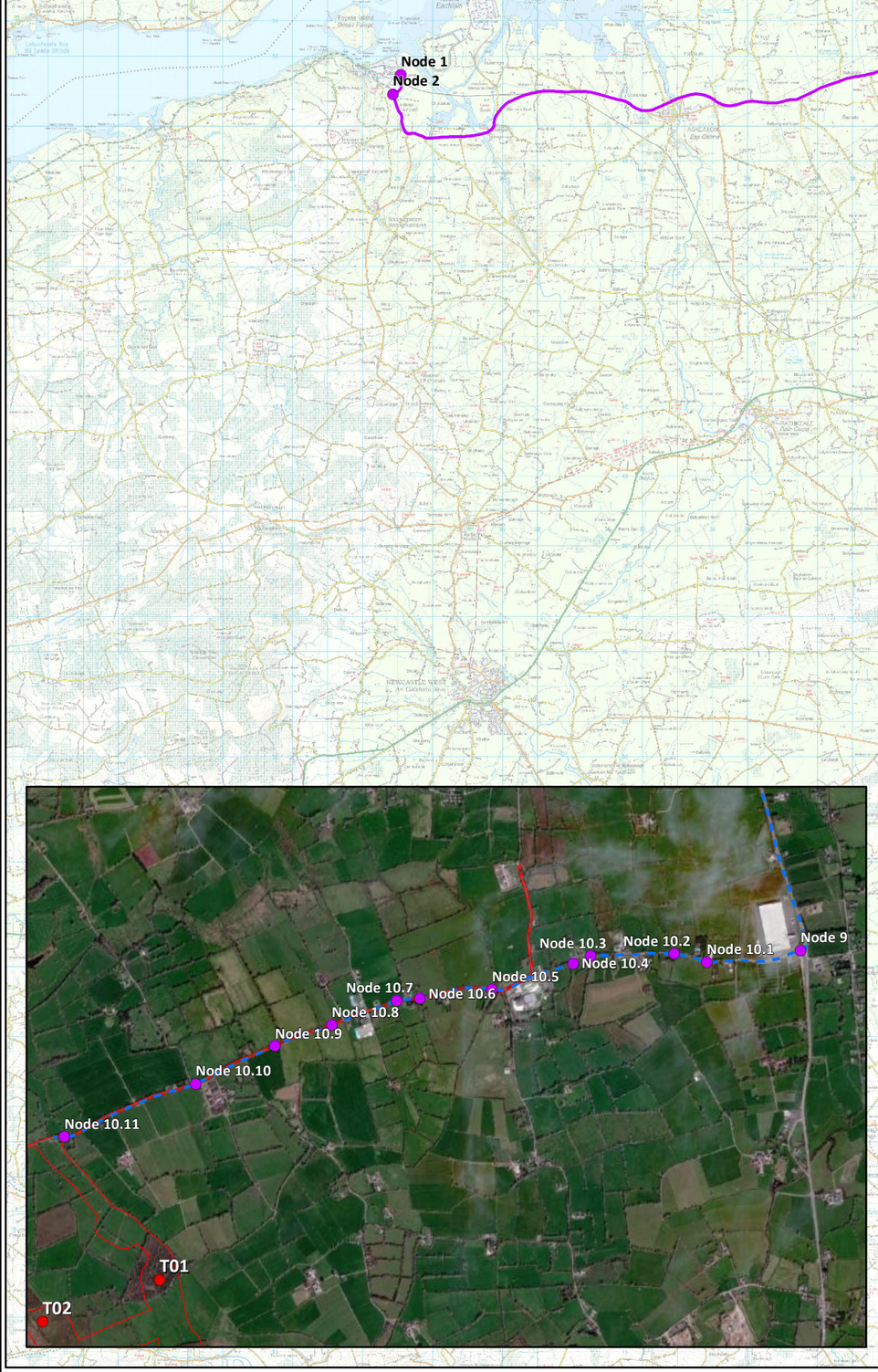


Legend

- Site Boundary
- Turbine Layout
- TDR Nodes
- Turbine Delivery Route



TITLE:	Turbine Delivery Route
PROJECT:	Annagh Wind Farm, Co. Cork
FIGURE NO:	3.5
CLIENT:	EMPower
SCALE: 1:160000	**REVISION:** 0
DATE: 12/10/2021	**PAGE SIZE:** A3

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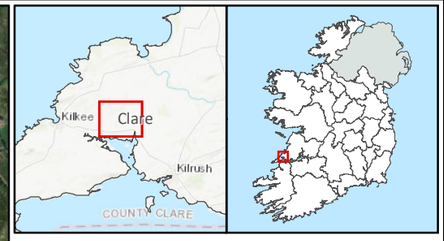
N W E S

0 5 10 20 Kilometers

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig3-6_ReplantLands_A3.mxd



Legend

Emlagh Replant Lands

N
W E
S

0 0.5 1 2 Kilometers

TITLE:	Replant Lands		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	3.6		
CLIENT:	EMPower		
SCALE:	1:12500	**REVISION:**	0
DATE:	07/07/2021	**PAGE SIZE:**	A3

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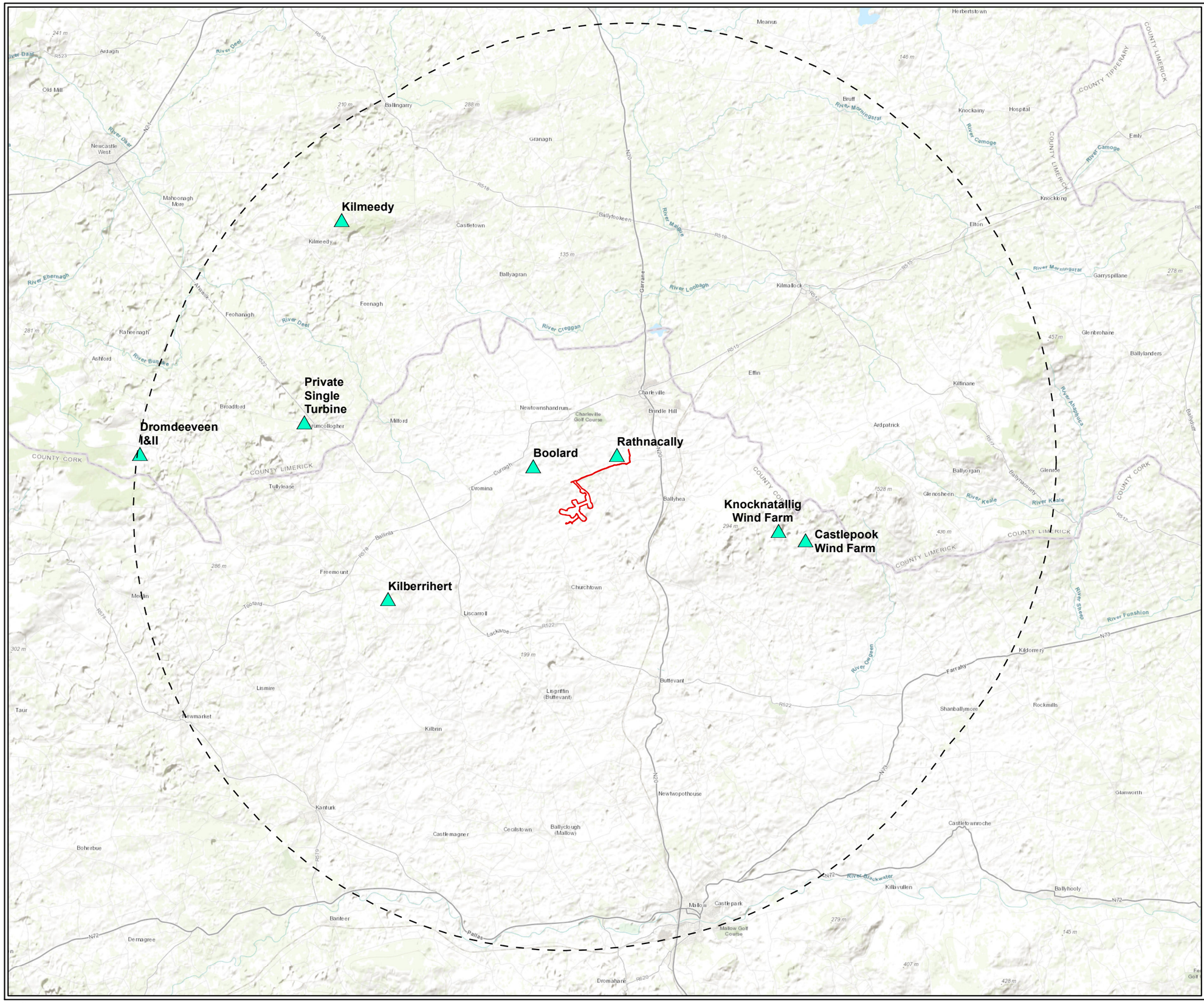
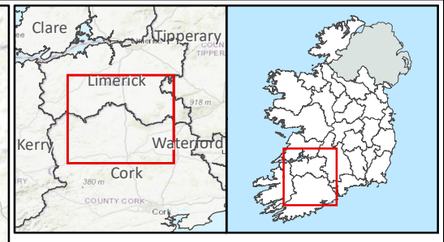
Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig3-7_WindFarmsInTheVicinity_A3.mxd





Legend

- Proposed Wind Farm Site
- Proposed Wind Farm Site 20km Buffer
- SEAI Wind Farms (2018)

N W E S

0 2.5 5 10 Kilometers

TITLE: Wind Energy Developments in the Vicinity			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	3.7		
CLIENT:	EMPower		
SCALE:	1:175000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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3.5.4 Power Output

The proposed wind farm will have an estimated Maximum Export Capacity (MEC) of approximately 37.2MW depending on final turbine technology installed. Turbines of the exact same make, model and dimensions can have different power outputs depending on the capacity of the electrical generator installed in the turbine nacelle. This is subject to change as a result of technological advancements.

A rated capacity of 37.2 MW has been used below to calculate the power output of the proposed wind farm. Assuming an installed capacity of 37.2 MW, the proposed wind farm has the potential to produce approximately 88,300 MWh (megawatt hours) of electricity per year, based on the following calculation:

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

where:

A = The number of hours in a year: 8,760 hours

B = The capacity factor, which takes into account the intermittent nature of the wind, the availability of wind turbines and array losses etc. A capacity factor of 29.3 % is applied here[1]

C = Rated capacity of the wind farm: 37.2 MW

The 95,480 MWh of electricity produced by the proposed wind farm would be sufficient to supply approximately 22,500 Irish households with electricity per year, based on the average Irish household using 4.2 MWh of electricity (this latest figure is available from the March 2017 Commission for Energy Regulation (CER) Review of Typical Consumption Figures Decision Paper).

The Sustainable Energy Authority of Ireland estimates a capacity factor of approximately 29.3% for onshore wind in Ireland. The proposed turbine type allows for the use of fewer, taller turbines with an increased efficiency and in return greater economic benefit to the consumer.

3.5.5 Turbines

3.5.5.1 Turbine Description

The proposed turbines will have a tip height of 175m, 100m hub height and a rotor diameter of 150m. The proposed turbine model is the Vestas V150.

The wind turbines that will be installed on site will be conventional three-blade turbines, that will be designed to ensure the rotors of all turbines rotate in the same direction at all times. Each discipline within the EIAR has assessed the proposed turbine dimensions as detailed above..

The turbine will be of the generic three bladed, tubular tower model with horizontal axis. The rotor blades are bolted to the central hub, which is connected to a generator located in the nacelle. The nacelle holds the following turbine components:

- Generator
- Electrical components
- Control unit

[1] Calculated using a capacity factor of 29.3 (2019 capacity factor for wind energy in Ireland, SEAI, 2020)

A glass fibre reinforcing polyester hood covers the nacelle. Earthing and isolation protect all components from lightning strikes.

3.5.5.2 Turbine Blades

The blades of the proposed turbine model (V150) are made up of glass fibre reinforced polyester. They turn at between 5 and 15 revolutions per minute depending on wind speed. The V150 turbine begins generating electricity at a wind speed of 3m/s, with rated power generation at wind speeds of approximately 13 to 16.5m/s.

The turbines shut down at wind speeds greater than 25m/s. The yaw mechanism turns the nacelle and blades into and out of the wind. A wind vane on the nacelle controls the yaw mechanism. Blades are pitched to match the wind conditions.

3.5.5.3 Turbine Tower and Foundation

The tower of the turbine is a conical steel tube, with multiple painted finish. It is generally delivered to site in four or five sections. The first section is bolted to the steel base, which is cast into the concrete foundation. The proposed turbine foundations will be 22m in diameter and 4m in depth.

The upper sections of the tower are bolted to the lower ones in sequence. The base of the tower is 5.5m in diameter, tapering to approximately 2-3m, where it is attached to the nacelle. The first floor of the tower is approximately 2-3m above ground level it is accessed by a galvanised steel staircase and a steel hatch door which will be kept locked except during maintenance.

3.5.5.4 Turbine Transformer

The turbine will have a transformer located within the tower. The turbine will generate electricity at approximately 660 volts. The turbine transformer will step up the voltage to 33kV to reduce the electrical loss on the cabling connector circuits that connect to the on-site substation.

3.5.5.5 Turbine Colour

The turbines have a multiple painted coating to protect against corrosion. They are coloured off-white to blend into the sky background. This minimises visual impact, as recommended by the following guidelines on wind energy development:

- “Wind Energy Development – Planning Guidelines” (2006), Department of the Environment, Heritage and Local Government
- “The Influence of Colour on the Aesthetics of Wind Turbine Generators”, ETSU W/14/00533/00/00
- PAN 45, The Scottish Office Environment Department
- PPG22, Department of the Environment - Welsh Office
- Technical Advice Note 8, Welsh Assembly, 2005

3.5.5.6 Turbine Layout

The proposed Annagh Wind Farm Project has been designed in accordance with the current Section 28 Ministerial Guidelines (section 28 of the Planning and Development Act 2000, as amended), Wind Energy Guidelines 2006. The layout and design of the wind farm has also had regard to the "Draft Revised Wind Energy Development Guidelines", published by the Department of Housing, Planning and Local Government (December 2019).

The proposed layout has achieved an optimum separation distance between dwellings and the proposed turbines by providing a separation distance of 700m between turbines and the closest dwellings, apart from 1 no. financially involved landowner whose dwelling is located 690m from the proposed turbine locations. There are 31 dwellings located within 1km of the proposed wind turbines.

3.5.6 Turbine Delivery Route Access Tracks and Hardstandings

3.5.6.1 Turbine Delivery Route (TDR)

The proposed turbine delivery route is presented in Figure 3-5. A Delivery Route Selection and Assessment was carried out to identify the optimum delivery route to site and is presented as Appendix 13-1 of this EIAR.

Large components associated with the wind farm construction will be transported to site via the identified turbine delivery route (TDR). The proposed access route to site is as follows:

- Loads will depart the Port of Foynes and turn left onto the N69 towards Limerick;
- Loads will travel onto the N18 and turn onto the M20/N21;
- Loads will turn onto the N20 and travel south through the town of Charleville
- The route then turns onto the L1322 local road at Ballyhea; and
- The route continues westwards on the L1322 for approx. 4km before entering the proposed wind farm site.

Temporary accommodation works required for the delivery of turbines are summarised in Table 3-2 below. The general location of accommodation works locations, or TDR nodes, are shown in Figure 3-5 and listed as "Points of Interest (POI's)" and further detailed in Appendix 13.1. The works required at each POI are assessed throughout this EIAR. Many of the POIs can be accommodated through a road opening licence. POIs which require planning consent do not form part of this application for planning permission but are assessed as part of the project.

Table 3-2: TDR Temporary Accommodation Works

TDR Node Reference Number (POI__)	Location	Summary Description of Proposed Temporary Accommodation Works
2	Foynes Port Access Road/N69	Vegetation on right will require trimming to 2.5m over road level to boundary fence. Road sign will require temporary removal. Lampposts require temporary removal and vegetation on left will be trimmed above 1m in height for mid oversail. The top 40cm (approx.) of the wall on the left-hand side should be removed to allow for mid oversail. The exact amount will be defined by trailer type used. Load bearing surface on verge.
4	Clarina Roundabout	Temporary hard surface required on roundabout to provide a cut-through track through the centre island. This will require tree removal and temporary signage removal.
5	Mungret Interchange – West Roundabout	Temporary load bearing surface required on roundabout to provide a cut-through track through the centre island. This will require vegetation removal and temporary signage removal.
6	Mungret Interchange – East Roundabout.	Temporary load bearing surface required on roundabout to allow for turn and oversail. Temporary removal of signage and public lighting.
7	M20- N20 off ramp Southbound	Temporary removal of signs and street lamp on left side and scrub clearance on left and right for mid and rear oversail.
8	N20 Right Curve. Ballymacrory	Vegetation trimming required to facilitate vehicle oversail on both sides of the road. Hedgerow to be lowered to 0.5m above road level on the right hand side to facilitate mid-oversail.
9	N20 – L1322 Junction, Ballyhea	Regrading and temporary load bearing surface required. Temporary removal of road signs to facilitate oversail.
10	L1322 Local Road – from Ballyhea to Site Entrance	Road will require upgrading and widening at various points to facilitate blade transport. There are ten POIs along the L1322 described below and illustrated in Appendix 13.1.
10.1	L1322	Temporary removal of fence and road markers to facilitate mid-oversail. Hedge trimming to facilitate vehicle oversail.
10.2	L1322	Vegetation trimming to facilitate vehicle oversail. Temporary removal of utility pole.
10.3	L1322	Vegetation trimming to tree canopy required. Vegetation removal to facilitated vehicle oversail.
10.4	L1322	Vegetation trimming to facilitate vehicle oversail.
10.5	L1322	Hedge and pump enclosure wall to be lowered to 0.5m above road level to facilitate vehicle oversail. Road narrows from this point onwards.
10.6	L1322	Section of wall to be lowered to 0.5m above existing road level to facilitate mid-oversail.
10.7	L1322	Vegetation trimming and temporary removal of utility pole.

TDR Node Reference Number (POI__)	Location	Summary Description of Proposed Temporary Accommodation Works
10.8	L1322	Hedgerow and tree branch trimming to facilitate vehicle oversail.
10.9	L1322	Hedgerow trimming required on both sides of the road throughout this section to facilitate vehicle oversail.
10.10	L1322	Hedgerow trimming on the right-hand side to facilitate vehicle oversail.
10.11	L1322	This node forms the main site entrance as described in section 3.5.8. Works here will include tree felling, vegetation clearance and installation of load bearing surface.

The location and nature of proposed temporary accommodation works are described in further detail in Chapter 13. All temporary accommodation works associated with the project shall be fully reinstated following the construction stage. Overhead utilities and obstructions will need to be removed at several locations to provide adequate overhead clearance. The removal of overhead utilities will involve temporary disconnections. Such works will be carried out by the utility providers in advance of turbine delivery to site. Further details of these works are provided in Chapter 13- Traffic and Transportation.

Temporary accommodation works will only be required during the operational phase in the unlikely event of a major turbine component replacement. It is expected that these temporary accommodation works will not be required for the decommissioning phase as turbine components can be broken up on site and removed using standard HGVs.

3.5.6.2 Internal Access Tracks

4.5 km of new internal access tracks will be required to be constructed and 0.38 km of upgraded agricultural tracks will be required as part of the project. Figure 3-2 illustrates the internal access tracks within the proposed wind farm site. The proposed internal site track layout will permit access for vehicles during the construction phase, for maintenance during the operational phase and for vehicles to decommission the turbines at the end of the life of the project.

All access tracks at the main wind farm site will be 5m wide along straight sections and wider to 5.6m at bends as required in accordance with wind turbine manufacturer requirements. The tracks will be finished with a well graded aggregate. The drainage system will be installed adjacent to the internal access tracks. Existing drainage infrastructure will be maintained and upgraded where necessary. The access track to the proposed met mast will be 3.5m in width, as larger vehicles will not be required to access this area. This track consists of a new access track linking to an existing agricultural laneway at the south of the site.

The stone required for the construction of the internal access roads will be sourced from licenced quarries in the vicinity of the project. The location of licensed quarries, waste facilities and haulage routes are identified in Chapter 13 – Traffic and Transportation.

The proposed new and upgraded internal access tracks will be founded. Further details on road and hardstanding construction are provided in Chapter 9 and the CEMP in Appendix 3.1.

Founded access track formation will consist of a minimum 500mm hardcore on geo-textile membrane. The proposed construction methodology for newly constructed tracks is as follows:

- The formation will be prepared to receive the geotextile membrane.
- Stone will be placed and compacted in layers to minimum 500mm depth.
- Drainage ditches will be formed, within the excavated width and along the sides of the track.
- A layer of compacted Cl 804 material will be placed on top to provide a suitable running surface.
- Surplus excavated material will be placed along the side of sections of the tracks in suitable locations as identified in the soil management plan and dressed to blend in with surrounding landscaping and partially obscure visibility of the track. The soil management plan is included in the CEMP included in Appendix 3.1 of this EIAR.

3.5.6.3 Turbine Hardstandings

A turbine hardstanding area consists of a main crane pad hardstanding of 31m x 92m with a number of additional smaller hardstandings that act as set down and assembly areas, located as shown on the accompanying planning drawings. These smaller hardstanding areas surround the main hardstanding area and measure approx. 4,630 square meters. This area will accommodate a main crane and an assist crane during the assembly of the turbine, as well as during occasional maintenance periods during the operation of the wind farm.

3.5.7 Temporary Site Facilities

During the construction phase, it will be necessary to provide temporary facilities for construction personnel. The location of the temporary site compound is located between the site entrance and the wind farm site, as shown on Figure 3-2. Wheel wash facilities will be provided within the site near the site construction compound. The Annagh site will have 1 no. temporary compound and will include welfare facilities and offices.

The temporary compound shall be aggregate hard standings surrounded by security fencing, located as shown on the accompanying drawings. Temporary facilities will be removed and the lands reinstated on completion of the construction phase.

Facilities to be provided in the temporary site compounds will include the following:

- site offices, of Portacabin type construction
- portaloos
- bottled water for potable supply
- a water tanker to supply water used for other purposes
- canteen facilities
- storage areas
- employee parking
- bunded fuel storage
- contractor lock-up facility
- diesel generator
- waste management areas

3.5.8 Wind Farm Site Entrance

Annagh Wind Farm shall have one main site entrance which will be used for both construction and operation. Access to the site shall be via an existing agricultural entrance on the L1322. The location of the site entrance is shown in Figure 3-2 and is further detailed in Chapter 13: Traffic & Transportation.

The site entrance will be upgraded and a section of treeline and hedgerow will require removal to allow for safe visibility and to accommodate a wider turning point for turbine delivery. The site entrance will form a bell mouth and land will be reprofiled to allow for safe vehicular entrance.

Access to the met mast for construction, operational maintenance and decommissioning will be made from the south of the site via an existing agricultural laneway, in the townland of Annagh North. This southern entrance will not be utilised for other elements of the proposed project and will not be linked to the proposed wind farm access track network.

3.5.9 Grid Connection

Electricity generated from wind turbines shall be collected at medium voltage (20/33 kV) by an internal circuit of buried cables which will follow on-site access tracks. This circuit shall be terminated at the proposed onsite substation and exported to the grid via a 38 kV buried cable to the existing Charleville substation, located in the townland of Rathnacally. This section describes the 38 kV underground grid connection between the proposed onsite substation and the existing Charleville substation.

3.5.9.1 Grid Connection Cable Route

The proposed wind farm will have an export capacity of approximately 37.2MW, depending on final turbine technology installed. Connection will be sought under the Enduring Connection Process (ECP) grid access regime. The project will connect from the onsite substation via underground 38kV cable to the Charleville 110kV substation in the townland of Rathnacally, County Cork. The cable will be installed along the public road. The proposed grid connection route (GCR) is shown in Figure 3-4. No overhead lines are proposed for this connection.

As shown in Figure 3-4, the GCR travels from the proposed on-site substation along the proposed access tracks within private lands. The GCR leaves the site at the proposed site entrance on the L1322. The GCR then follows the public road for 3.4km running east along the L1322 and turning north along an unnamed local road, north of the Dawn Meats Facility, where it will enter the existing Charleville 110kV Substation in the townland of Rathnacally. There is 1 no. watercourse crossing located along the public road and there is 1 no. watercourse crossing located within the Wind Farm Site on private lands. These watercourse crossings are described in Section 3.5.10.

Connection works to Charleville substation will involve the installation of ducting, 9 no. joint bays, drainage and ancillary infrastructure and the subsequent running of cables predominantly along the existing road network. This will require delivery of plant and construction materials, followed by excavation, laying of cables and subsequent reinstatement of trenches.

It is expected that full road closures will be put in place to facilitate cabling works in combination with lane closures, partial road closures and stop/go systems. This will enable the works to be completed as quickly and as safely as possible, with minimal disruption time for residents of the area.

These works shall be undertaken on a rolling basis with short sections closed for short periods before moving onto the next section. This is described in more detail in Chapter 13 - Traffic and Transportation.

3.5.10 Drainage and Watercourse Crossings

The Annagh Wind Farm will use existing drainage alongside the implementation of Sustainable Drainage Systems (SuDS) for the proposed project. This design approach ensures that existing drainage patterns will be maintained throughout the site.

An appropriate drainage design is the primary mitigation measure for the protection of waterbodies, incorporating silt protection infrastructure and control measures to reduce the rate of surface water runoff from the wind farm site.

The drainage system will be constructed alongside all turbine hardstands, internal access tracks, substation and the temporary construction compound. The drainage system for the existing tracks will be retained.

Further details on hydrology and drainage are contained in Chapter 10 Hydrology and Water Quality and in the accompanying Planning Drawings.

3.5.10.1 Internal Access Track Watercourse Crossings

Minor drains such as manmade agricultural and forest drains will be crossed using 450mm diameter pipes. Where cross drains are to be provided to convey the drainage across the track, the sizes of these cross drains are 225 mm diameter pipes.

Silt Protection Controls (SPCs) are proposed at the location of the drain crossings SPCs will consist of a minimum of silt traps containing filter stone and filter material staked across the width of the swales and upstream of the outfall to any watercourse.

A description of construction methodologies for watercourse crossings is presented Section 3.6 and in the accompanying CEMP.

There is one watercourse crossed by internal wind farm access tracks as described in Table 3-3. This proposed crossing is on the Oakfront Stream (EPA name) which is a part of the Awbeg [Buttevant] sub-catchment:

Table 3-3: Internal Access Track Watercourse Crossings

Feature ID	ITM_X	ITM_Y	EPA Name	EPA Code	WFD Waterbody Designation	Description
GCR-WCC1	550639	617750	Oakfront	18O12	Awbeg [Buttevant]	Stream crossing. Proposed clear span bridge will accommodate GCR cable and internal collector cables within its deck.

3.5.10.2 Watercourse Crossings Along the GCR

There is one existing watercourse located along the proposed GCR. This watercourse is the Rathnacally Stream, also part of the Awbeg [Buttevant] sub-catchment. The existing road bridge at this point consists of a shallow concrete bridge with a 5.3m carriageway and 0.7m and 0.8m verge. It is proposed to install ducting beneath this stream using horizontal directional drilling (HDD). Therefore, construction and installation of the ducts shall not require works within the watercourse and shall not affect the watercourse. Watercourse pollution control measures and mitigation will be put in place during the construction phase as detailed in the Construction Environmental Management Plan (CEMP) included in Appendix 3.1.

Table 3-4: Grid Connection Route Watercourse Crossings

Feature ID	ITM_X	ITM_Y	EPA Name	EPA Code	WFD Waterbody Designation	Description
GCR-WCC2	552635	619466	Rathnacally	18R32	Awbeg [Buttevant]	HDD in public road corridor

A description of construction methodologies for watercourse crossings is presented in in the CEMP in Appendix 3.1, Section 3.6 of this Chapter, and in Chapter 10 of this EIAR.

3.5.10.3 Turbine Delivery Route (TDR) Watercourse Crossings

The TDR crosses a number of watercourses along the route between the Port of Foynes and the proposed wind farm site. There are no specific accomodation works requried at bridge points along the TDR. Works will be requried at Node 10.5 in proximity to the Rathnacally Stream on the L1322. These works include hedgerow trimming and the lowering of a wall to accommodate vehicle oversail. There are no works requried within the stream, however, watercourse pollution control measures will be put in place at this point during the construction phase as detailed in the Construction Environmental Management Plan (CEMP) included in Appendix 3.1.

3.5.11 Onsite Electricity Substation

A permanent onsite electricity substation will be constructed within the proposed wind farm site as shown in Figure 3-2. This will provide a connection point between the wind farm and the proposed grid connection point at the existing Charleville Substation.

As described in Section 3.5.9, electricity generated from wind turbines shall be collected at medium voltage (20/33 kV) by an internal circuit of buried cables which will follow on-site access tracks. This circuit shall terminate at a proposed onsite substation and be exported to the national grid via a 38 kV buried cable to the existing Charleville substation.

The dimensions of the substation compounds will be 50m x 25m and will include a substation control building and electrical components necessary to export the electricity generated from the wind farm to the national grid. The substation compound will be surrounded by a ca. 2.5 metre high steel palisade fence and internal fences will also be provided to segregate different areas within the main substation compound.

Lighting will be required on site and this will be provided by lighting poles located around the substation and exterior wall mounted lights on the control buildings.

The control building located within the substation compound will measure 22m by 7.5m and 6m in height. The control building will include the Independent Power Production (IPP) and grid operator control rooms, an office space and welfare facilities for staff during the operational phase of the wind farm. Due to the nature of the project there will be a small water requirement for occasional toilet flushing and hand washing with a rainwater harvesting tank adjacent to the control building.

A wastewater holding tank will be provided outside the substation compound fence line so that it can be maintained where required without requiring access to the substation compound. The wastewater holding tank will be a sealed storage tank with all wastewater transported by tanker off site as required by an authorised waste collector to a wastewater treatment plant. Only waste collectors holding valid waste collection permits under the Waste Management (Collection Permit) Regulations, 2007, will be employed to transport wastewater away from the site. The proposed wastewater storage tank will be fitted with an automated alarm system that will provide sufficient notice that the tank requires emptying. The wastewater storage tank alarm will be part of a continuous stream of data from the site's turbines, wind measurement devices and electricity substation that will be monitored remotely 24 hours a day, 7 days per week. This approach for managing wastewater on site has become standard practice on wind farm sites, which are often proposed in areas where finding the necessary percolation requirements for on-site treatment can be challenging and has been accepted by numerous Planning Authorities and An Bord Pleanála as an acceptable proposal. Existing facilities in the surrounding area have been assessed for the purposes of this planning application. A list of waste facilities in the locality can be found Section 3.6.12.

3.5.12 On-site Electrical Cabling

As described in Section 3.5.9, electricity generated from wind turbines shall be collected at medium voltage (20/33kV) by an internal circuit of buried cables which will follow on-site access tracks. This circuit shall terminate at the proposed onsite substation. Electricity generated from the site will be exported to the grid via a 38kV buried cable to the existing Charleville substation. The grid connection location is shown in Figure 3-4.

Internal collector circuit cable routes are shown on the planning application drawings and will generally follow the alignment of the internal access tracks.

The electricity will be transmitted as a three-phase power supply so there will be three individual conductors (or individual cables) in each cable circuit. The three conductors will each be laid in separate ducts which will usually be laid in a trefoil formation but shall also be laid in a flat formation at stream/drain crossings, or where cabling crosses other on-site cables.. The specification for the cables and cable-laying will be in accordance with ESBN requirements.

The width of a cable trench with a trefoil formation will be 600mm, a flat formation requires a wider trench width of 1,040mm. The depth of cover to the ducts carrying the cables will usually be up to 750mm cover to the top of the upper duct in public roadways and grassed areas.

The depth of trench for the cables will be up to 1220mm. However, in certain instances, for example when crossing a bridge with shallow cover or crossing exiting services, a shallower depth of 450-950mm could be utilised. In those circumstances, the particular design will be agreed with ESBN and additional cable protection measures such as steel plates or reinforced concrete cover may be required.

Cables laid within the site in field locations will be laid to a depth of up to 750mm to the top of the upper duct. The diameter of the ducting will be selected to suit the range of cross-sectional areas of electrical cables and is likely to be 110mm diameter.

3.5.12.1 Internal and Grid Connection Cable Installation

The specifications for cables and cable installation will be in accordance with ESBN requirements. A description of cable installation works is presented in Section 3.6 and the CEMP.

3.5.12.2 Buried Drains and Service Crossings

The watercourse crossing required for the proposed 38kV cable route to Charleville Substation is described in Section 3.5.10.2.

For the crossing of other services, if encountered along this route, the following options for construction may be used:

- Piped Culvert Crossings – Where sufficient cover is available, the cable ducts will be laid above the culvert with a minimum separation distance of 300mm.
- Piped Culvert Crossings - Where sufficient cover is not available, the cable ducts will be laid under the culvert with a minimum separation distance of 300mm.
- Flatbed Formation over or under Culverts - where the cable duct is to be installed over an existing culvert where sufficient cover is not available, the ducts will be laid in a much shallower trench the depth of which will be determined by the location of the top of the culvert. The duct will be laid in this trench in a flatbed formation over the existing culvert and will be encased in 6mm thick steel galvanized plate with a 30N concrete surround as per ESBN specification.

3.5.12.3 Joint Bays

Joint bays are pre-cast concrete chambers where individual lengths of cables are joined to form one continuous cable. A joint bay is constructed in a pit. The bay will be 4.5m x 2m x 1.5m deep. A reinforced precast concrete slab is laid in the bay to accommodate the jointing enclosure.

Suitable joint bay locations along the grid connection route have been identified and assessed as part of the EIAR. Figure 3-8 shows a standard ESBN 38kV single circuit joint bay and communications chamber arrangement. ESBN and Cork County Council shall be consulted as part of the detailed design of joint bays which will be within the parameters as set out above and detailed in Drawing Sheet 05813-DR-013 (TLI Group Drawing Set).

It is expected that 9 no. joint bays will be required for the grid connection. Of these, 5 no. joint bays shall be located in public road corridor, 3 no. joint bays will be located within the wind farm site on private lands and 1 no. joint bay will be located at the Charleville 110kV substation. The single joint bay located at the Charleville 110kV Substation is assessed as part of this EIAR, however, does not form part of this application for consent.

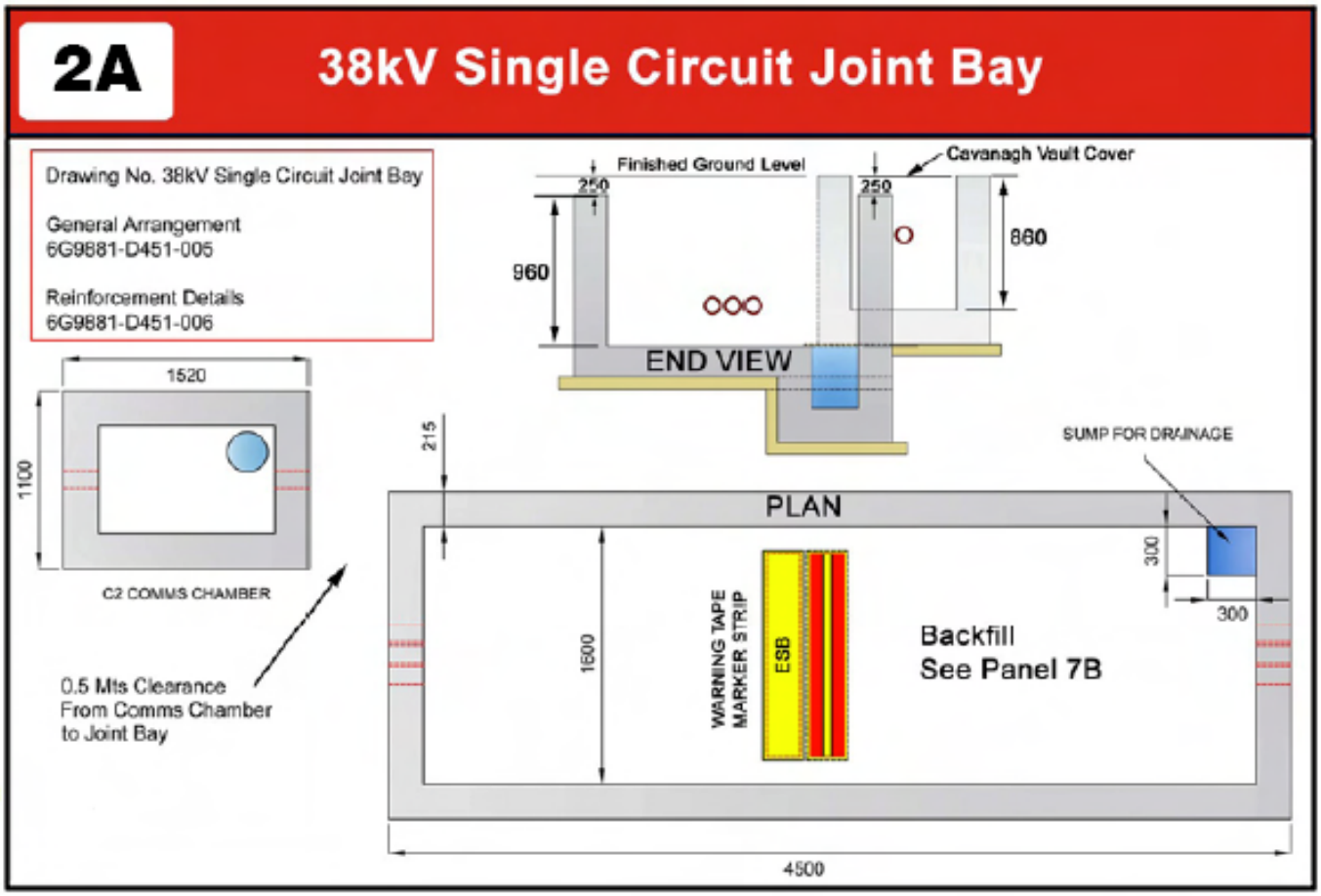

Figure 3-8: ESBN 38kV Single Circuit Joint Bay

3.5.13 Traffic Management

A careful approach will be taken to planning the entirety of the works associated with the proposed project to ensure minimal impacts on road users and the general public.

Traffic Management at the wind farm site will be coordinated by an appointed Traffic Manager for the duration of the construction phase of the proposed project. A haul route has been selected from the N20 National Primary Road to the site entrance which runs along the L1322. This will be used for HGV traffic to avoid impact on other unsuitable roads in the area of the wind farm site.

A pre-condition survey will be carried out on all public roads that will be used in connection with the development to record the condition of the public roads in advance of construction commencing. A post-construction survey will also be carried out after the works are completed. All roads will be reinstated expeditiously on completion of the construction works.

Letter drops will be carried out to notify members of the public living near the proposed works to advise them of any particular upcoming traffic related matters. Clear signage relating to the development, both temporary and permanent, will be provided for accessing the site. The entrances to the site will be secured when the site is not in use. When necessary, a flagman will be used to assist traffic movements at the site entrance or in other areas as required.

For the grid connection construction, cable trenching will be carried out with the aid of either lane closures or road closures, which will ensure that the trenching works are completed as expeditiously as possible. The cabling to be installed within the road corridor will be conducted over a period of up to 3-months (ca. 14 weeks). Road closures will be applied for by the appointed contractor and will outline local diversions whilst maintaining local access at all times for residents, farms and businesses.

Road closures will be subject to the applicable statutory processes as implemented by the Roads Authority. Road closures will be facilitated by the existing road network. 'Rolling road closures' will be implemented, whereby the site will progress each day along a road, which will have the effect of reducing the impact for local residents.

A traffic management plan for the cable trenching will be adopted , in consultation with Cork County Council, to provide a safe environment for road users and construction workers

Turbine delivery will require the transportation of abnormal loads. This will be completed at off-peak times under agreement with the local authority and An Garda Siochána. A turbine delivery route assessment was carried out to identify the most appropriate transport route for turbine deliveries and includes the identification of temporary accommodation works required. Temporary accommodation works will be carried out with the use of lane closures or road closures, where required, and in agreement with the local authority. A programme for turbine deliveries will dictate dates and times of each component delivery. The deliveries will be escorted by An Garda Siochana to ensure greater road safety.

For construction of the proposed 100m met mast and associated access track, access will be made from the south of the site via an existing agricultural laneway. A banksman will control traffic at this entrance to maintain traffic safety.

A Traffic Management Plan is contained in the Construction Environmental Management Plan (CEMP) which is included in Appendix 3-1 of Volume 3 of this EIAR. In the event permission is granted for the proposed project the Traffic Management Plan shall be finalised following the appointment of the contractor for the main construction works to address the requirements of any relevant planning conditions, including any additional mitigation measures that are conditioned and shall be submitted to the planning authority.

3.5.14 Soil Management

There are no peat deposition areas required as part of this project following assessment of the existing environment. Any soil excavated for the construction of access roads within the site will be re-used on site in berms and for landscaping purposes and along the margins of the access roads.

Berms will be created from suitable excavated material and are located on the opposite side of infrastructure to any interceptor drains. The berms will therefore not obstruct flow or risk siltation to interceptor drains. Berms will be placed outside the roadside drains which drain the new access tracks. Further details on soil management can be found in Chapter 9 of this EIAR and the Soils Management Plan contained within the CEMP in Appendix 3-1.

3.5.15 Drainage

The drainage system will be constructed alongside all turbine hardstands, internal access tracks, substation and the temporary construction compound.

The drainage system for the existing tracks and field boundaries will be retained. Where the roads require widening, this will involve the re-location of existing roadside swales to allow for widening.

Further details on hydrology and drainage are contained in Chapter 10 Hydrology and Water Quality, the Surface Water Management Plan which is contained within the CEMP in Appendix 3-1 and in the Planning Drawings. The number of stilling ponds and their locations are shown on the planning drawings accompanying this application for consent.

3.5.16 Temporary Stockpile Areas

Due to the possibility of soil-borne diseases, all topsoil recovered from each individual farm property within the proposed wind farm site will remain on the same property. These stockpiles will be covered and where required, drainage and sediment controls including temporary silt fencing will be put in place. The topsoil will be re-used for landscaping and will also be used for reinstatement purposes around turbine bases and hardstanding areas within the same farm property.

Further details on soils management can be found in Chapter 9 of this EIAR and the Soils Management Plan contained within the CEMP in Appendix 3-1. Further details on the drainage of the site are contained in Chapter 10, the CEMP in Appendix 3-1 and in the accompanying Planning Drawings.

3.5.17 Tree Felling

The proposed wind farm site comprises areas of broadleaf forestry plantations. The proposed 6 no. turbines are located within or partly within forestry and consequently tree felling will be required as part of the project. Permanent felling of approximately 12.6 ha of broadleaf forestry is required within and around the wind farm infrastructure to accommodate the construction of turbines, hardstands, crane pads, access tracks and the proposed onsite substation.

The felling area proposed is the minimum necessary to construct the proposed project and comply with any environmental mitigation (bats in particular).

The felling will be the subject of a Felling Licence Application to the Forest Service prior to construction as per the Forest Service's policy on granting felling licenses for wind farm developments.

The Forest Service Policy requires that a copy of the planning permission for the wind farm be submitted with a felling license application therefore the felling license cannot be applied for until planning permission is received for the proposed project site. The license will include the provision of relevant replant lands to be planted in lieu of the proposed tree felling on the site as discussed in Section 3.5.18 below. It should be noted that the forestry within the proposed wind farm site was originally planted as a commercial crop and will be felled should the project proceed or not.

To ensure a tree clearance method that reduces the potential for sediment and nutrient runoff, the construction methodology will follow the specifications set out in the Forest Service Forestry and Water Quality Guidelines (2000) and Forest Harvesting and Environmental Guidelines (2000).

Before any felling works commence on site all personnel, particularly machine operators, will be made aware of the following and will have copies of relevant documentation, including:

- The felling plan, surface water management, construction management, emergency plans and any contingency plans;
- Environmental issues relating to the site;
- The outer perimeter of all buffer and exclusion zones;
- All health & safety issues relating to the site.

The proposed method of tree felling near 'infrastructure' will be limited to:

- 20m wide corridors for new and upgraded access tracks;
- 10m buffer surrounding hardstandings;
- 8m corridor for buried cables in private lands;
- Up to 92m radius around each turbine located in forestry for bat impact mitigation. Each turbine has a different felling radius depending on the surrounding tree height. This is calculated in line with Scottish Natural Heritage's Guidance Document: Bats and Onshore Wind Turbines (Jan 2019). The felling radius for each turbine is as follows:
    - T01: 86m
    - T02: 86m
    - T03: 92m
    - T04: 86m
    - T05: N/A
    - T06: 86m

Felling will not be required at the proposed temporary construction compound and meteorological mast as these elements do not fall within forestry plantation areas.

3.5.18 Replant Lands

As described in Section 3.1, replanting lands at Emlagh, County Clare have been assessed for cumulative impacts. An appropriate assessments has been carried out on this site and is contained in Appendix 3.3 of this EIAR.

Replacement replanting of forestry in Ireland is subject to license in compliance with the Forestry Act 2014 as amended. The consent for such replanting is covered by the Forestry Regulations 2017 (S.I. No. 191 of 2017).

As it is proposed to fell approximately 12.6 ha of broadleaf forestry for the proposed project, replant lands of the same area are required. The replacement replanting of forestry can occur anywhere in the State subject to licence.

A potential replanting site has been identified at Emlagh County Clare. The total area identified for replanting is 12.6 ha. A technical approval application for the replant lands has been submitted to the forestry service under reference CN88795. If these replant lands become unavailable, other similarly suitable/approved lands will be used for replanting should the proposed project receive planning permission.

3.5.19 Permanent Meteorological Masts

1 no. permanent meteorological (Met) mast shall be erected on site as shown in Figure 3-2. The permanent met mast shall be of the following general configuration:

- 100m high free standing lattice steel mast with a shallow concrete foundation.

The mast will include a concrete base measuring 8m by 8m and will be 1.5m in depth.

The mast will be accessed from the south of the site via an existing agricultural laneway. A section of new track will lead from the existing agricultural track to the met mast location adjacent an existing farm yard. A turning head will be constructed adjacent the mast site. The met mast access track will be 3.5m in width and will include drainage.

A construction sequence for the proposed mast is described in Section 3.6.11. Details of the proposed met mast design can be found in the planning application drawings.

3.6 Project Construction

3.6.1 Construction Programme

As discussed in Section 3.5, the construction of the project in its entirety is expected to take between 12 – 18 months. The proposed construction programme upon which assessments in the EIAR have been based is presented in Figure 3-9 below.

Activity	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Mobilisation and site setup												
Site clearance and felling												
Internal access tracks												
Turbine hard standings												
Turbine foundations												
Turbine Installation												
Onsite substation												
Grid connection cable works												
Private electrical network												
Landscaping, reinstatement, demob												

Figure 3-9: Proposed Construction Programme

3.6.2 CEMP

A Construction and Environmental Management Plan (CEMP) is contained in Appendix 3-1 of Volume 3.

The CEMP sets out the key environmental management measures associated with the construction, operation and decommissioning of the proposed project, to ensure that during these phases of the project, the environment is protected, and any potential impacts are minimised.

The final CEMP will be developed further at the construction stage, on the appointment of the main contractor to the project to address the requirements of any relevant planning conditions, including any additional mitigation measures that are conditioned.

The CEMP document is divided into six sections:

Section 1: *Introduction* provides details on the existing site and the proposed project.

Section 2: *Existing Site Environmental Conditions* provides details of the main existing geotechnical, hydrological, ecological and archaeological conditions onsite. These conditions are to be considered by the Contractor in the construction, operation and decommissioning of this proposed project.

Section 3: *Overview of Construction Works*, this section provides an overview of the construction works proposed and drainage and sediment controls to be installed.

Section 4: *Environmental Management Plan (EMP)*, this section defines the work practices, environmental management procedures and management responsibilities relating to the construction of the proposed Annagh Wind Farm in order to meet the specified contractual, regulatory and statutory requirements and ensure implementation of the identified mitigation measures throughout the EIAR.

Section 5: *Safety & Health Management Plan,* this section defines the work practices, procedures and management responsibilities relating to the management of health and safety during the design, construction and operation of the proposed project.

Section 6: *Emergency Response Plan* contains predetermined guidelines and procedures to ensure the safety, health and welfare of everybody involved in the project and to protect the environment during the construction phase of the proposed project.

3.6.3 Construction Activities

In the event that the Planning Authority decides to grant planning permission for the proposed project, tree felling, upgrading of existing site tracks and the provision of new site tracks will precede all other activities. Drainage infrastructure will be constructed in parallel with the track construction. This will be followed by the construction of the turbine hardstanding areas and foundations.

In parallel with these works the on-site electrical works i.e. the sub-station and internal cable network as well as off-site connection works to the national grid will be completed. Construction techniques are outlined in the CEMP in Appendix 3-1.

The hours of construction activity will be limited to avoid unsociable hours as per Section 8.5 (d) of the code of practice for BS 5228: Part 1: 1997. Construction operations shall generally be restricted to between 08:00 hours and 19:00 hours Monday to Saturday. It should be noted that it may be necessary to commence turbine base concrete pours earlier due to time constraints incurred by the concrete curing process.

Work on Sundays or public holidays will only be conducted in exceptional circumstances or in an emergency. Additional emergency works may also be required outside of normal working hours as quoted above. Further details on working hours and restrictions of same are provided in the CEMP in Appendix 3.1.

3.6.4 Felling

In advance of construction works, clearance felling will commence on site and is expected to take up to 2 months. The felling area proposed is the minimum necessary to construct the proposed project and comply with any environmental mitigation. The felling will be the subject of a Felling Licence Application to the Forest Service prior to construction as per the Forest Service's policy on granting felling licenses for wind farm developments.

3.6.5 Site Access Tracks and Drainage

Access tracks are required to facilitate the construction of the proposed wind farm site and to provide access to each of the turbines. Drainage infrastructure will be constructed in parallel with the access track construction.

Existing drainage is extensive throughout the wind farm site and shall be maintained wherever possible and upgraded as required to meet the requirements of the proposed wind farm drainage design. SuDS design approach shall ensure that existing drainage patterns shall be maintained throughout the wind farm site.

The drainage system for the existing tracks and roads will largely be retained. It is proposed to upgrade approximately 0.38km of existing agricultural tracks on the approach to the proposed substation. All track widening will be undertaken using clean uncrushable stone with a minimum of fines. This will involve tree felling and hedge trimming and the upgrade of existing roadside ditches to allow widening.

3.6.6 Cable Trenches

The proposed grid connection cable route is indicated in Figure 3-4. As part of the scoping and consultation process for the project, searches of existing utility services were carried out to identify areas where major assets exist such as high voltage electricity cables or gas mains. Private utility and telecommunications companies were also consulted during this period. In advance of the construction phase records of services such as watermains, sewers, gas mains and other power cables will be obtained from the relevant service providers. Cable detection tools, a ground penetrating radar and slit trenches will be used, as appropriate, to verify the exact locations of existing services. The final locations of the proposed cable routes in the public roads and in the verge along the public road will be within the area indicated and assessed in this EIAR and will minimise conflicts with other services.

It is desirable that a minimum separation distance of 300mm will be maintained with existing services. New cable ducts will be laid below existing services wherever possible.

For cable trenches located in public roads, the contractor will excavate cable trenches and then lay high density polyethylene (HDPE) ducting in the trench in a surround of cement bound material (CBM). A rope will be inserted into the ducts to facilitate cable-pulling later. The as-constructed detail of the cable duct locations will be carefully recorded. Cable marker strips will be placed above the ducts and the two communication ducts will also be laid.

An additional layer of cable marker strips will be laid above the communication ducts and the trench back-filled. Back-filling and reinstatement in public roads will be to a specification to be agreed with the road authority.

A similar construction methodology will apply for cable trenches laid within site access tracks. In this case the cable-ducts will generally be laid when the track is being constructed and will follow the edge of the site access tracks. The trenches within these locations will generally be backfilled using the excavated material.

Figure 3-10: Cable Duct Laying in Trefoil Configuration

The following is a synopsis of the key activities for the installation of cabling:

- All relevant bodies i.e. ESBN, Gas Networks Ireland, Eir, Cork County Council, Irish Water etc. will be contacted and all drawings for all existing services will be sought to confirm the conditions identified in this EIAR.
- Immediately prior to construction taking place the area where excavations are planned will be surveyed and all existing services will be identified, and temporary warning signs erected where necessary.
- For cable works in the public road, the traffic management plan will be implemented. 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.
- An excavator will be used to excavate the trench to the dimensions of approximately 600mm wide by approximately 1.2m deep.
- A silt filtration system will be installed on all existing drainage channels for the duration of the cable construction to prevent contamination of anywatercourse.

- Any ingress of ground water will be removed from the trench using submersible pumps and pumped to the nearest available existing drainage channel following filtration.
- Once the trench has been excavated, a bedding layer of sand or 15 Newton concrete will be installed and compacted. All concrete will be offloaded directly from the concrete truck into the trench.
- PVC ducts for electrical and communication cables will be installed on top of the compacted base layer material in the trench.
- Once the ducts have been installed, couplers will be fitted and capped to prevent any dirt etc. entering the unjointed open end of the duct. In poor ground conditions, the open end of the duct will be shimmed up off the bed of the trench to prevent any possible ingress of water and dirt into the duct. The shims will be removed once the next length of duct has been joined to the duct system.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to ensure recording of exact location of the ducts, and hence the operational electricity cable. These 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 compacted.
- Spacer templates will be used during installation to ensure 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) or excavated material (off 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, road verge, or agricultural land will be reinstated as per its original condition or to the requirements of the Cork Area Engineer.
- Precast concrete cable joint bays will be installed within excavations in line with the trench. The cable joint bays are backfilled and the finished surface above the joint bay reinstated as per its original condition. The cable joint bays are re-excavated a second time during cable pulling and jointing, after which the finished surface above the joint bays is reinstated again to its original condition.
- When trenching and ducting is complete, the installation of the grid connection cable will commence between the wind farm onsite sub-station to the existing Charleville Substation.
- Construction work areas and traffic management measures will be setup at 2 no. consecutive cable joint bays simultaneously. 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 is pulled through.
- The cables are jointed within the precast concrete cable joint bays.
- The finished surface above each cable joint bay is reinstated to its original condition, and the construction work area removed.

For simplicity, each cable circuit is referred to as a cable in the remainder of this document.

3.6.7 Watercourse Crossings

Watercourse crossings can generally be classified as follows:

- Existing structures (bridges or culverts) that need to be crossed by infrastructure (access tracks or cables) associated with the proposed project, without a need to modify the existing structure;
- Installation of new structures to facilitate the crossing of existing watercourses by infrastructure associated with the proposed project;
- Existing structures that need to be either replaced or upgraded to facilitate the crossing of existing watercourses by infrastructure associated with the proposed project; and
- Crossing of existing open streams or drains by cable ducts.

As described in Section 3.5.10, there is a single watercourse crossings required for new access tracks within the proposed main wind farm site. The watercourse crossing method is detailed in Table 3-3.

The proposed method for crossing the existing watercourse along the grid connection route is described in Table 3-4. Construction details outlining crossing methods for watercourses listed in Table 3-3 and Table 3-4 can be found in the accompanying planning drawings.

The methodology/sequence of works associated with the proposed watercourse crossing methods are described below.

3.6.7.1 Single-span Bridge Crossing at the Oakfront Stream

As described in Section 3.5.10, the method for crossing the Oakfront Stream within the wind farm site is by single-span concrete bridge. It is proposed to construct a clear span bridge at this location to minimise environmental impacts by avoiding instream works. Drawing P2359-1700-0001 illustrates the proposed bridge structure.

The bridge will be of adequate length and will be designed to ensure that no in-stream works will be required and that the existing stream banks are not disturbed during construction. Sufficient free-board will be allowed for in the proposed bridge designs to allow for 1 in 100-year fluvial flood conditions. In order that flood flows would not be obstructed, the stream crossings will be sized to convey a 1 in 100-year flood flow with a 20 % allowance for Climate Change.

So as not to interfere in any way with the bed or bank of the watercourse, bridge foundations will be designed and positioned at least 2.5m from the river bank. Silt fencing will be erected at the location of the crossing.

The beams of the bridge will be precast off site and transported to the site for installation. The beams will house a flat formation of precast ducts to allow for both the export grid connection cable and internal circuit cables to cross the stream at this point. Cover of 450mm will be provided in the deck between the bridge surface and the 38kV export cable ducts.

For the construction of the bridge crossing, the following methodology shall apply:

- Construction of the water crossing will be scheduled to adhere with fisheries seasonal restrictions.
- The access road on the approach to the watercourse will be completed to a formation level which is suitable for the passing of plant and equipment required for the installation of the watercourse crossing.
- All drainage measures, including check-dams and /or silt traps, along the proposed road will be installed in advance of the works.
- All earthworks adjacent to the crossing locations will be carried out so as to prevent soil entering the watercourse.
- Safe access over the stream for this installation will be via a steel walkway & handrail which will span the stream.
- Excavation near river banks is required to install and secure pre-cast concrete abutments meaning that dry instream working conditions will need to be established.
- Abutments will be set back 2.5m from 1% AEP flood height (100-year event). It is envisaged that dry working conditions at these sites will be maintained by retaining the existing bank and using a short section of sand bag cofferdam. This will isolate flow either side of the channel in sequence, to allow dry working conditions while each abutment is installed. The required working area is relatively small for each abutment and the cofferdam set-up allows continuous flow during the short construction period.
- Strong polyethylene bags filled with clean sand will be used and will be wrapped between geotextile to create watertight conditions. Once complete, the water retained by the coffer dam within the work area will be pumped out to a sediment retention device before being discharged, so as to create the dry working area.
- On alternate sides of the stream, within the sequenced cofferdam set-ups, the base will be excavated to rock or competent stratum with a mechanical excavator.
- The foundations and abutments will be constructed using a pre-cast concrete section and will be lifted into place on the base. The area around the abutments up to access road level will be infilled with a structural fill.
- Once each abutment is in place and secured with structural fill, the pre-cast concrete deck will be laid down on the abutments, anchored and a thin screed of concrete will be poured on top.
- When the concrete deck is connected to the abutments, the filling and compaction of the road will be completed.
- The access road leading to and from the crossing will be profiled using cut from other areas across the site. Where necessary, depending on the quality of the ground, clean imported fill with low fines content may be required.
- Cables will be pulled through the bridge deck following completion of the bridge structure.

3.6.7.2 Horizontal Directional Drilling (HDD) Under Existing Structure (Electrical Cables)

HDD will be employed at 1 no. location along the proposed grid connection route as part of the project as shown on the site layout plans. HDD will be employed for the crossing of an existing watercourse, the Rathnacally Stream.

The operation shall take place from one side of the watercourse within the public road corridor and will be carried out by an experienced HDD specialist. The installation of the crossing is expected to take place in a single day under one mobilisation.

In the case of HDD operations within the public road corridor, the works shall be carried out in accordance with measures described in the Traffic Management Plan contained within the CEMP in Appendix 3-1.

The process will involve setting up a small tracked drilling rig on one side of the watercourse at least 10m back from the stream bank.

A shallow starter pit will be excavated at the point of entry and shall be located at a sufficient distance from the watercourse to achieve a minimum clearance depth below the bed of the watercourse. A pilot hole will be bored as per the agreed alignment and shall be tracked and controlled using a transmitter in the drill head. By tracking the depth, position and pitch of the drill head the operator can accurately steer the line of the drilling operation. The drilling operation is lubricated using a fluid. When the pilot hole has been drilled to the correct profile, its diameter is increased if necessary to match the external diameter if the cable duct. The flexible plastic ducting is then pulled through the pre-drilled hole and sealed at each end until required for cable installation.

A detailed method statement with site specific mitigation measures for this activity is included in the CEMP accompanying this planning application.

Minimum environmental protection measures to be implemented on site shall include the following:

- A site-specific drilling design, risk assessment and method statement shall be prepared by the contractor prior to the works.
- If drilling fluids are required, a biodegradable fluid such as CLEARBORE shall be used rather than Bentonite.
- HDD operations to be limited to daytime hours and conditions when low levels of rainfall are forecast.
- The depth of the bore shall be at least 3m below the bed of the watercourse.
- Visual inspection to take place at all times along the bore path of the alignment.
- A field response plan to minimize loss of returns of drilling fluid and actions to restore returns shall be provided.
- Silt fences will be constructed around proposed work areas prior to commencement of works.
- No refuelling will take place within 50m of the watercourse or any sensitive habitats.
- Pre-construction verification surveys shall take place at drilling sites to confirm the presence of any sensitive species.
- A qualified biological monitor will be onsite for the duration of the drilling operation.

The depth of the bore shall be at least 3m below the level of the public road and stream bed. A detailed survey of buried services within the public road to confirm the conditions predicted in this EIAR will be carried out by the contractor prior to commencement of the operation. The council will be made aware in advance of the operation and invited to oversee the activity.

The location of the launch and reception pits will be adequately spaced from the carriageway to ensure the bore is at such depth as not to conflict with the drainage or surface of the road or associated infrastructure.

There is sufficient room available to accommodate the necessary equipment. The cables will be laid at sufficient depth below the road to stay below the drainage and without impacting on the road foundations.

3.6.7.3 Standard Trench Crossings of Existing Culverts or Services (Electrical Cables)

For the crossing of buried pipe drains, culverts or services, if encountered, ducts shall be installed above or below the existing infrastructure as previously described.

When crossing existing culverts or buried services, the following methodology will be employed:

- The general method of trench construction will follow the procedure outlined above for Installation of cable ducting.
- The service infrastructure shall be located and marked by an engineer in accordance with the Code of Practice for Avoiding Underground Services.
- All services will be safeguarded and protected in accordance with the asset owner's specifications.
- Within 500mm of the existing service, hand digging will be employed to expose it.
- Cable ducts shall pass over or under the existing service, depending on the depth of the service and other constraints. Figure 3-11 shows design details for ducts passing in flat formation above existing culverts and buried services.
- A minimum separation distance of 300mm shall be maintained between the cable ducts and the existing service.
- Existing services within the trench shall be left in the same condition as they were found. Any issues shall be reported to the asset owner immediately.

Piped Culvert Crossing – Ducting Over Culvert

Where sufficient cover exists above the culvert, the trench will be excavated above the culvert and the ducts will be installed in the trefoil arrangement passing over the culvert where a minimum separation distance of 300mm will be maintained, ensuring no interference in the operation of the culvert. This method of duct installation is further detailed in Figure 3-11.

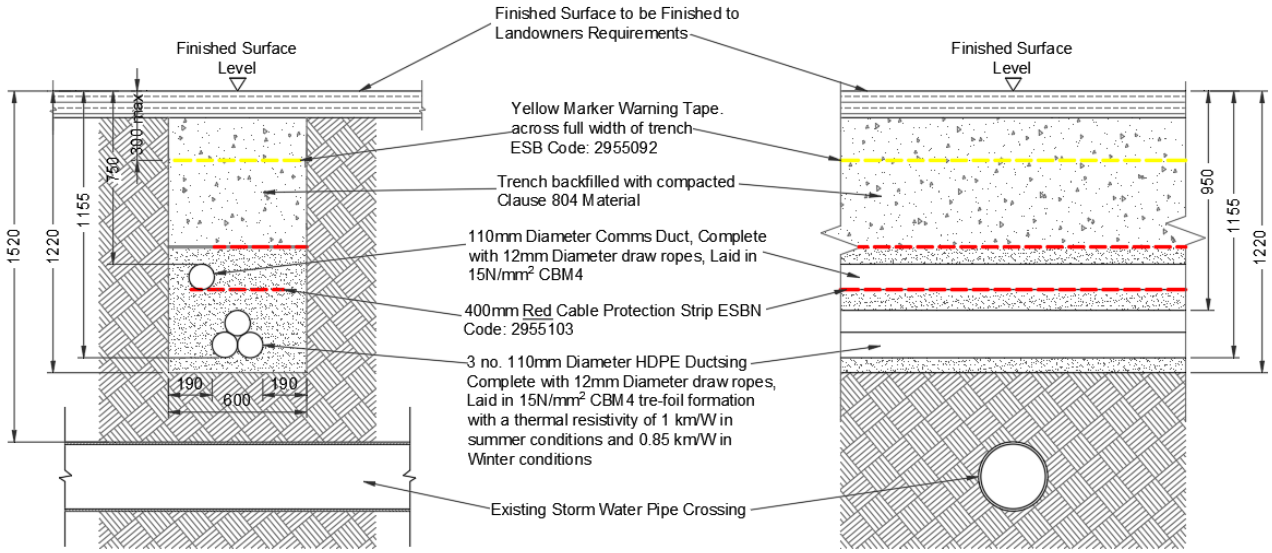

Figure 3-11: Piped Culvert Crossing - Ducting Over Culvert Crossing Details

Piped Culvert Crossings – Ducting Under Culvert

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

This method of crossing is illustrated in Figure 3-12 below. If these duct installation methods cannot be achieved or utilized, the ducts will be installed by alternative means as set out in the following sections.

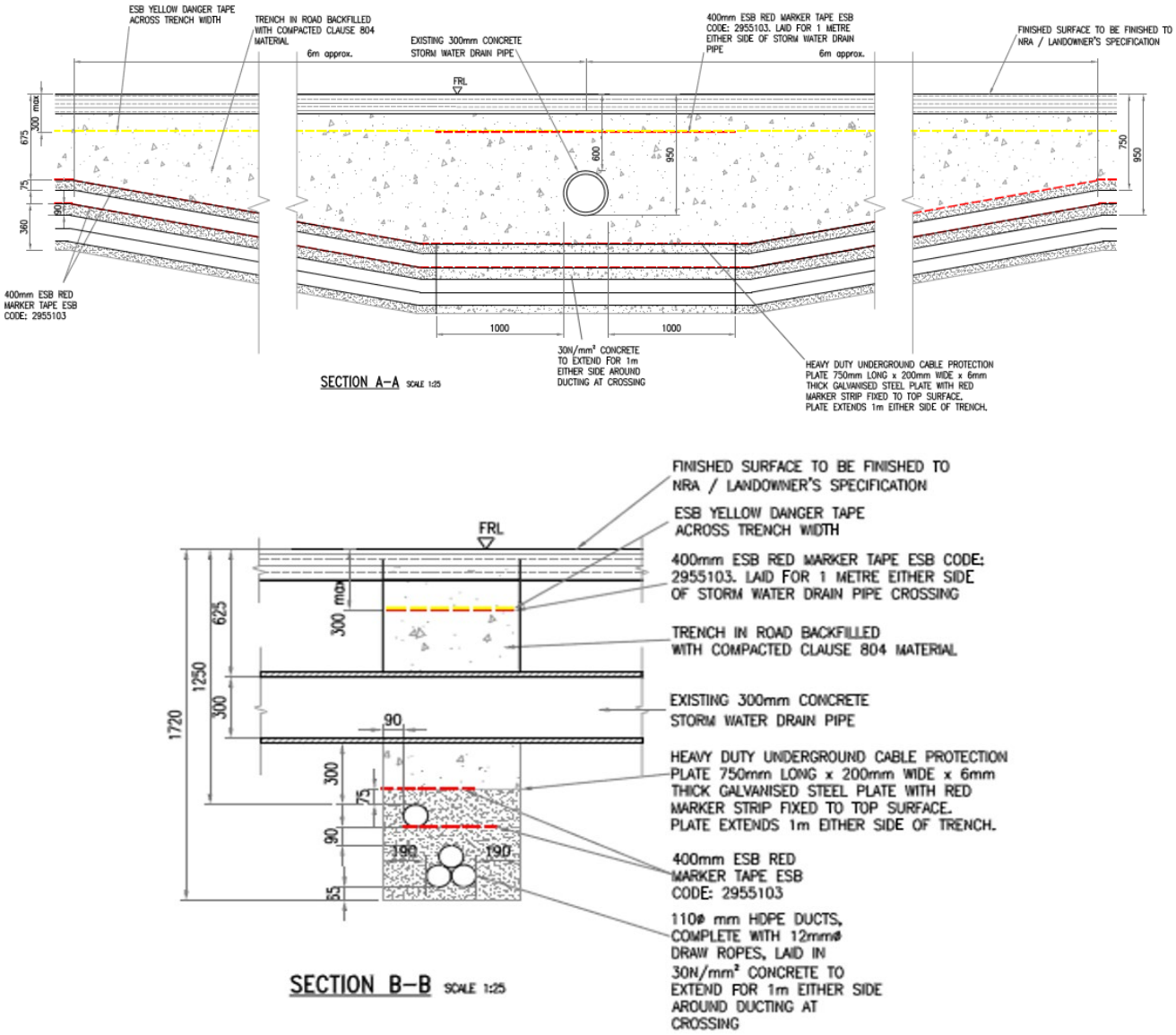

Figure 3-12: Piped Culvert Crossings - Ducting Under Culvert Crossing Details

Flatbed Formation Over Culverts

Where cable ducts are to be installed over an existing culvert where sufficient cover cannot be achieved by installing the ducts in a standard trefoil arrangement, the ducts will be laid in a much shallower trench, the depth of which will be determined by the location of the top of the culvert. The ducts will be laid in a flatbed formation over the existing service and will be encased in a reinforced concrete surround as per ESBN/Eirgrid specification.

After the crossing over the culvert has been achieved, the ducts will return to the trefoil arrangement within a standard trench. This will be done gradually to comply with minimum duct and cable design bend requirements. In transition sections between trefoil and flat formation, the base of the trench shall be graded to eliminate stepping and minimum bedding and surround material will be maintained throughout.

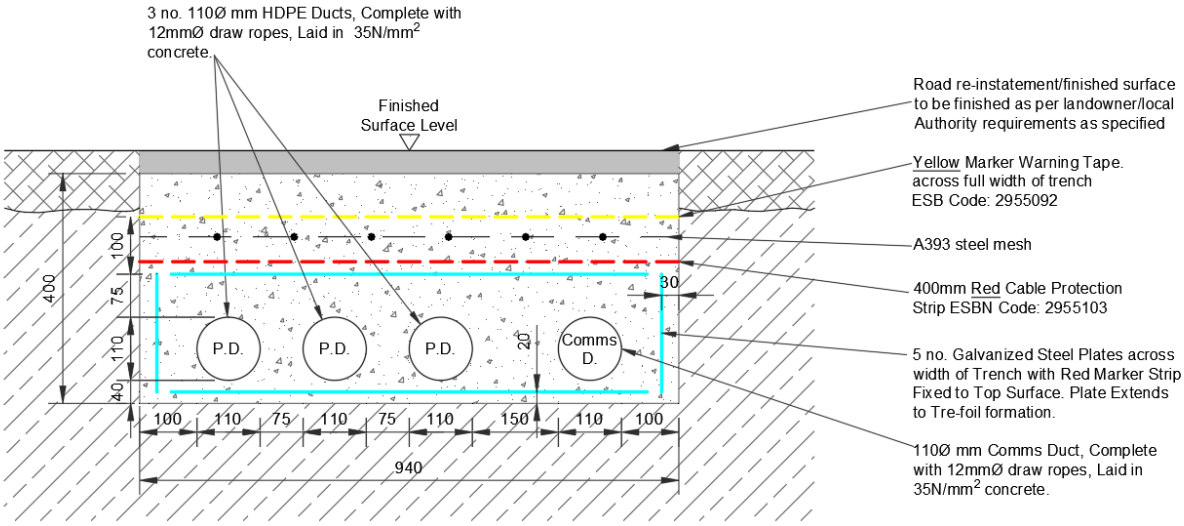

Figure 3-13: Flatbed Cable Formation Detail

3.6.7.4 Minor Watercourses and Drain Crossings (Access Tracks)

It is expected that all minor watercourse and drain crossings within the site will be crossed using piped culverts. Piped culverts will only be used over very short stretches i.e. at track crossings. Pipe culverts will be sized to take the 1 in 100-year flood flow with a 20% allowance for Climate Change. Concrete or HDPE pipes may be used depending on the size of the watercourse to be crossed.

Pipe culverts will be installed in accordance with the design shown in Figure 3-14 below.

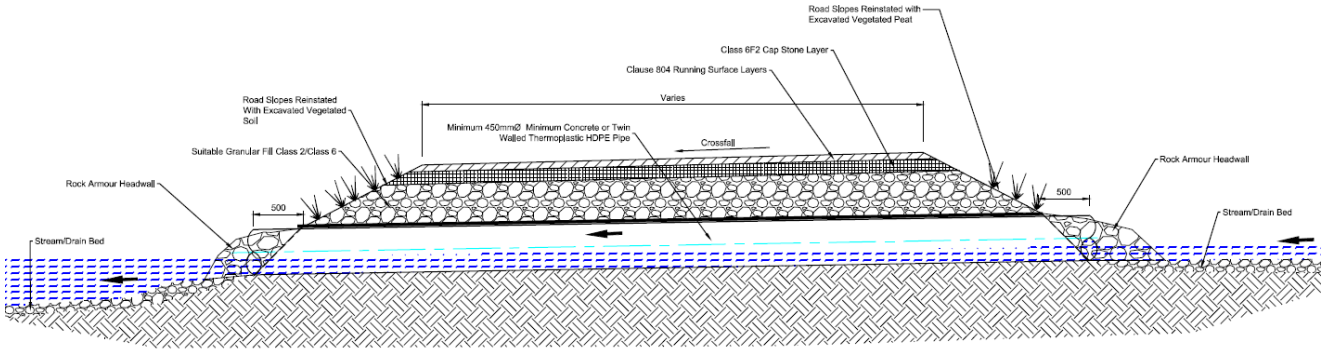

Figure 3-14: Piped Culvert Crossing Long Section

For a minor watercourse/drain crossing using a piped culvert, the following methodology will be used:

- The access track construction will finish at least 10m from the nearside bank of the minor watercourse/drain.
- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in the CEMP in Appendix 3-1.
- Pipe culvert installation will only take place during dry periods.
- The bed of the watercourse will be prepared using a mechanical digger and hand tools to the required levels in accordance with the design.
- A bedding layer will be laid in the base of the minor watercourse/drain using Class 6 aggregate material and blinding to the desired levels in accordance with the design.
- The pipe is laid in one lift or in sections using a crane in accordance with an approved lift plan.
- Bedding material is placed and compacted around the pipe to the desired levels in accordance with the design.
- Suitable bedding material in the form of clean round gravel between 10-100mm diameter, shall be laid in the base of the pipe in accordance with the recommendations set out in *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Watercourses from* Inland Fisheries Ireland.
- The pipe is covered using compacted Class 6N fill material in accordance with the design up to the levels required by the access track sub formation.
- Rock armour headwalls will be constructed where necessary to protect pipe ends and the base of slope embankments on either side of the track.
- For small drain crossings, pipes of suitable diameter will be laid directly into the bed of the drain.

In some cases, where existing internal forest tracks need to be widened, it will be necessary to widen, replace or extend existing pipe drains. In such cases, the above measures shall also be employed.

3.6.7.5 Minor Watercourses and Drain Crossings (Cable Trenching)

For a minor watercourse/drain crossing, the following methodology will be used.

- The cable trench construction will finish at least 10m from the nearside bank of the minor watercourse/drain.
- No water flow shall be present in the watercourse/drain during the works. Duct installation will only take place during dry periods to ensure no in-stream works and an environmental monitor shall supervise the works.
- All environmental mitigation measures will be implemented locally in advance of the works, in accordance with the measures outlined in the CEMP in Appendix 3-1.
- The bed of the watercourse will be excavated using a mechanical digger and hand tools to the required levels in accordance with the design along the alignment of the cable route.
- Once the trench has been excavated, a bedding layer of sand will be installed and compacted.
- PVC ducts for the electrical and communications cables will be installed on top of the compacted base layer material in the trench.

- Once the ducts have been installed, couplers will be fitted and capped to prevent any dirt etc. entering the unjointed open end of the duct.

  In poor ground conditions, the open end of the duct will be shimmed up off the bed of the trench to prevent any possible ingress of water and dirt into the duct. The shims will be removed once the next length of duct has been joined to the duct system.
- The as-built location of the installed ducts will be surveyed and recorded using a total station/GPS before the trench is backfilled to ensure recording of exact location of the ducts, and hence the operational electricity cable. These 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 or will be carefully installed in the trench around the ducts so as not to displace the duct and compacted.
- A red cable protection strip will be installed above duct surround layer of material.
- A layer of excavated material will be installed on top of the duct surround material to the correct level.
- Yellow marker warning tape will be installed for the full width of the trench.
- The bed of the watercourse, stream banks and agricultural land will be reinstated as per their original condition.

3.6.8 Turbine Hardstands

A turbine hardstanding area will be constructed at the base of each turbine to provide a solid area for the main installation crane that will be used to erect the turbine and for the assembly of the turbine.

The stone required for the construction of the turbine hardstandings will be sourced from a licenced quarry in the vicinity of the wind farm site. The most proximate quarry with the appropriate material has been identified at Lackanamona, Mallow, County Cork. This is discussed further in Chapter 13: Traffic and Transportation.

Hard standing formation will consist of a minimum 500mm hardcore on geo-textile membrane. The construction methodology for newly constructed hardstandings will be as follows:

- The formation will be prepared to receive the geotextile membrane.
- Stone will be placed and compacted in layers to minimum 500mm depth.
- A drainage ditch will be formed, within the excavated width and along the sides of the hard standing.
- Surplus topsoil will be placed along the side of the hard standing and dressed to blend in with surrounding landscaping.
- Surplus excavated subsoil will be used for reinstatement throughout the wind farm site.

3.6.9 Turbine Foundation

The wind turbine foundations will be constructed using standard reinforced concrete construction techniques and will be designed as standard shallow foundations.

Detailed construction methodologies for both standard and piled foundations are provided in the CEMP in Appendix 3.1.

Turbine foundations will be designed to Eurocode Standards. Foundation loads will be provided by the wind turbine supplier, and factors of safety will be applied to these in accordance with European design regulations. The turbine will be anchored to the foundation as per the turbine manufacturer's guidelines which will be incorporated in the civil foundation design.

The base of the foundations are excavated to competent bearing strata. Based on site investigations carried out to date, it is expected that turbines for Annagh Wind Farm will have foundation depths of 4m and a base diameter of 22m.

Excavated soil will be placed in the temporary storage areas adjacent to the turbines in accordance with the soil management plan contained within the CEMP in Appendix 3.1. Formwork and reinforcement are placed, and the concrete poured. Once the concrete is set the earthing system is put in place and the foundation is backfilled with suitable material.

3.6.10 Turbine Erection

Once the turbine components arrive on site they will be placed on the hardstand and lay down areas prior to assembly. The towers will be delivered in sections and each blade will be delivered in a separate delivery. Once there is a suitable weather window the turbine will be assembled.

It is anticipated that each turbine will take approximately 3 to 4 days to erect (depending on the weather), requiring two cranes. Finally, the turbines will be commissioned and tested.

It is expected that the construction phase, including civil, electrical and grid works, and turbine assembly will take between approximately 12-18 months.

3.6.11 Erection of Permanent Met Masts

The works shall be carried out by a small crew in line with the following sequence of works:

- The site of the mast location shall be marked out and the necessary area cleared of vegetation.
- Mark out mast base in accordance with detailed design drawings.
- A temporary access track shall be extended towards the mast location from the existing agricultural track. The access track shall be up to 3.5m in width. Temporary and permanent drainage infrastructure shall be extended also.
- General construction methods for the above access track and hard standing shall match those described in Sections 3.6.5 and 3.6.8 however the dimensions and stone depth requirements of the access infrastructure will be considerably less than that required for that serving the wind turbine construction.
- A temporary crane pad of approximately 10m x 10m in size shall be put in place in front of the proposed mast location. Bog mats will be used for the temporary crane pad.
- The foundation of the mast shall be excavated followed by shuttering, steel fixing and finally concrete pouring by ready mix truck. Excavation and concrete operations shall be carried out in accordance with the CEMP.
- Following crane setup, the mast sections shall be delivered and unloaded by truck.

- Mast sections will be assembled on the ground.
- In accordance with an agreed lifting plan, mast sections shall be lifted by crane into place. Wind speeds shall be monitored at all times during lifting operations by the lead climber and crane operator.
- Mast sections shall be bolted together by climbers.
- Following erection of main mast sections, lightning protection and other ancillary components shall be fixed to the mast.

The masts will be decommissioned using a similar methodology as the construction except in reverse.

3.6.12 Waste Management

A Waste Management Plan for the project has been included in the CEMP in Appendix 3.1.

The Developer, in conjunction with appointed contractor, will prevent, reduce, reuse and recover as much of the waste generated on site as practicable and ensure the appropriate transport and disposal of residual waste off site to licensed facilities. This is in line with the relevant National Waste Management Guidelines and the European Waste Management Hierarchy, as enshrined in the Waste Management Act 1996, as amended.

Any waste generated during the project construction phase will be collected, source separated and stored in dedicated receptacles at the temporary compound during construction. It will be the responsibility of the contractor for the main construction works (when appointed) to nominate a suitable site representative such as a Project Manager, Site Manager or Site Engineer as Waste Manager who will have overall responsibility for the management of waste.

The waste manager will have overall responsibility to instruct all site personnel including sub-contractors to comply with on-site requirements. They will ensure, at an operational level, that each crew foreman is assigned direct responsibility.

Waste Generated

It is envisaged that the following categories of waste will be generated during the construction of the project:

- Municipal solid waste (MSW) from the office and canteen
- Construction and demolition waste
- Waste oil/hydrocarbons
- Paper/cardboard
- Timber
- Steel

Sanitary waste will be removed from site by a licensed waste disposal contractor. All portaloo units located on site during the construction phase will be operated and maintained in accordance with the manufacturer's instructions and will be serviced under contract with the supplier. All such units will be removed off-site following completion of the construction phase.

A fully authorised waste management contractor will be appointed prior to construction works commencing. This contractor will provide appropriate receptacles for the collection of the various waste streams on site and will ensure the regular emptying/and or collection of these receptacles.

Waste Minimisation/Reduction

All efforts will be made by site management to minimise the creation of waste throughout the project. This will be done by:

- Material ordering will be optimised to ensure only the necessary quantities of materials are delivered to site;
- Material storage areas will be of a suitable design and construction to adequately protect all sorted materials to ensure no unnecessary spoilage of materials occurs which would generate additional waste;
- All plant will be serviced before arriving on site. This will reduce the risk of breakdown and the possible generation of waste oil/hydrocarbons on site;
- All operators will be instructed in measures to cut back on the amount of wastage for trimming of materials etc. for example cutting of plywood, built into the amount ordered;
- Educating foremen and others to cut/use materials such as ply wisely for shutters etc.;
- Prefabrication of design elements will be used where suitable to eliminate waste generation on site;
- Where materials such as concrete are being ordered, great care will be practiced in the calculation of quantities to reduce wastage.

Waste Reuse

When possible, materials shall be re used onsite for other suitable purposes e.g.:

- Re-use of shuttering etc. where it is safe to do so;
- Re-use of rebar cut-offs where suitable;
- Re-use of excavated materials for screening, berms etc.;
- Re-use of excavated material etc. – where possible will be used as suitable fill elsewhere on site for site tracks, the hardstanding areas and embankments where possible;

It is important to clarify that any excess excavated material that will be used for fill, re-instatement, or similar activities, within the wind farm site boundary is not technically categorised as a waste material under relevant waste legislation, rather this material is exempt from waste classification.

Article 2 (1) (c) of Directive 2008/98/EC on waste, transposed through Article 26 (1) (c) of the European Communities (Waste Directive) Regulations (S.I. 126 of 2011) identifies the following as being an exclusion from the scope of the Directive:

> *"uncontaminated soil and other naturally occurring material excavated in the course of construction activities where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated".*

It is envisaged that surplus material will be re-instated in its natural condition on the site from which it was excavated, this material is not considered as waste.

Waste Recycling, Recovery & Disposal

In accordance with national waste policy, source separation of recyclable material will take place. This will include the provision of receptacles for the separation and collection of dry recyclables (paper, cardboard, plastics etc.), biological waste (canteen waste) and residual waste.

Receptacles will be clearly labelled, signposted and stored in dedicated areas.

The following source segregated materials containers will be made available on site at a suitable location:

- Timber;
- Ferrous metals;
- Aluminium;
- Dry mixed recyclables;
- Packaging waste;
- Food waste.

The materials will be transported off-site by an authorised contractor to a permitted recovery centre and these materials will be processed through various recovery operations.

Residual waste generated on-site may require disposal. This waste will be deposited in dedicated receptacles and collected by the permitted waste management contractor and transported to an appropriate facility. All waste movements will be recorded. Records will be held by the waste manager on-site.

Authorised waste management facilities have been identified in the greater County Cork area as listed on the Local Authority Waste Facility Register by the National Waste Collection Permit Office. The authorised waste facilities utilised during the construction and decommissioning of the proposed project will depend on the contractors appointed and will depend on the capacity of the various facilities at the time of construction and decommissioning. A list of existing licensed waste facilities in proximity to the wind farm site is presented in Table 3-5 below. These facilities were identified at the time of the preparation of this EIAR.

Table 3-5: Licensed Waste Facilities in the Vicinity of Annagh Wind Farm

Licensed Waste Facility Location	Type of Waste
Tooreen South/Glashaboy South Carrignavar	Soil and Stone
Ballykenly, Glanworth	Soil and Stone
Newcastle, Blarney	Concrete, bricks, tiles, ceramics, soil and stone
Booladurragha North, Ballynoe, Mallow	Sludges from on-site effluent treatment
Spa Road, Mallow	Plastics, materials unsuitable for consumption or processing, sawdust, shavings, cuttings, wood, paper, cardboard, copper, bronze, brass, aluminium, lead, zinc, iron, steel, cables, glass, textiles, mixed construction and demolition waste, biodegradable kitchen and canteen waste, mixed municipal waste and other non-biodegradable wastes.

In relation to quantities of waste, materials excavated during the construction phase will be reused on-site. Therefore, excavated materials are not expected to require export from the construction site as detailed in Chapter 9. It is expected that general waste and recyclables will be collected from the site no more than 2 times per week by Heavy Goods Vehicle (HGV). This has been factored into the traffic calculations detailed in Chapter 13. Waste management will be coordinated in line with the Waste Management Plan included in the project CEMP, located in Appendix 3.1, Volume 3 of this EIAR.

Waste is not expected to be produced during the operation phase of the proposed development.

3.7 Operation and Lifespan

During the operational period, the turbines will operate automatically on a day-to-day basis, responding by means of anemometry equipment and control systems to changes in wind speed and direction. The turbine manufacturer or a service company will carry out regular maintenance of the turbines.

Scheduled services will occur twice a year and takes place over a 3-4 week period. The operation of the wind turbines will be monitored remotely, and a caretaker will oversee the day to day running of the proposed wind farm.

The expected physical lifetime of the turbines is approximately 35 years, and permission is sought for a 35-year operation period commencing from full operational commissioning of the wind farm. It should be noted that section 7.2 of the Planning Guidelines 2006 includes for the following:

> *'The inclusion of a condition which limits the life span of a wind energy development should be avoided, except in exceptional circumstances'*

In this respect, the applicant requests the grant of permission is on the basis of a 35-year operational period from the date of full operational commissioning of the wind farm.

3.8 Decommissioning

On decommissioning, cranes will disassemble the above ground turbine components which will be removed off site for recycling. All the major component parts are bolted together, so this is a relatively straightforward process.

The foundations will be covered over and allowed to re-vegetate naturally. Leaving the turbine foundations in situ is considered a more environmentally sensible option as to remove the reinforced concrete associated with each turbine would result in environmental nuisances such as noise and vibration and dust.

It is proposed that the internal site access tracks and turbine hard standings will be left in place. The access tracks will continue to be used for forestry and agriculture access. Turbine hardstandings shall be covered over with topsoil and left to revegetate naturally.

It is expected that the temporary accommodation works along the TDR will not be required for the decommissioning phase as turbine components can be broken up on site and removed using standard HGVs.

Grid connection infrastructure including substation and ancillary electrical equipment shall form part of the national grid and will be left in situ.

It is expected that the decommissioning phase will take no longer than 6 months to complete.

A detailed decommissioning plan will be agreed in advance of construction with Cork County Council.

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 4 - POLICY

Prepared for: EMPower

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4. POLICY AND PLANNING

4.1 Introduction

This Chapter of the EIAR outlines current EU, national, regional and local policy (where relevant) in combination with legislation relating to the proposed Annagh Wind Farm Project.

The Irish Planning Policy system is set within a hierarchical structure, as identified in Figure 4-1. National policy is informed by EU Directives, Planning Legislation, Ministerial Guidelines, Government Policy and Capital programmes.

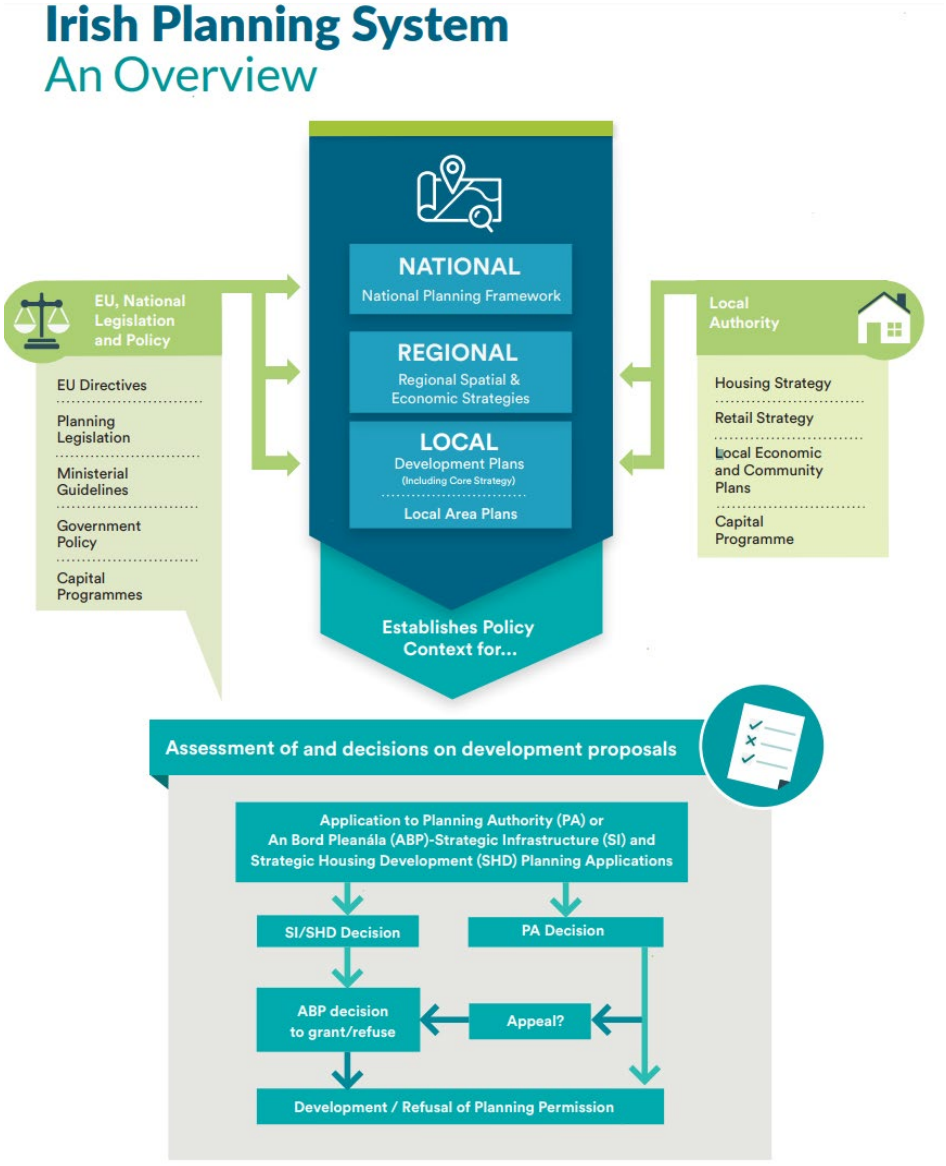

Figure 4-1: Irish Planning System – An Overview Extract from the National Planning Framework – Ireland 2040

International and European legally binding agreements to reduce the reliance on fossil fuels and to manage climate change internationally have been adopted into Ireland's National Energy Policy. This section of the EIAR outlines how these legally binding agreements are being facilitated through national energy and climate policy with a clear mandate to support onshore wind energy development within the state. The importance in complying with the national energy policy at a local level cannot be overstated if Ireland is to achieve its national renewable energy targets.

The latest SEAI figures indicate that Ireland has not met its 2020 renewable energy targets with renewable electricity production at approximately 36.5%, 3.5% below the 40% national target (SEAI, 2020a). Furthermore, the increase in renewable electricity targets to 70% by 2030 indicates the need for significant escalation in renewable energy production in Ireland. The following Chapter sets out how the proposed development complies with national and local energy and planning policy and will contribute towards Ireland's national renewable energy targets.

4.2 International Global Policies

4.2.1 United Nations Framework Convention on Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) is an international environmental treaty negotiated at the United Nations Conference on Environment and Development (UNCED), in Rio de Janeiro in 1992. Its ultimate objective was to achieve "... stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (United Nations, 2013) " There are 195 parties ratified to the Convention and these are subdivided into Annex I, Annex II, Annex B, Non-Annex I and Least Developed Countries.

The Framework Convention specifies the aim of developed (Annex I) parties stabilising their greenhouse gas emissions (carbon dioxide and other anthropogenic greenhouse gases not regulated under the Montreal Protocol) at 1990 levels, by the year 2000. The treaty did not set any limits or binding targets, instead, it provided a framework for negotiating specific international treaties ("protocols") that set binding limits on greenhouse gases. It does, however, require all parties in Annex 1 [Decision 3 CP.5] (of which the European Union 15 (EU 15) forms part of) to prepare and publish National Inventory Reports (NIRs) on emissions. The Environmental Protection Agency (EPA) is responsible for the preparation of Ireland's NIR.

The Conference of the Parties (COP) is the highest body of the UNFCCC and consists of environment ministers who have met annually since 1995 to assess progress in dealing with the issue of climate change. At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal. The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C above pre-industrial levels and to limit the increase to 1.5°C. Under the agreement, Governments also agreed on the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries and to undertake rapid reductions thereafter in accordance with the best available science.

The International Panel on Climate Change (IPCC) has put forward its clear assessment that the window for action on climate change is rapidly closing and that renewable energy sources such as wind will have to grow from 30% of global electricity at present to 80% by 2050 if we are to limit global warming to well below 2°C above pre-industrial levels in accordance with the COP 21 agreement. Former Minister Kelly remarked in 2015 that "As a nation we must do everything in our power to curb our emissions".

In this regard, the Government enacted the Climate Action and Low Carbon Development Act 2015 and the Climate Action and Low Carbon Development (Amendment) Act 2021 which provides for the approval of plans by the Government in relation to climate change for the purpose of pursuing the transition to a low carbon, climate resilient and environmentally sustainable economy.

4.2.2 Kyoto Protocol

In 1997, at one of the COPs, the Kyoto Protocol which set legally binding obligations for developed countries to reduce their greenhouse gas (GHG) emissions in two commitment periods was established.

The first commitment period (2008 - 2012) applied to emissions of six main greenhouse gases (carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6)), and set targets for:

- A 5% overall reduction in the emission of greenhouse gases in developed countries.
- An average 8% reduction below 1990 levels within the EU.

The EU 15 and other European countries (some of which subsequently acceded to the EU) have individual GHG reduction and limitation targets under the Kyoto Protocol.

Together, these European countries committed to achieve an annual emission reduction of 456 Mt CO2-equivalent (CO2eq) below 1990 levels over the period 2008 to 2012 (European Environmental Agency 2010).

Ireland's contribution is a limit of 13% above 1990 greenhouse gas emission levels which corresponds to an average limit of 62.8 million tonnes (Mt) of carbon dioxide equivalent (CO2eq) per annum during the period 2008 – 2012. Countries not fulfilling their obligations are forced to purchase carbon credits on an open market from compliant countries.

The second commitment period applies to emissions from 2013 - 2020. All members of the European Union have binding targets in the second commitment period.

The EU 27 countries committed to reducing their GHG emissions by at least 20% by 2020 compared to 1990 levels and to increase this commitment to a 30% reduction if other major emitting countries agree to similar targets under a global climate agreement.

Developing countries do not have binding targets under the Kyoto Protocol, but are still committed under the treaty to reduce their emissions. Actions taken by developed and developing countries to reduce emissions include support for renewable energy, improving energy efficiency, and reducing deforestation.

One of the key mechanisms introduced under the Kyoto Protocol is the international emissions trading scheme which allows developed countries to trade their commitments. They can trade emissions quotas among themselves and can also receive credit for financing emissions reductions in developing countries.

The EU Emission Trading Scheme (ETS) came into operation on 1 January 2005 and was introduced to facilitate Member States achieve their commitments to limit or reduce greenhouse gas emissions in a cost-effective way. It is the largest such scheme in the world and allows participants to buy or sell emission allowances which means that emission cuts can be achieved at least at cost.

The EU ETS is a 'cap and trade' scheme, in that it caps the overall level of emissions allowed but, within that limit, allows participants in the scheme to buy and sell allowances as they require.

These allowances are the common trading 'currency' at the heart of the scheme. One allowance gives the holder the right to emit one tonne of CO2 or the equivalent amount of another greenhouse gas (CO2eq).

The categories of activity covered by the EU ETS are set out in Annex 1 of the principal Directive (2003/87/EC) and the greenhouse gases to which the Scheme applies to are set out in Annex II of the same Directive.
While all six gases listed in Annex A of the Kyoto Protocol are included in Annex II, not all are in practical terms actually covered by the ETS and the listing of all in Annex II is perhaps a signal of the intention to extend the scheme in the future.

The Scheme operates in periodic cycles that have come to be known as 'phases' as the EU ETS scheme is open ended with no termination date specified. Phase 1 ran from 2005 - 2007 and was known as the commitment period, Phase 2 covered 2008 -2012 (the Kyoto Phase) and Phase 3 extends from 2013 – 2020 and this phase ties in with the EU Commissions end date of 31 December 2020 for its own reduction in greenhouse gases.

Further changes proposed for the ETS commenced in 2013 through Directive 2009/29/EC. In summary Member states, will no longer draw up National Allocation Plans (NAPs) – instead, there will be a single EU-wide cap and allowances will be allocated on the basis of harmonised rules amongst other changes to the trading period etc.

Phase 4 runs from 2021-2030 and aims to improve the ETS as part of a revision to the ETS Directive, concluded in 2018, to achieve the EU's 2030 emission reduction targets in line with the 2030 climate and energy policy framework and as part of the EU's contribution to the 2015 Paris Agreement (EU, 2019). The legislation governing the auctions of emission allowances required to be changed to take into account new rules agreed as part of the 2018 revision of the ETS Directive. The changes concern in particular the use of the common auction platform to monetise the allowances dedicated to the Innovation and Modernisation Fund. This phase will include a reduced emissions allowance at an annual rate of 2.2%, up from 1.74%, increasing each nation's need to cut emissions on an annual basis.

4.3 EU Directives and Policy

This section summarises the previous policies and targets for renewable energy and greenhouse gas (GHG) emissions in Europe up to 2020 in order to provide context and establish the progress made in Ireland over the past two decades to achieve these EU targets. The section then details the latest policies and targets with a view to 2030 and beyond. The various directives and policies of the EU set a clear mandate for each member state to transition to sustainable, renewable energy and reduce greenhouse gas emissions. This is reflected in the theme of European Commission President, Ursula von der Leyen's inaugural 'State of the Union' address delivered on 16 September 2020 which emphasised the need to transform the European economy and society to deal with the climate change emergency.

4.3.1 European Union Targets for 2020 and the Irish Context

The year 2020 was a significant milestone for renewable energy and emissions targets in Europe. The EU Directive on the Promotion of the Use of Energy from Renewable Sources (2009/28/EC) set a target of 20% of EU energy consumption from renewable sources by 2020 and a 20% cut in greenhouse gas emissions by 2020, the so-called 20:20:20 plan.

As part of this Directive, Ireland's overall national target for the share of energy from renewable sources in gross final consumption of energy in 2020 was 16% (increased from 3.1% in 2005). For renewable electricity alone, Ireland set a national target of 40% by 2020 as outlined in the National Renewable Energy Action Plan (NREAP). The sectoral components of the overall 16% target are detailed in Table 4-1, which outlines each form of renewable energy supply (RES). The current share of renewable energy in these components is also presented. The latest figures from SEAI detail the 2019 share of renewable energy.

Table 4-1 demonstrates that Ireland has made significant progress in achieving its 2020 renewable electricity targets. Wind energy accounted for 32% of all electricity generated in 2019, the largest contributor of renewable electricity in Ireland.

Table 4-1: Target and Current Share of Renewable Energy in Energy Sectors

Form of Renewable Energy Supply	2018 Position (SEAI, 2020)	2019 Position (SEAI, 2020a)	Target Share For 2020
Electricity (RES-E)	33.2%	36.5%	40%
Heat (RES-H)	6.5%	6.3%	12%
Transport (RES-T)	7.2%	8.9%	10%

Source: SEAI (2020), Renewable Energy in Ireland 2020 Update & SEAI (2020a), Energy in Ireland 2020 Report

In 2008, the EU agreed a climate and energy package that included a target to reduce GHG emissions across the EU by 20% below 1990 levels by the year 2020. This resulted in two pieces of European legislation focusing on reduction in GHG emissions. Directive 2009/29/EC requiring ETS companies to reduce their emissions by 21% below 2005 levels by 2020; and Decision 406/2009/EC requiring Ireland to reduce non-ETS emissions by 20% below 2005 levels by 2020.

According to SEAI (2020a), Ireland achieved approximately 14.6% reduction in GHG emissions compared to 2005 levels. This included an approximate 23% reduction in GHG emissions in the energy sector, indicating renewable energy's significant contribution to the overall reduction in greenhouse gas emissions in Ireland.

Although the final 2020 figures for Renewable Energy and Greenhouse Gas Emissions are not available at the time of preparing this Chapter, it is demonstrated by the progress made towards the 2020 targets as detailed in Table 4-1 that renewable sources of energy have contributed greatly to the achievement of Ireland's energy and emissions targets as set by the EU. This places Ireland in a strong position to continue this progress towards 2030 EU targets, as detailed in the following sections.

4.3.2 2030 Climate and Energy Framework

In October 2014 EU leaders adopted the 2030 Climate and Energy Framework (European Commission, 2014) which was subsequently updated in 2018. The framework provides a long term perspective beyond 2020 targets. The 2030 Climate and Energy Framework sets out three key targets for the year 2030:

- At least 40% cuts in greenhouse gas emissions (from 1990 levels)
- At least 32% share of renewable energy
- At least 32.5% improvement in energy efficiency.

Further to this the European Commission in 2016 published its 2030 emissions targets break down for each Member State. While the overall EU target is a reduction of 40% on 1990 greenhouse gas emissions by 2030, every Member State negotiates an individual target. Ireland will have to reduce its emissions by 30% relative to its 2005 emissions.

Ireland will have 4% one-off flexibility from emissions trading, at the highest end of the ranking. Ireland will have 5.6% flexibility from land use. This is a substantially larger margin than any other Member State except Latvia.

4.3.3 A Roadmap for Moving to a Competitive Low Carbon Economy in 2050

Looking beyond 2020 in compliance with the EC Energy Roadmap 2050, an EU target of at least 27% has been indicated as the share of renewable energy consumed in the EU in 2030. While the Department of Communications, Climate Action and Environment (DCCAE) is currently examining the potential for diversifying Ireland's renewable technology mix in the post-2020 period, the Department recognises that; "as a proven and cost effective technology, onshore wind will remain part of Ireland's generation portfolio out to 2030 and will help to meet Ireland's contribution to the binding EU-wide 2030 renewable energy target". The Roadmap has informed national policy and has influenced the Climate Action Plan (2019) which sets out actions to reduce climate change towards 2050.

4.3.4 Clean Energy for all Europeans Package (2019)

The EU, in 2016, decided to tackle the transition towards clean energy and a carbon-neutral economy by rewriting the EU's energy policy framework to facilitate a clean and fair energy transition. By providing a modern, stable legal environment and setting a clear and common sense of direction, the EU aims to stimulate the necessary public and private investment and bring European added value by addressing these challenges. As a package, the new rules will reinforce consumer rights, putting them at the heart of the energy transition and creating growth and green jobs in a modern economy. They will enable the EU to show leadership in the fight against climate change following the Paris Agreement.

The Clean energy for all Europeans package sets the right balance between making decisions at EU, national, and local level. Member States will continue to choose their own energy mix but must meet new commitments to improve energy efficiency and the take-up of renewables in that mix by 2030. For example, the new rules on the electricity market, which have been adopted, will make it easier for renewable energy to be integrated into the grid, encourage more inter-connections and cross-border trade, and ensure that the market provides reliable signals for future investment. Member States are required to draft plans to prevent, prepare for and manage possible crisis situations in the supply of electricity in coordination with neighbouring Member States, and to enhance the role of the Agency for the Cooperation of Energy Regulators.

In December 2018, the recast Renewable Energy Directive 2018/2001/EU entered into force, as part of the Clean energy for all Europeans package, aimed at keeping the EU a global leader in renewables and, more broadly, helping the EU to meet its emissions reduction commitments under the Paris Agreement.

4.3.5 Recast Renewable Energy Directive (RED2)

In June 2018, an agreement was made in Europe between negotiators for the Commission, the European Parliament, and the Council with regard to increasing renewable energy use in Europe.

The new regulatory framework includes a binding renewable energy target for the EU for 2030 of 32% with an upwards revision clause by 2023. This agreement will help the EU meet the Paris Agreement goals. In terms of renewable energy production, the agreement has achieved:

- A new, binding EU renewable energy target of 32% by 2030, including a review clause by 2023 for an upward revision of the EU level target;
- Improved design and stability of renewable energy support schemes.

The revised renewable energy Directive 2018/2001/EU entered into force in December 2018.

4.3.6 European Green Deal (December 2019)

The European Green Deal is a growth strategy for the EU which aims to transform the EU into a fair and prosperous society, improving quality of life with modern, resource-efficient, and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use. The EU aim to do this by becoming climate-neutral by 2050.

With regard to the supply of clean, affordable and secure energy, the European Green Deal underlines the fact that in order to meet the EU's climate and sustainability goals, all sectors must increase their use of renewable energy and phase out fossil fuels.

The EU aim to increase the greenhouse gas emission reductions targets for 2030 to at least 50% and towards 55%, compared to 1990 levels, in order to achieve net-zero greenhouse gas emissions by 2050. A key principle for achieving this will be to develop a power sector based largely on renewable resources.

Furthermore, the European Commission has indicated an intention to adopt the increased target of 55% as the EU's Nationally Determined Contribution (NDC) under the Paris Agreement by the end of 2020. As well as the target being given legislative force in the EU through the proposed EU Climate Law, it will oblige all EU institutions across all areas of competence, and the Member States, to work collectively to achieve the greenhouse gas emission reduction target of 55%.

4.4 National Policies

National energy and climate policy is derived from the overarching European Policy which aims to unify the European Union in energy and climate goals. The following section sets out the relevant national policies which will influence the development of the country in the coming decades with respect to energy production, carbon neutrality and climate change mitigation.

These policies are supported by the latest Programme for Government (2020) 'Our Shared Future' which presents strong climate governance in rapidly reducing climate change in order to protect and improve public health and quality of life. The government are committed to rapid decarbonisation of the energy sector with an aim of providing the necessary actions to deliver national renewable electricity targets. These government ambitions support the ongoing generation of renewable energy from on-shore wind sources, as detailed in the following section.

4.4.1 Climate Action and Low Carbon Development Act 2015

The Climate Action and Low Carbon Development Act was published in January 2016 by the then Minister for Environment, Heritage and Local Government.

The Act sets out the national objective of transitioning to a low carbon, climate resilient and environmentally sustainable economy in the period up to and including the year 2050. The Act provides for a solid statutory foundation to the institutional arrangements necessary to enable the State to pursue and achieve the "national transition objective".

While there are no explicit targets set out within the Act itself, the legislation obliges the State to take into account any existing obligations of the State under the law of the European Union or any international agreement. In effect, the Act formally obliges the State to adhere to EU targets. The other major feature of the Act is the establishment of an expert advisory council which will advise and make recommendations to the Minister for the Environment. The Climate Action and Low Carbon Development Act has paved the way for national policy support for renewable energy generation and the reduction in greenhouse gas emissions as set out in the following sections.

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

The Climate Action and Low Carbon Development (Amendment) Act 2021, signed into law 23rd July 2021, is an Act to provide for the approval of plans by the Government in relation to climate change for the purpose of pursuing the transition to a climate resilient, biodiversity rich and climate neutral economy by the end of the year 2050. It will establish a legally binding framework with clear targets and commitments set in law, and ensure the necessary structures and processes are embedded on a statutory basis to ensure we achieve our national, EU and international climate goals and obligations in the near and long term. The Act amends the Climate Action and Low Carbon Development Act 2015 to significantly strengthen the framework for governance of climate action by the State in order to realise our national, EU and international climate goals and obligations.

The Act embeds the process of carbon budgeting into law, the Government is required to adopt a series of economy-wide five-year carbon budgets, including sectoral targets for each relevant sector, on a rolling 15-year basis, starting in 2021. This includes a provision for the first two five-year carbon budgets to equate to a total reduction of 51% emissions over the period to 2030, in line with the programme for Government which commits to a 7% average yearly reduction in overall greenhouse gas emissions over the next decade, and to achieving net zero emissions by 2050. This Act will drive implementation of a suite of policies to help us achieve this goal.

The Act also requires for all Local Authorities to prepare individual Climate Action Plans which will include both mitigation and adaptation measures, representing a mandate for Local Authorities to adapt to climate change.

4.4.3 Climate Action Plan (2019)

The Government published a Climate Action Plan (CAP) in June 2019. The CAP resulted from the Irish Government declaring a climate and biodiversity emergency on 9th May 2019. The CAP identifies how Ireland will achieve its 2030 targets for carbon emissions throughout various sectors with a number of actions. The CAP is under its 2 year review and will be fundamental in implementing the Climate Action and Low Carbon Development (Amendment) Bill.

A selection of Actions that are relevant to the proposed Annagh Wind Farm are listed below:

- The CAP sets out an objective to more than double Ireland's onshore wind energy capacity to 8.2GW by 2030 in order to meet new renewable energy targets and reduce emissions.

The CAP states that:

> *"The analysis presented in this Plan shows that it is not only technically feasible to meet our 2030 EU target, but that it is also economically achievable. The majority of the required abatement to 2030 could be achieved by deploying measures that are, over their life-time, either cost-neutral or result in net savings to society."*

Key actions identified for electricity include:

- Increase reliance on renewables from **30% to 70%** adding 12GW of renewable energy capacity (with peat and coal plants closing).
- Put in place a coherent support scheme for micro-generation with a price for selling power to the grid.
- Open up opportunity for community participation in renewable generation as well as community gain arrangements.
- Streamline the consent system, the connection arrangements, and the funding supports for the new technologies on and offshore.

The following actions are of importance.

- Action 2: Establishment of Climate Action Delivery Board.
- Action 4: Publish the Climate Action (Amendment) Bill 2019.
- Action 15: Implement National Planning Framework.
- Action 17: Ensure that ESB Networks and EirGrid plan network and deliver on connecting renewable energy sources to meet the 2030 70% RES-E target.
- Action 18: Facilitate additional hybrid connections (e.g. solar/wind/batteries) operating in the electricity market to increase RES-E penetration.
- Action 19: Ensure that the next phase of renewable connection policy is fit for purpose to deliver on renewable energy targets and community projects, and report annually on the timeliness of grid connection.
- Action 24: Facilitate very high penetration of variable renewable electricity by 2030 (both SNSP and average) through system services and market arrangements.
- Action 28: Design and implement the Renewable Energy Support Scheme (RESS). Increase the volumes and frequencies of RESS auctions to deliver on the 70% renewable electricity target by 2030 ensuring an appropriate community/enterprise mix to achieve an efficient delivery of renewables.
- Action 29: Ensure that 15% of electricity demand is met by renewable sources contracted under Corporate PPA's.

The policies and objectives of the CAP are reflected in the Draft National Energy & Climate Plan (NECP) 2021-2030 which was submitted to the European Commission in December 2018.

The NECP was prepared to incorporate all planned policies and measures that were identified up to the end of 2019 and which collectively deliver a 30% reduction by 2030 in non-ETS greenhouse gas emissions (from 2005 levels). The NECP was drafted in line with the current EU effort-sharing approach, before the Government committed to its higher level of ambition, and therefore does not reflect this higher commitment. Further interactions of the NECP will reflect the current government's stronger climate governance.

4.4.4 EU Governance Regulation and Ireland's National Energy and Climate Plan (NECP)

Under the EU Governance Regulation, Member States had to submit their 2021-2030 draft National Energy and Climate Plans (NECP's) by the end of 2018 and final plans by the end of 2019. The Commission has assessed these both at EU and Member State level. Member States will also need to update their NECPs by the end of June 2023 in a draft form and by 30 June 2024 in a final form in order to reflect an increased ambition. Member States are required to report on the progress made in implementing their energy and climate policies, including their NECPs, for the first time in March 2023 and every two years thereafter. The Governance Regulation is effectively the piece of EU legislation under which Ireland is held accountable in meeting its de-carbonisation targets.

It is important to note that Article 4 of the Regulation sets out specific trajectory requirements for renewable energy share in key intermediate years of 2022, 2025 and 2027. The final version of Ireland's first NECP set out specific annual targets for delivery of onshore and offshore wind in order to meet the requirements of Article 4. These intermediate targets will be particularly difficult to deliver and will require early deployment of onshore wind in particular, as the legislative framework underpinning offshore wind is still under development. The minimum target for onshore wind in Ireland by 2025 is a total installed capacity of 5900MW, an increase of approximately 1,590MW between 2021 and 2025[1]. This would need to increase substantially if there is any delay in the delivery of offshore wind in this timeframe. Given the timelines for grid offer processing, financing and construction, which can only commence after a successful grant of planning permission, the delivery of this 2025 intermediate target will depend entirely on the scale of projects consented in the next 1-2 years.

4.4.5 Project Ireland 2040: The National Planning Framework

As a strategic development framework, Project Ireland 2040: The National Planning Framework, demonstrates an approach that joins up ambition for improvement across the different areas of Irish life, bringing the various government departments, agencies, State owned enterprises and local authorities together behind a shared set of strategic objectives for rural, regional and urban development.

> "The National Planning Framework is a planning framework to guide development and investment over the coming years.
>
> It does not provide every detail for every part of the country; rather it empowers each region to lead in the planning and development of their communities, containing a set of national objectives and key principles from which more detailed and refined plans will follow."

[1] 4,309 MW Installed Capacity in the Republic of Ireland as of July 2021 (Wind Energy Ireland)

The Framework sets out the key goals and objectives for the State, and central to this framework is the theme of Realising Our Sustainable Future. In particular, Section 9.2 of the Framework titled 'Resource Efficiency and Transition to a Low Carbon Economy' states the following:

"Our transition to a low carbon energy future requires:

- A shift from predominantly fossil fuels to predominantly renewable energy sources;
- Increasing efficiency and upgrades to appliances, buildings and systems;
- Decisions around development and deployment of new technologies relating to areas such as wind, smart grids, electric vehicles, buildings, ocean energy and bio energy; and
- Legal and regulatory frameworks to meet demands and challenges in transitioning to a low carbon economy."

The NPF is supported by a series of National Strategic Outcomes which the Framework seeks to deliver. The purpose of the National Strategic Outcomes (NSOs) is to create a single vision, through a shared set of goals for every community across the country. The most pertinent outcomes in the context of the proposed renewable energy development are as follows:

National Strategic Outcome 3: Strengthened Rural Economies and Communities,

National Strategic Outcome 6: A Strong Economy Supported by Enterprise, Innovation and Skills,

National Strategic Outcome 8: Transition to Sustainable Energy.

A series of National Policy Objectives (NPOs) were developed to set the context for regional and local planning policy in Ireland. In the context of the proposed development, the following NPOs are considered the most relevant:

Table 4-2: National Policy Objectives (NPOs) from Project Ireland 2040: The National Planning Framework

Policy Objective	Description
National Policy Objective 15	Support the sustainable development of rural areas by encouraging growth and arresting decline in areas that have experienced low population growth or decline in recent decades and by managing the growth of areas that are under strong urban influence to avoid over-development, while sustaining vibrant rural communities.
National Policy Objective 21	Enhance the competitiveness of rural areas by supporting innovation in rural economic development and enterprise through the diversification of the rural economy into new sectors and services, including ICT based industries and those addressing climate change and sustainability.
National Policy Objective 23	Facilitate the development of the rural economy through supporting a sustainable and economically efficient agricultural and food sector, together with forestry, fishing and aquaculture, energy and extractive industries, the bio-economy and diversification into alternative on-farm and off-farm activities, while at the same time noting the importance

Policy Objective	Description
	of maintaining and protecting the natural landscape and built heritage which are vital to rural tourism.
National Policy Objective 52	The planning system will be responsive to our national environmental challenges and ensure that development occurs within environmental limits, having regard to the requirements of all relevant environmental legislation and the sustainable management of our natural capital.
National Policy Objective 54	Reduce our carbon footprint by integrating climate action into the planning system in support of national targets for climate policy mitigation and adaptation objectives, as well as targets for greenhouse gas emissions reductions.
National Policy Objective 55	Promote renewable energy use and generation at appropriate locations within the built and natural environment to meet national objectives towards achieving a low carbon economy by 2050.

Section 1.2: Making the Vision a Reality, recognises the need for new energy systems and transmission grids in order to deliver a more distributed, renewable focused national energy system in order to harness the potential from wind, wave and solar energy sources.

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

With regard to planning and investment for rural locations, Section 5.4: Planning and Investment to Support Rural Job Creation, recognises the key role of energy production in assisting in the rejuvenation of rural towns and villages to create and sustain vibrant rural communities.

> "Rural areas have significantly contributed to the energy needs of the country and will continue to do so, having a strong role to play in securing a sustainable renewable energy supply. In planning Ireland's future energy landscape and in transitioning to a low carbon economy, the ability to diversify and adapt to new energy technologies is essential. Innovative and novel renewable energy solutions have been delivered in rural areas over the last number of years, particularly from solar, wind and biomass energy sources."

4.4.6 Project Ireland 2040: National Development Plan 2021 - 2030

The National Development Plan 2021-2030 (NDP) published in October 2021, in tandem with the National Planning Framework (NPF), sets out the Government's over-arching investment strategy and budget for the period 2021-2030.

The plan aims to balance the demand for public investment across all sectors with focus on improving the delivery of infrastructure projects. The NDP provides a platform from which investment can be provided and strategized in terms of economic growth, development and sustainability needs.

The key role of the NDP is to set out the updated configuration for public capital investment over the next 10 years in order to achieve the National Strategic Outcomes as set out within the NPF. The NDP outlines a number of key energy initiatives, that set out to diversify our energy resources, and to assist in the transition towards a decarbonised society.

The NDP emphasises National Strategic Outcome 8: Transition to a Climate-Neutral and Climate Resilient Society, noting that:

> "The Government will continue to support the deployment of additional electricity generation through the auction-based Renewable Electricity Support Scheme (RESS)"

In achieving a Climate-Neutral and Climate Resilient Society, the NDP outlines strategic investment priorities which related to the aims of the Renewable Electricity Support Scheme. It is stated that the Renewable Energy Support Scheme (RESS) auctions will deliver competitive levels of onshore wind electricity generation which indicatively could be up to 8 GW of onshore wind by 2030. The NDP also outlines that the RESS will also support the delivery of up to 5 GW of additional offshore renewable electricity generation by 2030.

It is considered that such schemes, in conjunction with greater investment in renewable energy, diversity of supply, and increased utilisation and adoption of electricity storage, will significantly assist in promoting a low-carbon/less energy intensive supply. The investments outlined within the NDP Review will make a critical contribution to the achievement of a low carbon and resilient electricity system. The Annagh Wind Farm project will contribute to the aims of the NDP in providing renewable electricity generation to the national grid.

4.4.7 Ireland's Greenhouse Gas Emission Projections, 2018 - 2040

The National Climate Change Strategy designated the Environmental Protection Agency (EPA) with responsibility for developing annual national emission projections for greenhouse gases for all key sectors of the economy, including transport. The EPA publishes greenhouse gas emission projections on an annual basis and submits emission projections to the Commission as required under Monitoring Mechanism Regulation 525/2013.

The EPA's publication entitled *Ireland's Greenhouse Gas Emission Projections (2019)* provides an updated assessment of Ireland's projected greenhouse gas emissions out to 2040 which includes an assessment of progress towards achieving its emission reduction targets to 2030 set down under the EU Effort Sharing Decision (Decision No 406/2009/EC). Ireland's 2020 target was to achieve a 20% reduction of non-Emission Trading Scheme (non-ETS) sector emissions (i.e. agriculture, transport, the built environment, waste and non-energy intensive industry) on 2005 levels with annual binding limits set for each year beyond 2020. 2030 targets for EU Member States were adopted by the European Council in 2018. Irelands 2030 target under the Effort Sharing Regulation is a 30% reduction of emissions compared to 2005 levels by 2030. There will be binding annual limits over the 2021-2030 period to meet that target.

During its operation, the estimated 88.3 GWh of electricity produced by the proposed Annagh Wind Farm would be sufficient to supply approximately 21,000 Irish households with electricity per year, based on the average Irish household using 4.200 MWh of electricity (this figure is available from the March 2017 CER Review of Typical Consumption Figures Decision).

Thus, this energy will be used to offset the same amount of energy that would otherwise be generated from burning of fossil fuels at power stations.

It is estimated that approximately 42,966 tonnes of CO2 emissions per annum will be offset due to the proposed Annagh Wind Farm. As a result, the operational stage of the proposed wind farm will have a significant long-term positive impact on air quality and climate change, in line with policy and legislation at a local, regional, national and international level.

Further details relating to the positive effects of the proposal on air quality and climate change are included in Chapter 6 of this EIAR.

4.4.8 National Policy Conclusion

The development of the proposed Annagh Wind Farm is in support of national policy as set out above. The project supports the enhancement of the competitiveness of rural areas and facilitates the development and diversification of the rural economy by supporting the energy sector and increasing the share of renewables in Ireland's energy mix.

The proposed development contributes to the nation's target increase of renewable energy from 30% to 70% by 2030 and supports the doubling of onshore wind energy in Ireland by 2030 as set out in the Climate Action Plan.

The project supports national targets of climate change mitigation and reduction in greenhouse gas emissions where significant focus has been set out in the recent Climate Action and Low Carbon Development (Amendment) Act 2021. The ambitious new programme for government is prioritising carbon neutrality and renewable energy generation. In light of this, it is important for the nation to rely on proven technologies such as on shore wind in order to meet the near-term objectives, as well as long-term objectives.

The proposed project promotes the generation of renewable energy at appropriate locations and supports the achievement of a low carbon economy by 2050. It is therefore considered that the proposed Annagh Wind Farm is in line with national policy and supports the achievement of national energy and sustainability targets.

4.5 Regional Policies

4.5.1 Southern Regional Spatial & Economic Strategy

The Southern Regional Spatial & Economic Strategy (RSES) came into effect on 31st January 2020. The RSES sets out a strategy to implement the NPF at a regional level. The RSES sets out a strategic vision which includes actions to mitigate against climate change. The RSES recognises the urgency to transition to a low carbon future, accelerate the transition towards a low carbon economy and increase the use of renewable energy sources across the key sectors of electricity supply, heating, transport and agriculture in order to safeguarding and enhance the region's environment through sustainable development, prioritising action on climate change across the region, driving the transition to a low carbon and climate resilient society.

The RSES states the following in relation to wind energy:

> "Wind energy is currently the largest contributor of renewable energy and it has the potential to achieve between 11-16GW of onshore wind and 30GW of offshore wind by 2050 (SEAI, 2016). The sector can make a significant contribution to meeting national energy demands while attaining our energy and emissions targets for 2020 and beyond."

The RSES includes a range of policy objectives which support the development of renewable energy projects such as the proposed Annagh Wind Farm Project. Objectives include the following:

Table 4-3: Regional Spatial and Economic Strategy Objectives

Policy	Description
RPO 50	It is an objective to further develop a diverse base of smart economic specialisms across the rural Region, including innovation and diversification in (among other things) renewable energy as a dynamic driver for the rural economy.
RPO 56	The RSES recognises the urgency to transition to a low carbon future and it is therefore an objective to accelerate the transition towards low carbon economy and circular economy through mechanisms such as the Climate Action Competitive Fund;
RPO 95	It is an objective to support implementation of the National Renewable Energy Action Plan (NREAP), and the Offshore Renewable Energy Plan and the implementation of mitigation measures outlined in their respective SEA and AA and leverage the Region as a leader and innovator in sustainable renewable energy generation.
RPO 99	It is an objective to support the sustainable development of renewable wind energy (on shore and offshore) at appropriate locations and related grid infrastructure in the Region in compliance with national Wind Energy Guidelines.

The development of the proposed Annagh Wind Farm will aid in meeting the objectives set out in the RSES including diversification of the rural economy, actions against climate change and the sustainable development of wind energy at an appropriate location.

4.6 Local Policy

4.6.1 Cork County Development Plan 2014

It is a specific planning policy requirement under Section 28 of the Planning & Development Act 2000 (as amended) that in making development plans a planning authority has regard to national policy on renewable energy as contained in the aforementioned policy documents. A County Development Plan is required to indicate how the implementation of the development plan will contribute to realising overall national targets on renewable energy and climate change mitigation. This applies in particular to wind energy production and the potential wind energy resource.

The Cork County Development Plan (CDP) 2014 sets out the strategic framework for land use planning in the county. Chapter 9 of the CDP sets out the energy strategy for the County with an aim to:

> *"Ensure that through sustainable development County Cork fulfils its optimum role in contributing to the diversity and security of energy supply and to harness the potential of the county to assist in meeting renewable energy targets."* (ED 1-1 Energy)

The most pertinent transposed policies and objectives are outlined in Table 4-4:

Table 4-4: Extracts from the Current County Council Development Plan (2014)

Policy / Objective	Description
Objective ED 3-1	National Wind Energy Guidelines - Development of on-shore wind shall be designed and developed in line with the 'Planning Guidelines for Wind Farm Development 2006" issued by DoELG and any updates of these guidelines.
Objective ED 3-2	*Wind Energy Projects - On-shore wind energy projects should focus on areas considered 'Acceptable in Principle' and Areas 'Open to Consideration' and generally avoid "Normally Discouraged" areas in this Plan.*
Objective ED 3-3	*Wind Energy Generation - Support a plan led approach to wind energy development in County Cork and identify areas for wind energy development. The aim in identifying these areas is to ensure that there are no significant environmental constraints, which could be foreseen to arise in advance of the planning process.*

The on-shore wind energy strategy designations of the Cork County Development Plan as set out in figure 9.3 of the CDP places the site within an area identified as '**Open to Consideration**' for wind energy development.

CDP Objective ED 3-5: ***Open to Consideration*** *– "Commercial wind energy development is open to consideration in these areas where proposals can avoid adverse impacts on:*

- *Residential amenity particularly in respect of noise, shadow flicker and visual impact;*
- *Urban areas and Metropolitan/Town Green Belts;*
- *Natura 2000 Sites (SPA and SAC), Natural Heritage Areas (NHA's) or adjoining areas affecting their integrity.*
- *Architectural and archaeological heritage;*
- *Visual quality of the landscape and the degree to which impacts are highly visible over wider areas."*

The Cork County Development 2014 is currently under review. The draft County Development Plan 2022-2028 was published in April of 2021. The plan is subject to public consultation, prior to its expected adoption in 2022.

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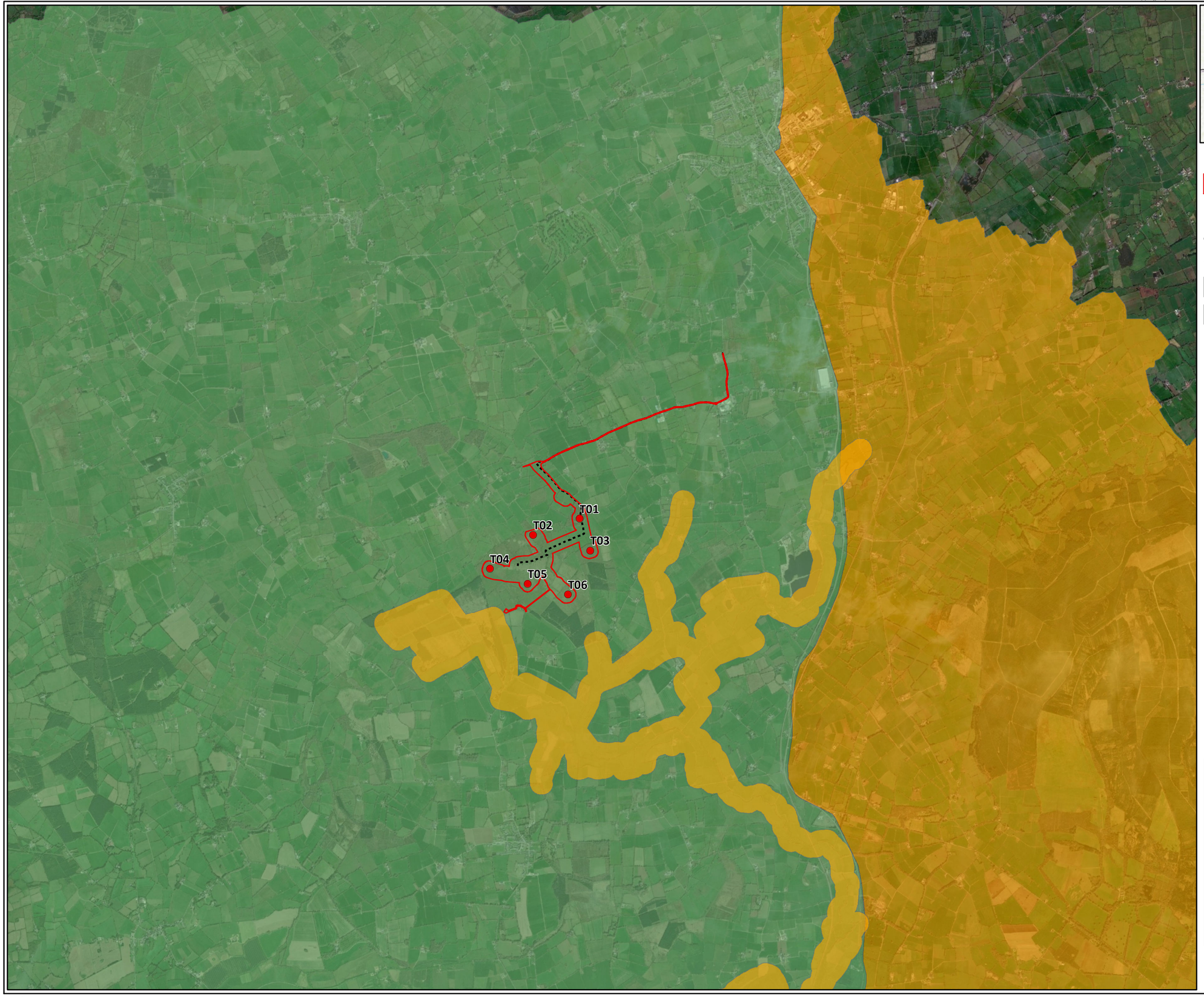

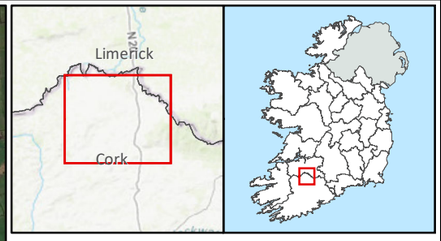

Legend

- Proposed Wind Farm Site
- Proposed Turbine Layout
- Underground Cable Route

Cork Wind Policy Areas:

- Normally Discouraged
- Open to Consideration

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TITLE:	Wind Energy Policy Areas		
PROJECT:	Annagh Wind Farm, Co. Cork		
FIGURE NO:	4.2		
CLIENT:	EMPower		
SCALE:	1:50000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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4.6.2 Cork County Development Plan 2014, Landscape Character Assessment

The site falls within a single landscape character type as set out in the Cork County Development Plan Landscape Character Assessment. These areas are further detailed in the Cork County Draft Landscape Strategy 2007.

Landscape Character Type 5: Fertile Plain with Moorland Ridge

This landscape type covers a substantial area of northeast Cork, consisting of low lying landscape, which comprises an extensive area of predominantly flat or gently undulating topography. The landscape is dominated by intensive mosaic farmland with patches of forestry throughout. According to Appendix E of the Cork CDP: Landscape Character Assessment, the landscape value and landscape sensitivity are considered to be very high and is considered to be of county importance. The southern extent of the proposed development falls within this landscape character area.

Scenic Routes

The Cork CDP policy objective GI 7-2: Scenic Routes states the following:

> *"Protect the character of those views and prospects obtainable from scenic routes and in particular stretches of scenic routes that have very special views and prospects identified in this plan."*

There are no scenic routes in proximity to the proposed wind farm site. The most proximate is Scenic Route S13 located approximately 15km east of the wind farm site. This route runs from Kilfinnan to Shanballymore Road in the southern foothills of the Ballyhoura Mountains. A visual impact assessment on this scenic route has been included in Chapter 15: Landscape & Visual.

4.6.3 Kanturk Mallow Municipal District Local Area Plan

Cork County Council have prepared a Local Area Plan (LAP) for each of the eight Municipal Districts which cover County Cork. The LAPs set out a land use planning strategy for the development of towns and villages across Cork. The LAPs were adopted in 2017. The proposed Annagh Wind Farm falls within the boundary of the Kanturk Mallow Municipal District LAP.

As the LAP focuses on development within towns, there is little reference to renewable energy development and few policies regarding rural lands. However, the LAP defines nearby Churchtown as a 'Village', settlement where a limited range of services are provided supplying the local area.

General objectives for 'Villages' include:

f) In accordance with Objective WS 5-1 of Chapter 11 of the County Development Plan, all new development will need to make provision for Sustainable Urban Drainage Systems (SuDs) and provide adequate storm water infrastructure. Surface Water Management and Disposal should be planned in an integrated way in consideration with land use, water quality, amenity and habitat enhancements as appropriate.

g) Sustainable Urban Drainage Systems (SuDs) and sufficient storm water attenuation in particular will be required for developments within the catchment of the Blackwater Special Area of Conservation and the Lower River Shannon/River Feale Special Area of Conservation (Rockchapel)

p) All proposals for development within the area at risk of flooding, shall comply with the provisions of the Ministerial Guidelines – 'The Planning System and Flood Risk management: Guidelines for Planning Authorities' and with the Flood Risk Assessment and management Objectives IN-01 in Section 1 of this Plan.

The proposed Annagh Wind Farm has been designed to avoid potential impact on the nearby village of Churchtown, including potential visual and traffic impacts. A flood risk assessment has been provided in Chapter 10 of the EIAR. The design of the proposed wind farm including all mitigation measures, aims to avoid impact on the receiving environment, providing for enhancement of biodiversity and avoid impact on protected sites. It is therefore considered that the proposed development is in line with local policy as set out in the Kanturk Mallow Local Area Plan (2017).

4.7 Other Relevant Policies and Guidelines

4.7.1 Department of Environment, Heritage and Local Government – Wind Energy Development – Planning Guidelines 2006

The Wind Energy Development Planning Guidelines (2006) published by the Department of the Environment, Heritage and Local Government (DoEHLG) offer advice to planning authorities assessing planning applications for wind farm developments. The guidelines set out criteria which assist in the identification of suitable locations for wind energy development. They are also of assistance to developers and the wider public in considering wind energy development.

The proposed development has considered the provisions of the Wind Energy Development Guidelines 2006 in the design and siting of the Annagh Wind Farm. The proposed development is considered to be in line with the recommendations as set out in the Guidelines.

4.7.2 Draft Revised Wind Energy Development Guidelines (December 2019)

The Draft Revised Wind Energy Development Guidelines were published in December 2019 for public consultation. The guidelines will supersede the 2006 guidelines once formally adopted by the government. The revised guidelines aim to apply consistency across all Renewable Energy Strategies with regard to Development Management objectives. The key points of note in the draft Revised Guidelines include:

- Revised set back distances. 4 times the tip height is to be applied between turbines and the nearest point of the curtilage of any residential property with a mandatory minimum set back distance of 500 meters to be applied.
- Revised noise limits provide a higher level of protection to nearby residential receptors. The draft guidelines propose a noise limit, referred to as a Relative Rated Noise Limit in the range of 35 – 43 dB(A), while not exceeding the background noise level by more than 5dB(A) with an upper limit of 43 dB(A).

- The draft guidelines confirm a policy of 'zero shadow flicker' at nearby existing dwellings or other affected properties.
- Wind energy developers will have to provide an opportunity for the proposed development to be of enduring economic or social benefit to the local community, whether by facilitating community investment/ ownership in the project, other types of benefits/ dividends, or a combination of the two.
- The revised guidelines encourage the implementation of a standardised operational period of 30 years for wind energy developments across the country.

The proposed Annagh Wind Farm has been designed in accordance with the current statutory Section 28 Ministerial Guidelines, Wind Energy Development Guidelines 2006. We are aware that these guidelines are subject to targeted review and therefore the design of the project has had regard to the Draft Revised Wind Energy Development Guidelines, published by the Department of Housing, Planning and Local Government (December 2019).

In this regard the proposed layout has achieved a minimum separation distance of 700m between turbine locations and the closest dwelling house of non-financially involved landowners. Furthermore, an objective to avoid shadow flicker at nearby dwellings through mitigation measures has also been included in the project, in line with the draft guidelines.

4.7.3 Irish Wind Energy Association – Best Practice Guidelines for the Irish Wind Energy Industry

The 'Best Practice Guidelines for the Irish Wind Energy Industry' were published by the Irish Wind Energy Association (IWEA) in 2008 and the Guidelines were updated in 2012. These guidelines are to encourage responsible and sensitive wind farm development, and to provide assistance and recommendations for those developing onshore wind energy projects in Ireland.

The approach to the development of the proposed Annagh Wind Farm is in line with the 2012 IWEA guidelines in that it is in accordance with relevant planning and environmental legislation, requirements for environmental impact assessment, provides an environmentally sensitive design, takes account of best practice health and safety and provides opportunities for quality public engagement in order to develop a responsible and sensitive wind energy project.

4.7.4 IWEA Best Practice Principles in Community Engagement and Community Commitment 2013

The Best Practice Principles in Community Engagement and Community Commitment were published by IWEA in 2013. IWEA and its members support the provision of financial contributions by wind farm operators to local communities and have sought to formulate best practice principles for the provision of a community commitment. The document sets out IWEA's best practice principles for delivering extended benefits to local communities for wind farm developments of 5MW or above.

Best Practice Principles of community engagement when planning the engagement strategy and preparing associated literature are also outlined in the document. The aim of the publication is to ensure that the view of local communities is taken on board at all stages of development and that local communities share in the benefits of the development. Throughout the consultation process for the proposed Annagh Wind Farm Project specific regard has been taken of this guidance document. Details of the public and stakeholder consultation process carried out throughout the development of the project is detailed in Chapter 5 – EIA Scoping, Consultation and Key Issues.

4.7.5 Code of Practice for Wind Energy Development in Ireland – Guidelines for Community Engagement

In December 2016, the Department of Communications, Climate Action and Environment (DCCAE) issued a code of practice for wind energy development in relation to community engagement.

This Code of Good Practice:

> *"is intended to ensure that wind energy development in Ireland is undertaken in observance with the best industry practices, and with the full engagement of communities around the country."*

The guidance states that the methods of engagement should reflect the nature of the project and the potential level of impact that it could have on a community. Throughout the consultation process the applicant has had regard to the Code of Practice for Wind Energy including the practical steps that wind farm promoters should comply with in engaging with communities as set out in this Guidance.

4.7.6 Commission for Regulation of Utilities: Grid Connection Policy

The Commission for Regulation of Utilities (CRU) (previously the Commission for Energy Regulation (CER)) launched a new grid connection policy in March 2018 for renewable and other generators, known as ECP-1, which will seek to allow "shovel ready" projects that already have a valid planning permission, connect to the electricity networks. The principal objective which guides this decision is to allow those projects which are 'shovel ready' to have an opportunity to connect to the network, along with laying the foundations for future, more regular batches for connection.

The first connection offers were issued in August 2018 with the system operators expected to hold further batches in 2021 / 2022.

On the 10 June 2020 the CRU published their decision on ECP-2, which set policy for at least three annual batches of connection offers (ECP 2.1, ECP-2.2, and ECP-2.3). The application windows are envisaged to be open for the month of September each year.

The ECP system replaces the previous 'Gate' system of grid connection applications. The grid connection application window under ECP-1 was the first time since 2007 that certain renewable energy projects including wind farms, have had an opportunity to secure a new grid connection offer.

4.7.7 Renewable Electricity Support Scheme (RESS)

The new RESS scheme was launched in July 2018. The RESS is different to previous support schemes as it proposes to support renewable electricity projects through a series of scheduled, competitive auctions.

The primary policy objectives relevant to RESS include delivering our renewable electricity ambitions, increasing community participation in and ownership of renewable electricity projects, ensuring value for electricity customers and enhancing security of supply. The new scheme will help deliver Ireland's contribution to the EU-wide binding renewable energy target of 32% RES by 2030 and the nation's renewed targets of 70% electricity produced by renewable sources by 2030 as set out in the Climate Action Plan (2019).

In February 2020 the Government of Ireland published the 'Terms and Conditions for the First Competition Under the Renewable Electricity Support Scheme RESS 2020'. The Renewable Electricity Support Scheme (RESS) is an auction scheme in which renewable energy projects bid for grid capacity. The noted document sets out the terms and conditions that apply to the first competition, RESS - 1.

Eligible projects under RESS include onshore wind, offshore wind, solar, hydro along with many other renewable generation methods. Should an applicant be successful under this system they will be invited to submit an offer price on their RESS project.

The results of the RESS-1 auction were published in August 2020. Successful onshore wind projects accounted for up to approximately 480MW of capacity. RESS-2, the second Renewable Energy Support Scheme auction, is set to take place in early 2022, highlighting the governments push towards a transition to a low carbon economy and the achievement of renewable energy targets as set out in the Climate Action Plan (2019).

4.8 Conclusion

The policy as described throughout this chapter sets out significant international, European, national and local policy support for a move to renewable energy technologies and a reduction in greenhouse gas emissions. Ireland is committed to meeting International and European targets and if these targets are not met the government must purchase Carbon Credits to meet compliance with both emissions and renewable energy targets or face fines from the EU.

The SEAI report: Energy in Ireland (2020a) sets out the nation's latest progress towards renewable energy targets, with an overall shortfall on the 2020 targets as renewable energy production accounts for approximately 12% of the nation's energy production while the 2020 target was set for 16%.

While Ireland has come a long way in increasing renewable energy generation, the targets are ever increasing from a European perspective. 2050 European targets effectively mean that Europe's energy production will have to be almost carbon-free by 2050, with an aim to increase reliance on renewables from 30% to 70% by 2030.

In response to this, Ireland produced the Climate Action Plan (2019) which aims to steer the country towards clean energy and reduce emissions. The CAP sets out an objective to more than double Ireland's onshore wind energy capacity to 8.2GW by 2030, greatly reducing the nation's dependency on fossil fuels.

Therefore, there is a clear national mandate to accommodate significant onshore wind within the next decade. Furthermore, the National Planning Framework emphasises a move to a low-carbon economy to reduce Ireland's carbon footprint by integrating climate action into the planning system in support of national targets.

It is this commitment on energy and climate policy that justifies a clear need for renewable energy generation in Ireland. It is recognised that there are a range of renewable resources alternatives that could be explored to meet our International and European commitments, however onshore wind is recognised as being the most economically competitive as emphasised in the Climate Action Plan 2019. It is also a proven technology that will be critical to meeting the near-term renewable targets up to 2030.

The Regional Spatial and Economic Strategy (RSES) for the Southern Region supports the increased use of renewable energy sources to transition the Southern Region to a low carbon, climate resilient and environmentally sustainable economy and mitigate against climate change.

The RSES aims to leverage the Southern Region as a leader and innovator in sustainable renewable energy generation, supporting the development of a renewable energy project in an appropriate location, such as that of the proposed Annagh Wind Farm.

National and regional energy policies have been reinforced by the Cork County Development Plan 2014 which applies a plan-lead approach to wind energy development. The proposed Annagh Wind Farm is located within an area considered to have capacity for wind energy development and is considered compatible with the existing land use on the site as discussed in detail in Chapter 11 – Population, Human Health & Material Assets.

In conclusion, the policy context for the site and surrounding area is considered favourable for the proposed Annagh Wind Farm, both from a national policy perspective with regard to renewable energy provision, and at a local level with respect to designations and the ability for the site to accommodate the proposed development.

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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 5 – SCOPING, CONSULTATION AND KEY ISSUES

Prepared for: EMPower

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5. EIA SCOPING, CONSULTATION AND KEY ISSUES

5.1 Introduction

Consultation is an important part of the Environmental Impact Assessment (EIA) process. This chapter describes the consultation process and EIAR scoping that was undertaken in order to identify key effects from the proposed Annagh Wind Farm project to be included in the EIAR. The consultation process carried out for the project has been a lengthy, detailed and thorough process. A number of points and submissions were raised as part of the consultation process which have informed the project design and this EIAR.

This chapter presents the key points that arose through the consultation process and how these points were addressed in the EIAR. The consultation process, scoping and pre-application consultation undertaken in respect of the proposed development are set out in this chapter.

Throughout the consultation process, specific regard has been taken to the *Code of Practice for Wind Energy Development in Ireland – Guidelines for Community Engagement* published on the 21st December 2016 by the Department of Communications, Climate Action and the Environment. "*This Code of Good Practice is intended to ensure that wind energy development in Ireland is undertaken in observance with the best industry practices, and with the full engagement of communities around the country".* The applicant had regard throughout the pre-planning process of the practical steps that renewable energy promoters should comply with, in engaging with communities as set out in this Guidance.

Furthermore, the latest public health guidance was observed throughout the development of the project with regard to the COVID-19 pandemic.

5.2 Scoping

The purpose of the EIA scoping process is to identify the key points and issues which are likely to be important during the environmental impact assessment (EIA) of a project and to eliminate those that are not. The scoping process identifies sources or causes of potential environmental effects, the pathways by which the effects can happen, and the sensitive receptors which are likely to be affected. It defines the appropriate level of detail for the information to be provided in the EIAR. In essence, the primary focus of scoping is to define the most appropriate assessment of significant effects related to the proposed development.

A scoping request letter and scoping report detailing a description of the proposed project, draft mapping, preliminary table of contents of the EIAR and outline of the methodology for assessment was distributed to consultees on the 22nd of September 2020. The recipients included the Local Authority, Government Departments, non-governmental organisations (NGOs), interested parties and key stakeholders. Consultees were invited to contribute to the EIAR by suggesting baseline data, survey methodologies and potential impacts that should be considered as part of the impact assessment process and in preparation of the EIAR.

Table 5.1 details the list of consultees who were issued a copy of the scoping document. A copy of the scoping request letter and scoping report are included in Appendix 5.2 of Volume 3 of this EIAR.

Table 5-1: List of Consultees

Type of Stakeholder	Body / Department
Consenting Authority	Cork County Council
Government Departments	Department of Housing, Planning and Local Government Department of Culture, Heritage and the Gaeltacht (DAU) Department of Agriculture, Food and the Marine Department of Communications, Climate Action and Environment Department of Transport, Tourism and Sport Department of Defence
NGOs & Stakeholders	Inland Fisheries Ireland (IFI) Transport Infrastructure Ireland (TII) Environmental Protection Agency (EPA) The Heritage Council An Taisce National Monuments Service An Chomhairle Ealaíon (Arts Council) Failte Ireland Health and Safety Authority Irish Water Commission for Regulation of Utilities National Roads Authority - Cork roads office Office of Public Works Health Service Executive (HSE) Geological Survey Ireland (GSI) Southern Regional Assembly Biodiversity Ireland Irish Wildlife Trust Butterfly Conservation Ireland Birdwatch Ireland National Parks and Wildlife Service (NPWS) Irish Raptor Study Group Irish Environmental Network Teagasc Gas Networks Ireland The Irish Meteorological Service (Met Eireann) Eirgrid ESB Networks Sustainable Energy Authority Ireland National Transport Authority Irish Wind Energy Association

Type of Stakeholder	Body / Department
	Geographical Society of Ireland An Garda Siochána – Charleville & Buttevant Branch Environmental Sciences Association of Ireland Irish Peatland Conservation Council Forestry Service Angling Council of Ireland NM20 Cork to Limerick Project Liaison Team
Aviation	Irish Aviation Authority Cork Airport Dublin Airport Authority (daa) Rathcoole Aerodrome Irish Community Rapid Response (ICRR) Shannon Airport Authority
Telecommunications	Nova Telecom Skylink Communications Imagine Munster Broadband Digiweb Ripplecom Magnet Networks BT Communications Ireland Ltd RTE Virgin Media Ireland Eir Vodafone (Netshare) Three ESB Telecoms TETRA Ireland Ltd. TowerCom Ltd. Pure Telecom Enet Telecommunications Network Limited ITS Irish Networks Services Ivertec Ltd. RTE/Saorview RTE Transmission Network (2RN) Cork County Council Viatel Broadcasting Authority of Ireland – BAI Commission for Communications Regulation

Full details of the scoping responses received are set out in Appendix 5-1. A summary of the consultation responses received are presented in Table 5-2:

Table 5-2: Summary of Scoping Consultation Responses

Consultee	Date of Response	Response / Key Points Raised	Chapter of EIAR where Key Points Raised are Addressed
Cork County Council Planning Department	17/11/2020	Comments on content of the EIAR including reasonable alternatives, cumulative impact, biodiversity, land, water, traffic, landscape and heritage. Consideration of construction, grid connection and decommissioning.	Considered throughout the EIAR
Department of Housing, Planning and Local Government	23/09/2020	Minister cannot offer any advice or comment in respect of this development	N/A
Department of Agriculture, Food and the Marine	23/11/2020	Comments on felling and reforestation policy.	Chapter 8 – Biodiversity Chapter 11 – Population, Human Health & Material Assets
Department of Transport Tourism and Sport	22/09/2020	No Comment	N/A
Transport Infrastructure Ireland	29/09/2020	Comments on recommended consultation, potential traffic impacts and impacts on national roads.	Chapter 13 – Traffic & Transportation Chapter 15 – Landscape & Visual
An Chomhairle Ealaíon (Arts Council)	22/09/2020	No Comment	N/A
Failte Ireland	09/10/2020	Guidance on how to assess impact on tourism as part of an Environmental Impact Assessment.	Chapter 11 – Population, Human Health & Material Assets
Irish Aviation Authority	02/10/2020	Recommended engagement with Shannon Airport, DAA and Cork Airport.	Chapter 16: Telecommunications & Aviation
Health & Safety Authority	23/09/2020	Site is not in proximity to any Major Accidents Hazard (COMAH) sites.	Chapter 11 – Population, Human Health & Material Assets
National Roads Office Cork	22/09/2020	No Comment	N/A
Geological Survey of Ireland	09/10/2020	Comments on geoheritage, groundwater, geohazards, natural resources and comments on GSI datasets.	Chapter 9 – Land, Soils & Geology Chapter 10 – Hydrology & Water Quality Chapter 11 – Material Assets

Consultee	Date of Response	Response / Key Points Raised	Chapter of EIAR where Key Points Raised are Addressed
Southern Regional Assembly	23/09/2020	No Comment	N/A
Irish Wildlife Trust	22/09/2020	No Comment	N/A
Birdwatch Ireland	22/09/2020	No Comment	N/A
Gas Networks Ireland	23/09/2020	No recorded Gas Network within the area of the wind farm site & grid route.	Chapter 11 – Material Assets
Met Eireann	23/09/2020	No Comment	N/A
ESB	22/09/2020	No Comment	N/A
National Transport Authority	22/09/2020	No Comment	N/A
Garda	14/10/2020	No Comment	N/A
Cork Airport	16/10/2020	No Comment	N/A
Dublin Airport Authority	06/11/2020	No anticipated impact on Cork Airport	Chapter 16: Telecommunications & Aviation
Shannon Airport Authority	26/11/2020	No anticipated impact on Shannon Airport	Chapter 16: Telecommunications & Aviation
N/M20 Project Office	16/02/2021	The proposed windfarm is outside the NM20 Short-listed option corridors.	Chapter 13 – Traffic & Transportation
Novatelecom	19/09/2020	Potential impact to telecommunications services.	Chapter 16: Telecommunications & Aviation
Imagine	28/09/2020	No potential impact.	Chapter 16: Telecommunications & Aviation
Munster Broadband	25/09/2020	Receipt. No comment	N/A
Digiweb	25/09/2020	Receipt. No comment	N/A
Ripplecom	25/09/2020	No potential impact.	Chapter 16: Telecommunications & Aviation
Magnet Networks	25/09/2020	Receipt. No comment	N/A
BT Ireland	29/09/2020	No record of BT infrastructure in the area.	Chapter 16: Telecommunications & Aviation

Consultee	Date of Response	Response / Key Points Raised	Chapter of EIAR where Key Points Raised are Addressed
Three	29/09/2020	No potential impact.	Chapter 16: Telecommunications & Aviation
ESB Telecoms	25/09/2020	No Comment	N/A
Eir	30/09/2020	No potential impact.	Chapter 16: Telecommunications & Aviation

5.2.1 Key Issues Raised During the Scoping Process

The scoping process proved beneficial to the identification of issues and potential issues in relation to the proposed Annagh Wind Farm project. Responses from the consultees identified a range of observations which have been taken into consideration in the preparation of the respective chapters of this EIAR.

Issues raised during the scoping process are summarised as follows and the responses are included in full in Appendix 5-1 of Volume 3 of this EIAR:

Cork County Council

The scoping response received from Cork County Council Planning Department advised on engaging in a pre-planning meeting with the Planning Department. Furthermore, relevant and best practice guidelines for the EIAR compilation process were recommended. The following points were highlighted for consideration:

- Reasonable Alternative: Given the location of the site relative to designated sites and CDP 2014 Wind Energy Policy, reasonable alternatives should be considered at this location. The developer must also indicate the main reasons for the option chosen taking into account the effects of the project on the environment.
- Cumulative Impact: The potential for cumulative impacts with other existing or approved developments in the area should be taken into account. Any EIAR should include for an assessment of all the existing or approved wind farm developments in the area. In addition the EIAR should also take into account existing or approved large scale developments in the area.
- Biodiversity: The site appears to be partially located within a designated European site. For any proposed development at this location the EIAR, scheme and relevant assessments should take into account the relevant guidelines and methodologies outlined in the relevant guidelines, best practice. An AA should be undertaken.
- Land & Soils: It is considered that relevant geotechnical assessments, geological assessments, hydro-geological investigations including a detailed evaluation of the nature of ground conditions onsite should be taken into account. Landslide, peat and slope stability risk assessments for all aspects of the development should be taken into account where applicable. The assessment of bog burst / landslide hazard, assessment on groundwater, details of any borrow-pits and if dewatering will apply, vibration impact assessment, borrow pit reinstatement, geotechnical analysis for turbine bases, method of excavations and hydrology assessments in accordance with the relevant wind energy guidelines and best practise should be taken into account for the proposed development.

Information on the location of quarries to be used or borrow pits proposed during the construction phase and associated remedial works should also be taken into account.

- Water: For the EIAR Hydrology assessments, drainage, SWMP, flood risk assessments in accordance with the relevant wind energy guidelines and best practise should be taken into account for the proposed development. Given the sites location relative to an SAC and watercourses, disturbance of drainage and water courses during construction and operation should be taken into account.
- Traffic: The adequacy of the local access road network to facilitate construction of the project and transportation of large machinery and turbine parts to site, including a traffic management plan should be taken into account.
- Landscape: The scale, height, layout of scheme and infrastructure and dimensions of same as outlined are noted. As per the EPA advice notes the size, movement and appearance of these structures present challenges that are unique to this project type. The site and receiving environment entails a number of landscape character types and a high value landscape is located to the east of the site. As outlined in the 2006 guidelines, the highest standards of siting and design for a wind energy development should be expected where the sensitivity of the landscape is high and the locations from where it is viewed are critical. The guidelines state where a wind energy development is close to and visible from an area of high sensitivity, it should be designed to achieve similar standards as viewed from key viewpoints in that area. For any proposed development at this location the EIAR, scheme and relevant landscape and visual assessments should take the relevant guidelines into account. These should also take into account wind energy developments in the area.
- Construction: The EIAR and construction practice and methodology should take into account ground conditions onsite and best practise. Disposal or elimination of waste/surplus material from construction/site clearance, particularly significant for peatland sites should be taken into account.
- Grid Connection: - Details of the grid connection should be outlined in the EIAR. Should the grid connection not form part of the planning application, the EIAR should indicate the most likely corridor of the grid connection, its width and route and the likely nature of the connection in terms of line voltage, whether it will be underground or over ground and any ancillary equipment.
- Decommissioning: Decommissioning considerations should be taken into account.

The planning department's response relates to various aspects of the proposed wind energy development. Aspects such as cumulative impact and decommissioning are considered in each respective EIAR technical chapter. The response to the various environmental issues cited above has been considered in the following chapters:

- Chapter 2 – Need for the Development & Alternatives Considered
- Chapter 4 - Policy
- Chapter 8 - Biodiversity
- Chapter 9 – Land, Soils and Geology
- Chapter 10 – Hydrology & Water Quality
- Chapter 13 – Traffic & Transportation
- Chapter 15 – Landscape & Visuals

Department of Agriculture Food & the Marine (Felling Division)

The scoping response received from the Department's Felling Division states: if the proposed development will involve the felling or removal of any trees, the developer must obtain a Felling License from this Department before trees are felled or removed. The developer should take note of the contents of Felling and Reforestation Policy document which provide a consolidated source of information on the legal and regulatory framework relating to tree felling. As this development is within a forest lands, particular attention should be paid to deforestation, turbulence felling and the requirement to afforest alternative lands.

When the Forestry Service is considering an application to fell trees, the following applies with respect to environmental concerns:

- The interaction of these proposed works with the environment locally and more widely, in addition to potential direct and indirect impacts on designated sites and water, is assessed.
- Development may be subject to EIAR.
- Have regard to the Appropriate Assessment procedure.
- Change in land use which may directly or indirectly involve the felling and replanting of trees.

"Pursuant to Article 2(3) of the EIA Directive, the Department of Agriculture, Food and the Marine strongly recommends that, notwithstanding the fact that a parallel consent in the form of felling licence may also have to be applied for, any EIAR and/or NIS produced in connection with the application for planning permission to the Local Planning Authority or An Bord Pleanála, should include an assessment of the impact of and measures, as appropriate, to prevent, mitigate or compensate for any significant adverse effects, direct or indirect, identified on the environment arising from such felling and replanting of trees, deforestation for the purposes of conversion to another type of land use, or replacement of broadleaf high forest by conifer species."

Potential impacts on the receiving environment from the felling and replanting of trees as part of the proposed project is considered throughout the EIAR. Chapter 8 – Biodiversity has considered the potential impact of tree felling throughout the wind farm site and afforestation at the replant lands site. Chapter 11 – Population, Human Health & Material Assets addresses potential impact of the change of land use of the proposed development with respect to forestry and also considered the potential impact of the removal of forestry as a material asset. Afforestation is also considered at the replant lands site with respect to cumulative impacts.

Transport Infrastructure Ireland (TII)

In their scoping response, TII set out general recommendations for the preparation of an EIAR where the National Road Network may be affected. The response states the following:

- The developer should have regard to any Environmental Impact Statement and all conditions and/or modifications imposed by An Bord Pleanála regarding road schemes in the areas concerned. The developer should, in particular, have regard to any potential cumulative impacts,
- The developer/scheme promoter therefore should have regard, *inter alia*, to the following. Consultations should be had with the relevant Local Authority/National Roads Design Office with regard to locations of existing and future national road schemes in the vicinity of the subject development site. The applicant is specifically advised that the proposal is located within the Phase 2 Study Area of the N/M20 Cork to Limerick Road Improvement Scheme . Therefore, the N/M20 Project Office, Lissanalta House, Dooradoyle, Limerick should be consulted.

- TII would be specifically concerned as to potential significant impacts the development would have on the existing national road network (and junctions with national roads) in the proximity of the proposed development.
- In relation to haul route identification, the applicant/developer should clearly identify haul routes proposed and fully assess the network to be traversed. Separate structure approvals/permits and other licences may be required in connection with the proposed haul route, including where temporary modification to the road network may be required. Consultation with relevant PPP Companies and MMaRC Contractors may also be required. All structures on the haul route should be checked by the applicant/developer, to confirm their capacity to accommodate any abnormal load proposed.
- Where the windfarm scheme includes grid connection proposals, the scheme promoter should note locations of existing and future national road schemes and develop proposals to safeguard proposed road schemes. In the context of existing national roads, alternatives to the provision of cabling along the national road network, such as alternative routing or the laying of cabling in private lands adjoining the national road, should be considered in the interests of safeguarding the investment in and the potential for future upgrade works to the national road network. The cable routing should avoid all impacts to existing TII infrastructure, such as traffic counters, weather stations, etc. and works required to such infrastructure shall only be undertaken in consultation with and subject to the agreement of TII. Any costs attributable shall be borne by the applicant/developer. The developer should also be aware that separate approvals may be required for works traversing the national road network and/or motorway network where applicable.
- It would be important that, where appropriate, subject to meeting the appropriate thresholds and criteria and having regard to best practice, a Traffic and Transport Assessment (TTA) be carried out in accordance with relevant guidelines, noting traffic volumes attending the site and traffic routes to/from the site, with reference to impacts on the national road network and junctions of lower category roads with national roads. TII's 'Traffic and Transport Assessment Guidelines' (2014) should be referred to in relation to proposed development, with potential impacts on the national road network. The scheme promoter is also advised to have regard to Section 2.2 of TII's 'TTA Guidelines', which addresses requirements for sub-threshold TTA.
- The designers are asked to consult TII Publications to determine whether a Road Safety Audit is required.'
- In the interests of maintaining the safety and standard of the national road network, the EIAR should identify the methods/techniques proposed for any works traversing/in proximity to the national road network.
- The developer, in preparing EIAR, should have regard to TII Publications (formerly DMRB and the 'Manual of Contract Documents for Road Works').
- The developer should assess visual impacts from existing national roads.
- The developer, in preparing EIAR, should have regard to TII's Environmental Assessment and Construction Guidelines, including the 'Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes' (National Roads Authority (NRA), 2006).
- The EIAR should consider the 'Environmental Noise Regulations 2006' (SI 140 of 2006) and, in particular, how the development will affect future action plans by the relevant competent authority. The developer may need to consider the incorporation of noise barriers to reduce noise impacts (see 'Guidelines for the Treatment of Noise and Vibration in National Road Schemes' (1st Rev., NRA, 2004)).

Chapter 13 - Traffic and Transportation was compiled in light of TII observations and recommendations. TII guidelines were used where relevant and recommendations such as the requirement for a Road Safety Audit and Road Safety Impact Assessment were taken on board in the preparation of the Chapter. Visual impact assessment was considered from national routes in Chapter 15 - Landscape and Visual. The Air Quality & Climate and Noise & Vibration Chapters have also had regard to TII guidance.

Fáilte Ireland

In response to the scoping request, Fáilte Ireland recommended referring to their document "EIAR Guidelines for the Consideration of Tourism and Tourism Related Projects". Fáilte Ireland's Guidance set out the guiding principles and the requirements of an EIAR including guidance on impact assessment to include quality, significance, extent, probability, type and duration of the effect, in line with draft EPA Guidance (2017).

The Guidance Document sets out the various environmental topics to be considered in the EIAR and how they may relate to or affect tourism, such as archaeology and cultural heritage, landscape and water-based tourism, or potential for noise or air quality impacts on tourism and leisure activities. The guidance also considered cumulative impacts and transboundary impacts. Finally, the guidance sets out various sources of information for gathering baseline information for the impact assessment on tourism.

This document has been considered, as recommended by Fáilte Ireland. Chapter 11: Population, Human Health and Material Assets describes the potential impacts on recreation, amenity and tourism as a result of the proposed development and in consideration of Fáilte Ireland's guidance.

Health and Safety Authority

In their scoping response, the Health and Safety Authority confirmed that the proposed wind farm is not in the vicinity of a Major Accidents Hazard (COMAH) site, and therefore the Authority has no remit in provide further advice on the proposed development.

Chapter 11 – Population, Human Health & Material Assets considers potential impact to human health and safety and considered the susceptibility of the project to major accidents or natural disaster.

Geological Survey of Ireland (GSI)

The Geological Survey of Ireland set out the following comments relating to the proposed Annagh Wind Farm project and recommended various GSI resources for the EIAR assessment:

In relation to geoheritage, GSI confirmed that "there are no unaudited County Geological Sites in the vicinity of the proposed wind farm development".

With regard to Flood Risk Management, there is a need to identify areas for integrated constructed wetlands. The proposed wind farm development is partially underlain by a 'Regionally Important Aquifer - Karstified (diffuse)'. The Groundwater Vulnerability map indicates the area covered is variable. GSI therefore recommended online resources to identify these elements in the EIAR.

GSI recommend that geohazards be taken into consideration, especially when developing areas where these risks are prevalent, and GSI encourage the use of their online data when doing so.

GSI highlights the consideration of mineral resources and potential resources as a material asset which should be explicitly recognised within the environmental assessment process. GSI provides data, maps, interpretations and advice on matters related to minerals, their use and their development and also provide information on Active Quarries, Mineral Localities and the Aggregate Potential. GSI recommended identifying and ensuring that natural resources used in the proposed development are sustainably sourced from properly recognised and licensed facilities.

GSI's scoping response was considered in Chapter 9 – Land, Soils & Geology with regard to geological heritage, groundwater vulnerability and geohazards, and consideration of mineral resources. Mineral resources are considered further in Chapter 11 – Material Assets with regard to non-renewable resources. Chapter 10 – Hydrology & Water Quality deals with flood risk management at the proposed wind farm.

Gas Networks Ireland

Gas networks Ireland provided a map of nearby infrastructure in proximity to the proposed wind farm site. Gas Networks Ireland confirmed that there is no recorded gas network within the area of interest. This information was drawn into Chapter 11 – Material Assets when considering potential impact on utility infrastructure.

N/M20 Cork to Limerick

The NM20 Project Liaison Team were contacted as part of the scoping process, as the proposed wind farm site was located within the constraints study area for the N/M20. The Liaison Team responded stating "The proposed windfarm is outside the NM20 Short-listed option corridors and as such we do not have any comments at this point in time". This response has been considered in Chapter 13 – Traffic & Transportation.

Irish Aviation Authority (IAA)

In their scoping response IAA recommended that consultation should be undertaken with Shannon Airport Authority and daa/Cork Airport Authority to assure that the proposed wind farm and the associated cranes during construction would have no impact on aviation activities at Shannon or Cork Airport.

Furthermore, IAA stated that in the event of planning being consented for the proposed development, an aeronautical obstacle warning light scheme for the wind farm should be agreed, notification should be sent to IAA prior to commencement of crane operations during construction, and the coordinates and ground and tip height elevations of the as-constructed turbines should be forwarded to the IAA.

The IAA's response is considered in Chapter 16 – Telecommunications and Aviation. Shannon Airport, Cork Airport and Dublin Airport Authority (daa) were all contacted during the scoping process as a result of IAA's request.

Shannon Airport Authority

Shannon Airport Authority was contacted following recommendation from the IAA. In their scoping response, Shannon Airport Authority confirmed that their assessment indicates that the proposed development should not impact on the aerodrome obstacle limitation surfaces.

Shannon Airport Authority recommended that regard should be had to the IAA's Obstacles to Aircraft in Flight Order (2005). This response is considered in Chapter 16 – Telecommunications and Aviation.

Dublin Airport Authority

Dublin Airport Authority (daa) was contacted following recommendation from the IAA. In their response, the daa stated that the proposal has been reviewed by their Aerodrome Standards Manager. There are no anticipated impacts on Cork Airport. The daa recommended consultation with the Irish Aviation Authority. This response is considered in Chapter 16 – Telecommunications and Aviation.

Telecommunications Operators/Providers

As part of the scoping process, telecommunications operators and providers in the area of the proposed wind farm were contacted and details of the wind turbine locations were shared in order to determine any potential impact on telecommunications links. Responses received indicate no potential impacts to telecommunications services. A single operator, Novatelecom, stated there would be potential impact to their publicly available telecommunications services. Further consultation and assessment was therefore conducted as part of the telecommunication assessment. All responses from telecommunications operators are considered in Chapter 16: Telecommunications & Aviation.

5.3 Consultation with Key Stakeholders

5.3.1 Pre-planning Meeting with Cork County Council

A pre-planning meeting was held on Tuesday the 27th of April 2021 with Cork County Council (ref. PPN 21/300). The meeting was conducted via a video call online. The following people were in attendance:

- Planner - Cork County Council
- Project Manager – EMPower
- Portfolio Manager – EMPower
- Planner – Fehily Timoney & Company
- Director of Services – Fehily Timoney & Company

Representatives from EMPower and Fehily Timoney presented the Annagh Wind Farm project including the proposed development, design of the project, policy context, receiving environment, environmental assessment to date, landscape and visual photomontages and consultation completed to date.

During the meeting the Cork County Council representative set out some observations including ensuring setback distance from the adjacent SAC and inclusion of a cumulative assessment of consented and constructed wind energy developments and other projects in the area of the site. Potential landscape and visual impact was also cited as an observation.

The Cork County Council representative recommended a Construction Environmental Management Plan (CEMP) be submitted and include details of quarries, borrow pits remedial works and mitigation.

It was also advised that all environmental assessment be conducted in line with best practice guidelines, for each respective environmental topic.

The Cork County Council representative recommended a number of departments to contact for feedback including the County Council Archaeologist, Ecologist and Area Engineer. These County Council departments were contacted with a copy of the pre-planning presentation following the meeting. A response was received from the Ecology department which is further detailed below.

Pre-planning Response from Cork County Council Ecology Office

An email response was received from Cork County Council Ecology Office on the 11/05/2021. The response set out general observations and likely areas of interest for the assessment of the project and is included in Appendix 5.1. Key concerns from an ecological perspective raised by the County Council are:

- Potential for impact on sites designated or proposed to be designated for protection of biodiversity;
- Potential for impact on habitats of high natural value; and
- Potential for the proposed development to give rise to negative effects on populations of protected species.

General issues highlighted include:

- Assessment of impact on designated sites. It is advised that you would commence the necessary survey and assessment work to compile a Natura Impact Statement in respect of this project.
- Potential for the project to give rise to negative effects on freshwater habitats. To this end, there should be a focus at design stage on providing for an appropriately designed surface water management system which minimises risk of release of contaminants to surface waters and ensures that there is no increase in surface water run-off from the site.
- Assessment of impact on habitats. Agricultural land (grassland & broadleaf plantations) are potentially utilised by a number of protected and/or species of conservation concern. It's noted that it is generally recommended that development on peat habitats is avoided and in particular, the site should be designed to avoid direct intervention within intact peat habitats and on other habitats of high natural/conservation value. The design and site layout should be informed by your ecological assessment.
- Any species-specific surveys which are deemed to be required including bird surveys must be completed by qualified and experienced practitioners following recognised best practise methods. Information gathered during the survey stage should be used to inform design to ensure that areas around known breeding sites and key foraging areas for sensitive bird species are avoided. Please present mapping of any habitat loss respective to foraging and breeding sites as part of assessment.
- With regard to bat activity, if commuting and foraging routes of bats relative to proposals could be presented and if these routes could also be presented respective of habitats on site including any habitat loss associated with the development. Furthermore, should it be proposed that the loss of ecological corridors for bats be offset through planting, it is recommended that any such planting should be done as to provide the continued use of the site by bats.

This should be done in such a way that while maintaining connectivity to the wider landscape, it should also provide a route that divert bats away from the turbine locations as to reduce the potential risk of mortality, while continuing to link bats to foraging and/or roosting habitat.

- Cumulative impacts assessed should also consider solar projects within the area having particular regard to cumulative impacts on protected species and habitats of high natural value.
- Decommissioning and reinstatement should be considered in detail and shall include opportunities for biodiversity enhancement where possible.

Finally, the Cork County Council Ecologist recommended that Ecological Impact Assessment (stand alone or within an EIAR) and the NIS should be prepared taking account of National and EU Guidelines as well as recent case law. Methodologies used for site surveys should be specified within the submitted reports.

The comments made by Cork County Council during the pre-planning meeting and subsequent follow up correspondence was considered with respect to the environmental impact assessment and design of the project.

5.3.2 Development Applications Unit (DAU) – National Parks & Wildlife Service (NPWS)

A consultation request was submitted to the DAU by email on the 10th of July 2020 which set out the elements of the proposed development, including mapping of sensitive habitat. Comments and observations were requested regarding the proposed development. Receipt was received on the same date.

A scoping request was sent to the DAU on the 22nd of September 2020. A follow up request for a meeting with the NPWS was forwarded to the DAU on the 12th of March 2021 in order to discuss the ecological aspects of the project in detail. No response was received from the DAU.

5.3.3 Projects in Proximity to the Proposed Wind Farm

Consultation was carried out with the developer of an adjacent consented solar farm (Charleville Solar Farm) located in the townland of Fiddane. Issues were raised around the interaction of the consented solar farm and the proposed wind farm. Potential for overshadowing of solar panels due to the presence of the proposed turbines was discussed. This resulted in the completion of shading analysis which concluded that the presence of the proposed 6 no. wind turbines would result in a minimal impact of 0.29% less generation at the consented solar farm. This was communicated to the developer of the solar farm. The shading analysis is further detailed in Chapter 11 in the material assets section.

Furthermore, the location of T02 was revised to create greater setback between the proposed turbine and the consented solar panels, reducing the potential shading effect. T02 was moved approximately 110m south. This alternative design is further discussed in Chapter 2 of the EIAR. Correspondence with the developer of the solar farm is included in appendix 5.4 of Volume 3 of the EIAR.

5.4 Community Consultation and Public Information Events

Community consultation events were organised and prepared by the developer. EMPower are committed to developing wind energy projects in a socially sustainable manner where the local community's views are taken on board and integrated into the project's design. EMPower began community consultation in late 2019 at the outset of the project during the feasibility stage. This aimed to involve the community from the outset of the project with an objective to maintain inclusion and transparency throughout the development process.

Community engagement was conducted by members of the development team who acted as the Community Liaison Officers (CLOs). Their role was to raise awareness of the project in the local community, engage with individuals in the area, distribute project information and updates, and invite feedback from the public. The following section summarises the community consultation which took place throughout the feasibility stage and pre-planning process of the Annagh Wind Farm.

In order to engage with local residents while observing public health guidance and restrictions surrounding COVID-19, alternative consultation methods were employed including online webinars, virtual consultation and information rooms, and distribution of information by email and post.

A report detailing the community consultation is included in Appendix 5.5, in Volume 3 of this EIAR. Materials distributed to the public are included in Appendix 5.3.

5.4.1 Community Information Event - October 2019

An information event was held by representatives of EMPower on Wednesday the 30th of October 2019 at Liscarroll Gaels GAA Club, Churchtown. The event was advertised in the Corkman Newspaper on Thursday the 24th of October. The event was aimed at introducing the local community to the project at an early stage during the feasibility assessment of the project. Members of EMPower's development team were present to inform members of the public of the intention to develop the project, describe the various details of the project that had been developed to date and to feedback public opinion into the design process.

The project team presented the Annagh Wind Farm proposal which was then made up of an 8 no. turbine array. Information bords including maps, text and graphics were presented to describe the project. The information presented included the following:

- A description of the project site, the proposed project and statistics on the potential power output.
- An introduction to EMPower, the company's mission statement and expertise.
- A description of the development process of the wind farm from land agreements to decommissioning.
- Facts about wind energy in Ireland including current situation, national policy goals and the renewable energy support scheme.
- Information on the community benefit fund, describing the development benefits to the local community as well as other socio-economic benefits such as job creation and County Council rates contribution.

A brochure was prepared describing the above information and made available at the event. Contact information for the project team was included so members of the public could get in contact and request information on the project.

5.4.2 Online Webinar – December 2020

An online webinar was held on the 09th of December 2020. An advertisement for the event was published in the Corkman Newspaper on the 03rd of December 2020 and a letter was distributed to dwellings in proximity to the proposed project, inviting participants to the event. Letters were distributed to dwellings within 2km of the proposed wind farm site. The purpose of the webinar was to engage with local residents while observing public health guidance and restrictions surrounding COVID 19, while providing meaningful information and discussion.

The presentation introduced EMPower and the environmental assessors Fehily Timoney & Company. A project schedule was set out including an outline planning submission date, date of application to the Renewable Energy Support Scheme and an approximate construction commencement date.

The site screening process was described, informing the public of how the site was selected at a national and regional scale. This was followed by an outline of the proposed wind farm development including the latest layout, potential haul routes and potential grid connection routes.

A description of the community benefit fund was provided as part of the Renewable Energy Support Scheme, and an approximate breakdown of allocated funding was set out in order to provide a visualisation of how the fund could be utilised. This was followed by the first round of questions from the attendees.

The presentation then moved onto the Environmental Impact Assessment Report compilation element of the project where the various environmental topics were described. This included insight into the visual analysis of the project where the zone of theoretic visibility of the proposed turbines was presented and the various viewpoints which would be used for the landscape and visual impact assessment were presented.

The attendees were then invited to ask questions on the environmental assessment. Finally, the project team concluded by providing contact information and a description of the virtual consultation room which was planned to be put on the project website prior to submission of the planning application.

5.4.3 Online Webinar – March 2021

A second online webinar was held on the 25th of March 2021. An advertisement for the event was published in the Corkman Newspaper on the 18th of March 2021 and a letter was distributed to dwellings within 2km of the proposed wind farm site, inviting participants to the event.

Similar to the previous event, the presentation described the applicant and environmental assessment team and set out the evolution of the project to date. Additional project information was presented such as a detailed layout of the project and the proposed turbine delivery route. Additional environmental information was also presented, and photomontages were included which demonstrated a visualisation of what the proposed wind farm would look like in the landscape from various viewpoints. The attendees were invited to ask questions and contact information was provided for any follow up queries.

5.4.4 Online Webinar – September 2021

A third online webinar was held in the evening of the 8th of September 2021. This webinar was advertised locally via a letter drop to houses within 2km of the wind farm site.

This webinar was held at the lead-up to the planning submission and presented more detailed information on surveys and assessments to date as well as findings of the environmental impact assessment.

An introduction to the applicant was presented and community benefit was discussed in detail for the project. The site screening process as detailed in Chapter 2 was set out. The design of the project was presented including the main wind farm site, turbine delivery route and grid connection. Environmental topics were discussed including social aspects, biodiversity, hydrology, ornithology, shadow flicker, noise, engineering, archaeology and landscape and visuals. Photomontages of various views of the proposed project were presented and discussed.

Questions from the public were encouraged and some frequently asked questions received by EMPower were addressed. The webinar was made available to view on the project website following the presentation.

5.4.5 Project Website

A dedicated project website was established in 2020 in order to provide accessible information to the public regarding the Annagh Wind Farm project. The contents of the website includes details of the applicant, Annagh Wind Farm project statistics including socio economic benefits and community benefit fund, information on environmental assessment, recent relevant publications, frequently asked questions on wind energy development, and contact details in order for members of the public to communicate directly with the project team.

The website also provided details of the public consultation webinars hosted by the project team, including information on the format of the webinars, and a portal to register for attending the webinars. Due to the development of the COVID 19 virus and the associated contact restrictions, the project website was seen as a significant tool for community engagement and provision of project related information.

An online virtual exhibition was made available on the project website in October 2021, in lieu of further workshops and community information events, as a result of COVID-19 restrictions. This included a range of project information and presentations provided by the project team.

The online exhibition includes an introductory video, an introduction to the development team, information on the development process and timelines, a description of the elements of the proposed project, information on the Environmental Impact Assessment, project literature and contact information for the project team. The exhibition also provides photomontages of the proposed development.

A screenshot of the online exhibition is included below in Figure 5-1.

The project website and online virtual exhibition can be accessed at: https://annaghwindfarm.ie/

Figure 5-1: Virtual Exhibition Web Page

5.4.6 Key Issues Raised During Community & Public Consultation

During the public consultation process many questions, queries and comments were raised by the local community during the online webinars, public meeting, and via emails and letters to the project team through the contact details provided on the project website and project literature.

Approximately 2 years of engagement with the local community took place with limited face-to-face engagement prior to March 2020. Following the establishment of COVID-19 contact restriction measures in March 2020, the project team endeavoured to continue the public engagement process in line with the Code of Practice for Wind Energy Development in Ireland - Guidelines for Community Engagement as so far as possible.

Face-to-face meetings and public events were curtailed for the remainder of 2020 and 2021 in line with Government Guidance, however, the development team provided detailed information to local residents where possible and allowed for project design comments, queries and concerns to be channelled through emails, post and telephone calls in order to maintain public safety.

The following is a summary of the main issues and concerns that emerged during the public consultation process:

Visuals – Issues were raised by locals regarding the potential visual impact of the proposed project, including enquiries on the setback distance to nearby dwellings, the number of turbines that would be visible from specific dwellings and potential for cumulative visual impact of the proposed development in combination with the existing Boolard and Rathnacally wind turbines. The development of the project include the removal of 2 no. wind turbines from the design throughout the process due to visual analysis and review of potential visual impacts and consideration of the policy context of the area. This aimed to reduce the visual impact of the proposal by consolidating the design to a smaller footprint, and also reducing the potential for cumulative impact in combination with the existing nearby wind farms when viewed from a distance. Furthermore, a minimum setback distance of 700m between turbines and dwellings was applied across the site for all non-financially involved landowners.

Maps and photomontages included in the Landscape and Visual Assessment was provided on the project website and presented to the public during the online webinars. Correspondence was sent to those who enquired by email or post.

Access – The public raised concerns regarding the access point to the site during the construction phase. This concern was focused on proximity of the access point to nearby dwellings and potential for noise, vibration and dust during the construction phase. The main access point for the proposed wind farm, located on the L1322, is positioned away from dwellings with a single dwelling located within 200m of the site. The second access point is located at the southern extent of the site and consists of an existing agricultural track. This second access point will be used for erection of the proposed met mast and construction of its associated access track. As a result, this entrance will see significantly less construction traffic.

Community Benefit Fund - Members of the public inquired about the community benefit fund associated with the project. Questions were raised about what type of offering would be made available and how it would be distributed throughout the community. Organisations in the community also contacted the project team to enquire if funding could contribute to local facilities. Based on the terms of the first auction of the Renewable Energy Support Scheme (RESS), August 2020, it is expected that for each megawatt hour (MWh) of electricity produced by any future wind farm, the project owners will contribute €2 into a community fund for the RESS contract period i.e. first 15 years of operation and €1 per MWh for the remaining lifetime of the wind farm. This was communicated to the local residents during the online webinars and on the project website, and correspondence was sent to those who enquired by email or post.

5.5 Conclusion

Consultation was carried out with a number of stakeholders, including Cork County Council, Government Departments, Non-Governmental Organisations, telecommunications providers, aviation organisations and local residents. Their comments and feedback were incorporated into the project design iterations and to the assessments conducted in the EIAR as identified in this chapter.

Pre-planning consultation was held with Cork County Council to determine the key points and potential impacts of the proposed development and to inform the assessment methodology. Further detailed correspondence was received from Cork County Council during the scoping exercise which informed various aspects of the EIAR assessment.

Public consultation was facilitated over one and a half years by organising public consultation meetings which were advertised in a local newspaper and invitations sent by post to nearby dwellings which included updates on the proposed project. The purpose of these events was to engage with the wider community and present detailed information.

A dedicated email address and postal address was provided with circulated materials so members of the public could directly contact the project team. This process was commenced as early as possible in order to inform the design of the project and to inform the EIA process prior to its commencement. A dedicated website was also set up to allow for further open communication between the applicant and community throughout the development process and run-up to the application submission. In addition, an online exhibition was set up on the project website to provide information and materials to inform the public of the proposed project.

Observations and issues that arose during the scoping and consultation process have informed the design, assessment and mitigation measures proposed as part of this project as set out throughout this EIAR.

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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 6 – AIR QUALITY & CLIMATE

Prepared for: EMPower

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6 AIR AND CLIMATE

6.1 Introduction

This chapter identifies, describes and assesses the potential significant direct, indirect and cumulative effects on air quality and climate arising from the construction, operation and decommissioning of the proposed Annagh Wind Farm.

The proposed wind farm site is located in north County Cork, approximately 45km north of Cork City. The Site is located approximately 6km south west of Charleville and approximately 8km north west of Buttevant.

The Site is located in a rural area. The settlement pattern in the area is linear, made up of one-off rural housing and farmyards generally located along the local road network. The nearest settlement is the village of Churchtown which is located approximately 3km to the south of the Site.

The Grid Connection Route runs along the L1322 public road from the site entrance to the Charleville 110kV Substation in the townland of Rathnacally. The Grid Connection Route follows the public road for approximately 3.4km.

The production of energy from wind turbines has no direct emissions as is expected from fossil fuel based power generating stations. Harnessing more energy by means of renewable sources will reduce dependency on fossil fuels, thereby resulting in a reduction in harmful emissions that can be damaging to human health and the environment. Some minor short term or temporary indirect emissions associated with the construction of the Project include vehicular and dust emissions.

A detailed description of the proposed project assessed in the EIAR is contained in Chapter 3.

The proposed project assessed in this EIAR is comprised of the following key elements:

- The wind farm site **(referred to in this EIAR as** 'the Site');
- The grid connection route (**referred to in this EIAR** as the 'GCR');
- The turbine delivery route **(referred to in this EIAR as** the 'TDR');

The Site includes the wind turbines, internal access tracks, hard standings, permanent meteorological mast, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm. Refer to Figure 3-2 for the general arrangement of the Site.

Replanting lands have been identified in the townlands of Emlagh, near Moyasta, County Clare. The replant lands have been assessed for potential cumulative impact throughout the EIAR.

6.1.1 Statement of Authority

This chapter of the EIAR was completed by Eoghan O'Sullivan and Donna O'Halloran. Eoghan is a civil engineer with Fehily Timoney & Company with 12 months of experience in EIAR production for renewable energy projects. Eoghan holds an BE (Hons) in Civil, Structural and Environmental Engineering from UCC, Cork.

Donna is a project environmental scientist with an MSc (Hons)Environmental Resource Management from UCD, Dublin and an MSc Ecological Assessment from UCC, Cork. Donna has 5 years' experience as an environmental scientist and ecologist across a multitude of sectors.

6.1.2 Air Quality

In order to protect our health, vegetation and ecosystems, EU Directives have set out air quality standards for Ireland and the other member states for a wide variety of pollutants. These Directives include how we should monitor, assess and manage ambient air quality. The European Commission set down the principles to this approach in 1996 with its Air Quality Framework Directive (96/62/EC). Four "daughter" directives lay down limits for specific pollutants:

- 1st Daughter Directive (99/30/EC): Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead;
- 2nd Daughter Directive (2000/69/EC): Carbon monoxide and benzene;
- 3rd Daughter Directive (2002/69/EC): Ozone;
- 4th Daughter Directive (2001/107/EC): Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air.

The Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) was published in May 2008. It replaced the Framework Directive and the first, second and third Daughter Directives. The fourth Daughter Directive (2004/107/EC) will be included in CAFE at a later stage. The limit and target values for both Directives are outlined below.

The CAFE Directive was transposed into Irish legislation by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). It replaces the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), the Ozone in Ambient Air Regulations 2004 (S.I. No. 53 of 2004) and the Environmental Protection Agency Act, 1992 (Ambient Air Quality Assessment and Management) Regulations, 1999 (S.I. No. 33 of 1999). The fourth Daughter Directive was transposed into Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009). Table 12.1 details the limit values for pollutants as per the CAFE Directive.

Table 6-1: Limit Values of CAFE Directive 2008/50/EC

Pollutant	Limit Value Objective	Averaging Period	Limit Value (ug/m3)	Limit Value (ppb)	Basis of Application of the Limit Value
SO_2	Protection of human health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year
SO_2	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year
SO_2	Protection of vegetation	calendar year	20	7.5	Annual mean
SO_2	Protection of vegetation	1 Oct to 31 Mar	20	7.5	Winter mean
NO_2	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year
NO_2	Protection of human health	calendar year	40	21	Annual mean
NO + NO_2	Protection of ecosystems	calendar year	30	16	Annual mean
PM_{10}	Protection of human health	24 hours	50		Not to be exceeded more than 35 times in a calendar year
$PM_{2.5}$	Protection of human health	calendar year	40		Annual mean
$PM_{2.5}$ - stage 1	Protection of human health	calendar year	25		Annual mean
$PM_{2.5}$ - stage 2	Protection of human health	calendar year	20		Annual mean
Lead	Protection of human health	calendar year	0.5		Annual mean
Carbon Monoxide	Protection of human health	8 hours	10,000	8620	Not to be exceeded
Benzene	Protection of human health	calendar year	5	1.5	Annual mean

There are no statutory limits for dust deposition, however, the TA Luft (German Government 'Technical Instructions on Air Quality') state a guideline value of 350 mg/m^2/day.

There are no limit values in relation to ozone, however, the Ozone Daughter Directive sets target values. These are detailed in Table 6.2 along with information threshold and alert threshold values.

Table 6-2: Target Values for Ozone

Objective	Calculation	Target Value for 2020
Protection of Human Health	Maximum daily 8-hour mean	120 µg/m^3
Protection of vegetation	AOT40*, calculated from 1-hour values from May to July	6000 µg/m^3-h
Information threshold	1-hour average	180 µg/m^3
Alert Threshold	1-hour average	240 µg/m^3
*The sum of the differences between hourly ozone concentration and 40 ppb for each hour when the concentration exceeds 40 ppb during a relevant growing season, e.g. for forest and crops.		

Air Quality and Health

According to the EPA (Irelands Environment 2020 – Chapter 14 – Environment, Health and Wellbeing), the number of deaths directly linked to air pollution is estimated at 1,300 premature deaths in Ireland annually due to poor air quality (predominantly due to PM2.5), with a figure of 6 to 7 million premature deaths worldwide(UN Environment, 2019)[1].

Generally, air quality in Ireland is acceptable. However, in the short term, when compared with WHO guideline values and EEA reference level values; ozone, particulate matter and PHAs are of concern and NO2 is expected to increase as traffic on our roads increase.

The use of fossil fuel-based electricity generation leads to NOx and SOx emissions; however, wind generation does not produce any NOx or SOx emissions.

6.1.3 Climate

Carbon dioxide (CO_2) is a greenhouse gas which, if released in excessive amounts, can lead to increases in global temperatures known as 'global warming' or the 'greenhouse effect' which can influence climate change. Once the project is constructed there will be no resultant negative impacts on climate change. The provision of the project will have a long-term positive impact by providing a sustainable energy source. Should the proposed wind farm not be developed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other emissions, and hinder Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal.

[1] EPA, 2020, cited in' Irelands Environment 2020 – Chapter 14 – Environment, Health and Wellbeing', p. 364.

The agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C above pre-industrial levels and to limit the increase to 1.5°C. Under the agreement, Governments also agreed on the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries and to undertake rapid reductions thereafter in accordance with the best available science.

The International Panel on Climate Change (IPCC) has put forward its clear assessment that the window for action on climate change is rapidly closing and that renewable energy sources such as wind will have to grow from 30% of global electricity at present to 80% by 2050 if we are to limit global warming. In this regard the Government enacted the Climate Action and Low Carbon Development Act 2015 which provides for the approval of plans by the Government in relation to climate change for the purpose of pursuing the transition to a low carbon, climate resilient and environmentally sustainable economy.

This was supplemented by the Climate Action and Low Carbon Development (Amendment) Bill 2021 which will establish a legally binding framework with clear targets and commitments set in law, and ensure the necessary structures and processes are embedded on a statutory basis to ensure we achieve our national, EU and international climate goals and obligations in the near and long term. The Bill will amend the Climate Action and Low Carbon Development Act 2015 to significantly strengthen the framework for governance of climate action by the State in order to realise the nation's climate goals and obligations.

Under the Kyoto Protocol and the Doha Amendment, during the first commitment period, 37 industrialized countries and the European Community committed to reduce GHG emissions to an average of five percent below 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18 percent below 1990 levels in the eight-year period from 2013 to 2020.

In December 2018, the revised Energy Efficiency Directive, the revised Renewable Energy Directive and the new Governance Regulation were formally adopted. The new regulatory framework includes a binding renewable energy target for the EU for 2030 of 32% with an upwards revision clause by 2023. This agreement will help the EU meet the Paris Agreement goals. The commission has also indicated an intention to adopt the increased target of 55% at the EU's Nationally Determined Contribution (NDC) under the Paris Agreement. As well as the target being given legislative force in the EU through the proposed EU Climate Law, it will oblige all EU institutions across all areas of competence, and the Member States, to work collectively to achieve the target of 55%[2].

The main achievements of this agreement in terms of renewable energy production are:

- Sets a new, binding renewable energy target for the EU for 2030 of 32%, including a review clause by 2023 for an upward revision of the EU level target;
- A financial framework for investors is to be established to facilitate investment in renewable energy projects;
- Increases competition and market integration of renewable electricity;
- Will reduce dependence on energy imports and increase energy security;
- Improves the design and stability of support schemes for renewables.

[2] https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1599

The Irish government has recently published the Climate Action Plan 2019 (CAP) which sets out a plan of action to address climate change and sets decarbonisation targets. In terms of renewable energy, an increase in electricity generated from renewable sources is to increase to 70% by 2030, with onshore wind capacity increasing to 8.2GW.

Chapter 1 of the CAP sets out the nature of the challenge which Ireland faces over the coming years. The CAP notes that the evidence for warming of our climate system is beyond dispute with observations showing that global average temperatures have increased by more than 1°C since preindustrial times. These changes will cause extensive direct and indirect harm to Ireland and its people, as well as to other countries more exposed and less able than we are to withstand the associated environmental impacts such as extremes in weather, flooding, displacement of population by the creation of climate refugees, poorer water quality and poorer air quality. In order to help reduce CO2 emissions and reach our 2030 and 2050 emissions targets, CAP has set out a list of renewable energy goals which includes implementing up to 8.2 GW total of onshore wind capacity on the island.

6.1.3.1 Climate Action Network Europe Off Target Report 2018

The June 2018 'Off Target Report' published by the Climate Action Network (CAN) Europe which ranks EU countries ambition and progress in fighting climate change listed Ireland as the second worst performing EU member state in tackling climate change. It also stated that Ireland is set to miss its 2020 climate (20% reduction in greenhouse gases) and renewable (40% increase in overall energy from renewable electricity sources) energy targets. Additionally, it was noted that Ireland is also off course for its 2030 emissions target.

In March 2019, the Minister for Communications, Climate Action, and the Environment, Richard Bruton, announced a renewable electricity target of 70% by 2030 for Ireland. Furthermore, the release of the CAP in June 2019 has noted a 30% reduction in greenhouse gases by 2030. Considering only renewable energy from electricity as part of this plan and to meet the required level of emissions reduction by 2030, Ireland will:

- Reduce CO2 eq. emissions from the sector by 50–55% relative to 2030 NDP projections.
- Deliver an early and complete phase-out of coal- and peat-fired electricity generation.
- Increase electricity generated from renewable sources to 70%, indicatively comprised of:
- at least 3.5 GW of offshore renewable energy;
- up to 1.5 GW of grid-scale solar energy; and
- up to 8.2 GW total of increased onshore wind capacity.
- Meet 15% of electricity demand by renewable sources contracted under Corporate PPAs.

Achieving 70% renewable electricity generation by 2030 will involve phasing out coal and peat-fired electricity generation plants, increasing our renewable electricity production, reinforcing our grid (including greater interconnection to allow electricity to flow between Ireland and other countries), and putting systems in place to manage intermittent sources of power, from renewable energy resources.

6.1.3.2 Climate Change Performance Index

The Climate Change Performance Index (CCPI) is an independent monitoring tool which tracks countries climate protection performance. It assesses individual countries based on climate policies, energy usage per capita, renewable energy implementation and Greenhouse Gas Emissions (GHG) and ranks their performance in each category and overall.

The 2021 CCPI was published in December 2020. While the 2021 CCPI indicated signs of potential reductions in global emissions, no country achieved a "very high" and therefore the first three places of the ranking system remain unoccupied.

Ireland has climbed 2 places from 41st out of 58 globally ranked countries to 39th place and remains at "low" in international performance. Despite these gains however, it remains at "very low" at a national performance level. The 2020 CCPI report states that while some improvements have been made, GHG per capita emissions are at a high level and "significant challenges lie ahead in closing Ireland's emission gap, meeting the current (2030) target and aligning Ireland's emission trajectory with a net zero goal for 2050. Therefore, the country still ranks among the bottom ten performers in this indicator." Recognising Ireland's Climate Action Plan 2019, the CCPI states:

> *"the government must go much further in implementing policies across all sectors that drive sustained emissions reductions over the next decade. Near-term ambition needs to be ratcheted up quickly by specifying deep cuts in fossil fuel and reactive nitrogen usage to put Ireland on a net zero emissions pathway aligned with the Paris temperature goals".*

6.1.4 Carbon Emissions

CO_2 emissions occur naturally in addition to being released with the burning of fossil fuels. All organic material is composed of carbon, which is released as CO_2 when the material decomposes. Organic material acts as a store of carbon. Peatland habitats are significant stores of organic carbon. The vegetation on a peat bog slowly absorbs CO_2 from the atmosphere when it is alive and converts it to organic carbon. When the vegetation dies, in the acidic waterlogged conditions of bogs and peatlands, the organic material does not decompose fully and the organic carbon is retained in the ground.

The carbon balance of proposed wind farm developments in peatland habitats has attracted significant attention in recent years. When developments such as wind farms are proposed for peatland areas, there will be direct impacts and loss of peat in the area of the development footprint. There may also be indirect impacts where it is necessary to install drainage in certain areas to facilitate construction. The works can either directly or indirectly allow the peat to dry out, locally, which permits the full decomposition of the stored organic material with the associated release of the stored carbon as CO_2. It is essential therefore that any wind farm development in a peatland area displaces more CO_2 produced from fossil fuel sources than it releases during the construction, operation and restoration of the wind farm site than is released.

The project is situated in an area which has no peat habitats. The site is not located on active bog or fen habitats. Most of the site has been cultivated and agricultural fields dominate the site.

The Scottish Carbon Calculator Tool was used to calculate carbon emissions and carbon savings as a result of the proposed wind farm - www.gov.scot. Input data used in the calculations is presented in Appendix 6.1.

Ireland's Carbon Emissions

Ireland's greenhouse gas (GHG) emissions are tracked and projected by the EPA for submission to the EU UNFCCC annually. Carbon dioxide emissions are reported alongside methane (CH4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

For 2018, the total national greenhouse gas emissions was estimated to be 60.93 million tonnes[3] carbon dioxide equivalent (Mt CO_{2eq}) (EPA, 2019). This is 0.19% lower (0.53Mt CO_{2eq}) than emissions in 2017. Emissions reductions have been recorded in 6 of the last 10 years, however, two of the last four years have seen large increases in emissions. In the last 3 years national total emissions increased by 5.5% or 3.58 Mt CO_{2eq}.

Emissions in the Energy Industries sector showed a decrease of 10.7% between 2017 and 2018 which is attributable to decreases in the consumption of coal, peat and oil while there were increases in renewable electricity generation. In 2017, electricity generated from wind and hydro increased by 21.1% and 1.6% respectively, reflected in a 9.1% decrease in the emissions intensity of power generation in 2017 (437g CO_2/kWh) compared with 2016 (480 g CO_2/kWh). Renewables accounted for 36.5% of electricity generated in 2019 (SEAI, 2020), up from 25.5% in 2016. Ireland's final consumption of electricity increased by 1.5% (SEAI, 2020).

SEAI estimate that the use of renewables in electricity generation in 2019 reduced CO_2 emissions by 4.8 million tonnes, avoided €297 million in fossil fuel imports. Over 450 MW of wind generation was installed in Ireland during 2019 and wind generation now accounts for 32% of the electricity generated (SEAI, 2020).

The EPA's latest projections report, 'Ireland's Greenhouse Gas Emissions Projections 2020-2040' (June 2021[4]) projected Ireland's greenhouse gas emissions under two scenarios: The With Existing Measures scenario and the With Additional Measures scenario. The With Existing Measures (WEM) scenario incorporates the anticipated impact of policies and measures that were in place (and legislatively provided for) by the end of 2019. The With Additional Measures (WAM) scenario is primarily based on SEAI's Advanced energy projection (which includes existing and planned policies and measures) and anticipated progress in the implementation of Government renewable and energy efficiency policies and measures including those set out in the National Renewable Energy Action Plan (NREAP), the National Energy Efficiency Action Plan (NEEAP) and Ireland's National Development Plan 2018 - 2027. Plate 6.1 illustrates the WEM and WAM projected emissions in relation to Energy Industries.

[3] EPA. 'Irelands National Inventory Report, 2020: Greenhouse Gas Emissions 1990-2018'. Table 2.1.

[4] EPA '2020 Greenhouse Gas Emissions Projections' 2020-2040.

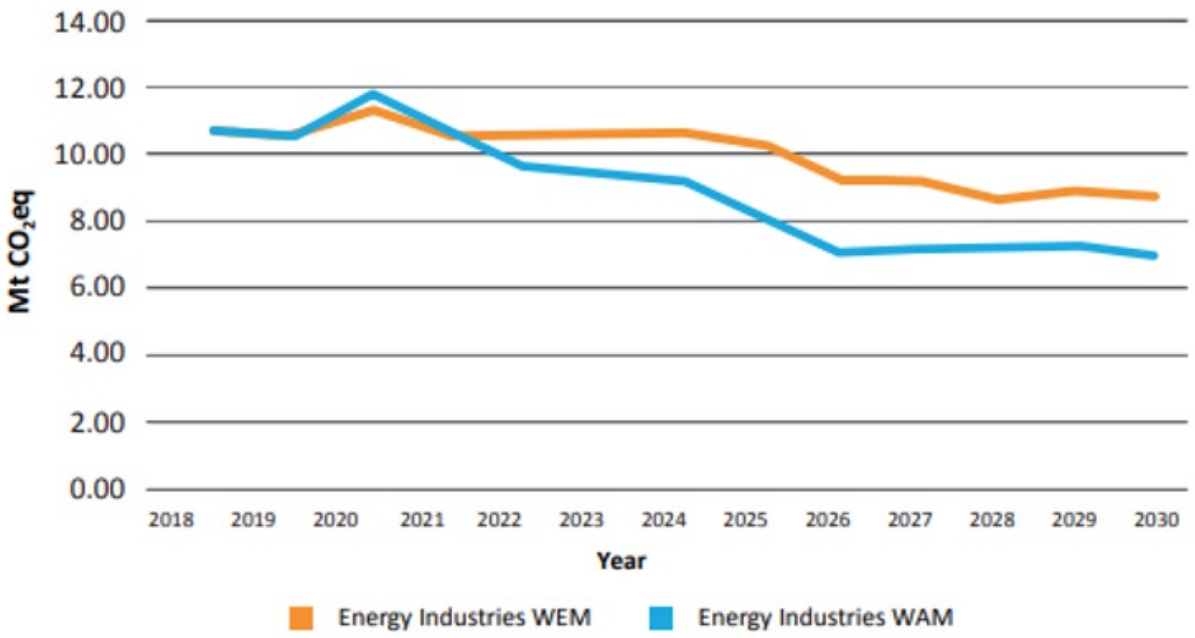

Plate 6-1: Greenhouse Gas Emissions Projections from the Energy Industries Sector under the WEM and WAM scenarios out to 2030

Ireland's 2020 target was to achieve a 20% reduction of non-Emission Trading Scheme (non-ETS) sector emissions i.e. agriculture, transport, residential, commercial, non-energy intensive industry and waste, on 2005 levels, with annual binding limits set for each year over the period 2013 – 2020. Ireland exceeded the binding targets between 2016 and 2019.

A new Effort Sharing Regulation setting out 2030 targets for EU Member States has recently been adopted by the European Council. Irelands 2030 target is a 30% reduction of emissions compared to 2005 levels by 2030 with binding annual limits over the 2021-2030 period to meet that target. Over the longer-term, Ireland's National Policy Position on Climate change has set a target of an aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors.

According to '*Ireland's Greenhouse Gas Emissions Projections 2020-2040*' (EPA, 2021), 2018 greenhouse gas emissions projections show total emissions decrease from current (2019) levels by 3% by 2030, under the With Existing Measures scenario. Under the With Additional Measures, emissions are estimated to decrease by 20% by 2030.

On 14th May 2018, the European Council adopted a regulation on greenhouse gas emission reductions. The regulation sets out binding emission reduction targets for Member States in sectors falling outside the scope of the EU emissions trading system for the period 2021- 2030. The results of the EPA projections show that in a low fuel price scenario, Ireland will exceed the carbon budget over the period 2021 – 2030 by 86-101 Mt CO_2 equivalent or by 40-56 Mt CO_2 with full use of the ETS and LULUCG flexibilities (EPA, 2019).

6.2 Methodology

As the operation of wind turbines does not give rise to emissions (with the exception of back-up generator which will not be in use regularly and has therefore been screened out of the assessment), in respect of air and climate, this chapter focuses on the potential emissions which may arise during the construction and decommissioning phases of the proposed wind farm and associated grid connection.

The Scottish Windfarm Carbon Assessment Tool was also used to predict the carbon savings for the wind farm for an operational period of 35 years and includes all activities and associated potential impacts during the construction, operation and decommissioning phase.

6.2.1 Air Quality

A review of existing air quality monitoring data undertaken by the Environmental Protection Agency (EPA) was reviewed and used to characterise the existing environment.

The impact assessment methodology involved the review and assessment of the proposed wind farm and associated infrastructure to identify the potential for air emissions during construction and decommissioning.

To assess the impacts of construction dust emissions, the NRA's *Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation In Place* was used. This table is provided in Appendix 8 of the National Roads Authority (NRA) *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes* (NRA, 2011) and reproduced below in Table 6.3.

Table 6.4 details the definitions of impact magnitude for changes in ambient pollutant concentrations and Table 6.5 details the descriptors for changes in annual mean nitrogen dioxide, PM10 and PM2.5 at receptors.

Table 6-3: Assessment Criteria for the Impact of Dust Emissions from Construction Activities, with Standard Mitigation in Place

Source		Potential Distance for Significant Effects (Distance from source)		
Scale	Description	Soiling	PM_{10}	Vegetation Effects
Major	Large construction sites, with high use of haul routes	100m	25m	25m
Moderate	Moderate sized construction sites, with moderate use of haul routes	50m	15m	15m
Minor	Minor construction sites, with limited use of haul routes	25m	10m	10m

(source: NRA/TII, 2011)

Table 6-4: Definition of Impact Magnitude

Magnitude of Change	Annual Mean NO_2/PM_{10}	No. Days with PM_{10} conc. >50µg/m³	Annual Mean PM_{10}
Large	Increase/Decrease ≥4µg/m³	Increase/Decrease > 4 days	Increase/Decrease ≥2.5 µg/m³
Medium	Increase/Decrease 2-< 4µg/m³	Increase/Decrease 3 or 4 days	Increase/Decrease 1.25 - <2.5 µg/m³
Small	Increase/Decrease 0.4 - <2 µg/m³	Increase/Decrease 1 or 2 days	Increase/Decrease 0.25 - <1.25 µg/m³
Imperceptible	Increase/Decrease <0.4 µg/m³	Increase/Decrease <1 day	Increase/Decrease <0.25 µg/m³

(source: NRA/TII, 2011)

Table 6-5: Air Quality Impact Descriptors for Changes to Annual Mean Nitrogen Dioxide and PM_{10} and $PM_{2.5}$ Concentrations at a Receptor

Absolute Concentration In relation to Objective/Limit Value	Change in Concentration		
	Small	**Medium**	**Large**
Increase with Scheme			
Above Objective/Limit Value with Scheme (≥40µg/m³ of NO_2 or MP_{10}) (≥25µg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Substantial adverse
Just below objective /limit value with scheme (36- <40 µg/m³ of NO_2 or PM_{10}) (22.5 - <25 µg/m³ of $PM_{2.5}$)	Slight adverse	Moderate adverse	Moderate adverse
Below objective / limit value with scheme (30- <36 µg/m³ of NO_2 or PM_{10}) (18.75 - < 22.5 µg/m³ of $PM_{2.5}$)	Negligible	Slight adverse	Slight adverse
Well below objective /limit value (<30 µg/m³ of NO_2 or PM_{10}) (<18.75 µg/m³ of $PM_{2.5}$)	Negligible	Negligible	Slight adverse
Decrease with Scheme			
Above objective/limit value without scheme (≥40 µg/m³ of NO_2 or PM_{10}) (≥25 µg/m³ of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Substantial beneficial

Absolute Concentration In relation to Objective/Limit Value	Change in Concentration		
	Small	Medium	Large
Just below objective / limit value without scheme (36 - <40 µg/m^3 of NO_2 or PM_{10}) (22.5 - <25 µg/m^3 of $PM_{2.5}$)	Slight beneficial	Moderate beneficial	Moderate beneficial
Below objective/limit value without scheme (30 - <36 µg/m^3 of NO_2 or PM_{10}) (18.75 - <22.5 µg/m^3 of $PM_{2.5}$)	Negligible	Slight beneficial	Slight beneficial
Well below objective/limit value without scheme (<30 µg/m^3 of NO_2 or PM_{10}) (<18.75 µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight beneficial

(source: NRA/TII, 2011)

6.2.2 Climate

A desk-top study assessment was undertaken of available climatic information to characterise the existing environment. In terms of climatic impact, the appraisal considered the net impact that operating the proposed wind farm will have in terms of CO_2 and its displacement of CO_2 from other energy sources over the carbon losses caused by its manufacturing, transportation, construction and decommissioning using the Scottish Carbon Calculator tool.

The impact assessment considered the positive impacts the proposed wind farm will have on contributing to national targets for the reduction of greenhouse gas emissions. The project will result in the production of energy from a renewable source which, once fed into the National Grid, has the potential to avoid several thousand tonnes of carbon dioxide (CO_2) annually that would have been released had the energy been generated by the average Irish power generation mix.

Figures from the Sustainable Energy Authority of Ireland (SEAI, 2020) indicate that the net CO_2 displacement intensity by wind generation was 577 kilo tonnes of CO_2 in 2005, and this increased to 3,879 kilo tonnes CO_2 in 2019. It was estimated that in 2019, approximately €501 million in fossil fuel imports were avoided, with €248 million attributed to wind generation.

In addition to the CO_2 factored for emissions purposes, greenhouse gas (GHG) emissions are also factored into the overall carbon calculation. GHG are associated with the manufacture, transport, construction, operation (linked to backup generation) and decommissioning of wind turbines.

The Intergovernmental Panel on Climate Change (IPCC) in 'Renewable Energy Sources and Climate Change Mitigation' (2014) state that 50 estimates from 20 studies indicate that emissions "are small compared to the energy generated and emissions avoided over the lifetime of wind power plants [farms]: the GHG [greenhouse gas] emissions intensity of wind energy is estimated to range from 8 to 20g CO_2/kWh in most instances". The IPCC (2010) report that the energy payback time, based on lifecycle assessment procedures, per turbine vary between 0.25 years and 0.65 years for onshore developments.

The amount of CO_2 that could potentially be avoided on an annual basis due to the proposed wind farm is estimated based on the expected output of the wind farm. The net displacement value may increase or decrease somewhat, as the generation mix in Ireland develops, under different fuel price scenarios and as demand changes over time, and as more storage, interconnection and demand side management (smart meters) come online. Refer to Section 6.4.4 for details of the calculations for carbon saving as a result of the proposed wind farm.

6.2.3 Carbon Calculation

Previously, guidance produced by Scottish Natural Heritage in 2003 had been widely employed to determine carbon payback in the absence of any more detailed methods. Concerns were raised about the methods of calculating carbon savings for large scale wind farms being developed in Scotland as many of the developments were located on peatlands and forestry which can contain large carbon stocks and which are poorly protected. The methodology for calculating carbon losses was created in 2008 by scientists at the University of Aberdeen and the Macauley Institute with support from the Rural and Environment Research and Analysis Directorate of the Scottish Government, Science Policy and Co-ordination Division. The document, 'Calculating Carbon Savings from Wind Farms on Scottish Peat Lands', was developed to calculate the impact of wind farm developments on the soil carbon stocks held in peat. This methodology was refined and updated in 2011 based on feedback from users of the initial methodology and further research in the area. The web-based version of the carbon calculator, which supersedes the excel based versions of the tool, was released in 2016. The tool provides a straightforward method for estimating the impacts of wind farms on the carbon dynamics of peatlands. The tool also provides guidance when figure inputs are unknown. The carbon calculator, whilst designed for Scottish wind farm developments is used for assessing Irish wind farm developments due to the similarity in development sites, i.e. high ground on peatlands which contain forestry in a similar climate.

The calculator was created to calculate the loss of carbon from acidic bog or fen habitat and defines peat soils as soils with a surface horizon greater than 50cm deep. The calculator takes into account the carbon fixing potential from peatland plants (which is small) and calculates the total area of peat excavation and the total area of peat affected by drainage, using the annual gains due to carbon fixing potential and the time required for any habitat restoration. Carbon stored within the peat itself represents a large potential source of carbon which can be lost during excavation and drainage. Forestry on proposed wind farm sites can affect wind energy yields and therefore clear felling is generally required. Carbon losses as a result of felling are calculated from the area to be felled, the average carbon sequestered annually, and the lifetime of the wind farm. The calculator also takes into account the carbon emissions from the life cycle analysis of the wind turbines and the backup source in order to calculate carbon savings and carbon payback times of a wind farm. Site specific capacity factor is also required to provide a realistic payback time for a site. The calculator also takes into account a grid mix emission factor. The calculator uses default values from the Intergovernmental Panel on Climate Change (IPPCC, 1997) as well as site specific equations from scientific literature to calculate carbon loss.

In keeping with guidance, specific figures have been inputted wherever possible and where this information was not available the guidance provided by the calculator was used. The assumption to use the fossil fuel generation emission factor was made based on the reality that additional wind generation will displace fossil fuel generation (Scot. Gov., 2018).

With regards to the windfarm characteristics the following presumptions for the proposed 6 turbine wind farm were made:

- the lifetime of the windfarm is 35 years,
- the MEC is Approximately 37.2MW,

- the capacity factor is 29.3%[5], and
- the fraction of output to back up is 1.86% (i.e. 5% of capacity factor).

With regards to the characteristics of the 'peatland' before development, no peat was found on site during walkovers by an Engineering Geologist.

Also, whilst 12.6ha of broadleaf forest is to be felled, approximately 12.6ha of forest will be replanted at Emlagh, Co. Clare and the carbon calculator does not take this into account. The calculator is also designed for sites where construction occurs on peat. There is no peat on this site. For these reasons it is therefore highly likely that the calculated carbon loss figure for the proposed project will be higher than the actual carbon loss for the project.

The Scottish Government's online carbon calculator as outlined above, was used to assess the impacts of the proposed wind farm in terms of potential carbon losses and savings taking into account peat removal, drainage, and forestry felling. A copy of the outputs is provided as Appendix 6.1 of this EIAR. A summary of the main CO_2 losses due to the proposed wind farm development are summarised in Table 6.12.

6.3 Existing Environment

6.3.1 Air Quality

European air quality legislation requires that each member state be defined in terms of Zones and Agglomerations for air quality, with Ireland divided into four zones. The EPA has designated four zones within Ireland[6]:.

- Zone A: Dublin City and its environs
- Zone B: Cork City and its environs
- Zone C: 24 cities and towns (such as Galway, Limerick and Waterford cities and towns such as Naas, Newbridge, Celbridge, Leixlip) with a population of greater than 15,000
- Zone D covers the remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The proposed wind farm and grid connection are located in Zone D. The majority of the Turbine Delivery Route (TDR) is in Zone D. A short section of the TDR is in Zone C where the route takes the N18, south of Limerick City.

The air quality in each zone is monitored by the EPA and classified with respect to upper and lower assessment thresholds based on measurements over the previous five years. The number of monitoring locations required is dependent on population size and whether ambient air quality concentrations exceed the upper assessment threshold, are between the upper and lower assessment thresholds, or are below the lower assessment threshold.

[5] Calculated using a capacity factor of 29.3 (2019 capacity factor for wind energy in Ireland, SEAI, 2020)

[6] EPA. Air Quality Zones

The Air Quality in Ireland 2019 – Indicators of Air Quality (EPA 2020) noted that Ireland's overall air quality was good, however, localised issues in cities, towns and villages occurred throughout 2019. When compared to WHO Air Quality Guideline values, Ireland exceeded the WHO Guideline values in 2019 at 33 monitoring sites across the country due to the burning of solid fuel. Ireland was above the European Environmental Agency reference level for PAH, a toxic chemical, at 4 monitoring sites due to the burning of solid fuel. The Air Quality Index for Health map on the EPA website, shows that the current air quality recorded at nearby monitoring stations in proximity to the wind farm site and grid connection is classed as 1 – Good.

An assessment of air quality was carried out in Limerick City from 26th January 2000 – 13th November 2000[7].The monitoring assessment at Limerick City is the closest site to the application site and provides an environmental baseline of air quality conditions in the region. A summary of findings for sulphur dioxide, Particulate Matter (PM_{10}), Nitrogen Dioxide (NO_2) and Carbon Monoxide (CO) is found in the following sections.

6.3.1.1 Sulphur Dioxide

Sulphur Dioxide for the period of January 2000 to November 2000 recorded at the Limerick City air monitoring station is presented in Table 6.6. The hourly limit value was not exceeded during the measurement period. There was one exceedance of the 50 µg.m-3 lower assessment threshold. The directive stipulates that the lower assessment threshold should not be exceeded more than three times in a calendar year.

Table 6-6: Sulphur Dioxide Data for Limerick City 2000

Parameter	Measurement
Number of Hours	6840
No. of measured values	6812
Percentage Coverage	99.6%
Maximum hourly value	235.1 µg.m^{-3}
98 percentile for hourly values	50.5 µg.m^{-3}
Mean hourly value	10.4 µg.m^{-3}
Maximum 24 hour mean	51.2 µg.m^{-3}
98 percentile for 24-hour mean	29.5 µg.m^{-3}

6.3.1.2 Particulate Matter (PM_{10})

Particulate matter are very small particles which can be either solid or liquid. Some of these particles occur naturally, while many are man-made. Particulate matter is referred to as PM. The number following the PM is used to show how small the PM is. The EPA monitors two types of PM and compare levels to limit values in the CAFE (Clean Air for Europe) Directive and WHO guidelines. These are PM_{10} and $PM_{2.5}$.

Particulate matter (PM_{10}) data for the year 2000 monitoring period in Limerick City is presented in Table 6.7.

[7]EPA. Ambient Air Monitoring in Limerick City. https://www.epa.ie/publications/monitoring--assessment/air/ambient-air-monitoring/EPA_air_assessment_Limerick.pdf

The 24-hour limit value for the protection of human health (50 µg.m-3) was not exceeded during the measurement period. The directive stipulates that the limit value should not be exceeded more than 35 times in a calendar year. The upper assessment threshold was exceeded on 52 days, the lower assessment threshold was exceeded on 122 days. The directive stipulates that each of the assessment thresholds should not be exceeded more than 7 times in a calendar year. The mean of the daily values during the measurement period (24 µg.m-3) is below the annual limit value for the protection of human health (40 µg.m-3).

Table 6-7: Particular Matter (PM_{10}) data Limerick City

Parameter	Measurement
No. of Days	291
No of missing values	84
Percentage coverage	71.1%
Maximum daily value	49.5 µg.m^{-3}
Mean daily value	24 µg.m^{-3}

6.3.1.3 Nitrogen Dioxide (NO2)

Nitrogen dioxide and oxides of nitrogen data for the year 2000 monitoring period in Limerick City is presented in Table 6.8. No hourly mean NO_2 values were above the lower assessment for the protection of human health (Figure 6). The directive stipulates that the lower assessment threshold should not be exceeded more than 18 times in a calendar year. The mean hourly NO_2 value (22 µg.m-3) during the measurement period was below the annual lower assessment threshold for the protection of human health (26 µg.m-3).

Table 6-8: Nitrogen Dioxide and Oxides of Nitrogen Limerick City

Parameter	Measurement
No. of Hours	6840
No of measure values	6809
Percentage coverage	99.5%
Maximum hourly value (NO_2)	243.2 µg.m^{-3}
98 percentile for hourly rates (NO_2)	57.6 µg.m^{-3}
Mean hourly value (NO_2)	22 µg.m^{-3}
Mean hourly value (NO_x)	34.1 µg.m^{-3}

6.3.1.4 Carbon Monoxide (CO)

Carbon Monoxide data for the year 2000 monitoring period in Limerick City is presented in Table 6.9. The mean hourly concentration of carbon monoxide recorded was 0.3 mg/m^3. The CO limit value for the protection of human health is 10 mg/m^3.

Table 6-9: Carbon Monoxide Data for Limerick City 2000

Parameter	Measurement
No of hours	6840
No. of measured values	6829
Percentage coverage	99.8%
Maximum hourly value	2.3 $mg.m^{-3}$
98 percentile for hourly values	0.9 $mg.m^{-3}$
Mean hourly value	0.3 $mg.m^{-3}$
Maximum 8 hour mean	1.8 $mg.m^{-3}$
98 percentile for 8 hour mean	0.9 $mg.m^{-3}$

6.3.1.5 Dust

The WHO[8] defines dust as: "*Airborne contaminants (which) occur in the gaseous form (gases and vapours) or as aerosols. In scientific terminology, an aerosol is defined as a system of particles suspended in a gaseous medium, usually air in the context of occupational hygiene, is usually air. Aerosols may exist in the form of airborne dusts, sprays, mists, smokes and fumes*". In more general terms, dust is an airborne particulate matter ranging in diameter from 10 to 50 microns which is generated by organic and inorganic matter such as coal, grain, metal, ore, rock and wood. Dust can be generated by activities which process organic and inorganic matter. Dust can be stirred up from inert states through weather and wind conditions and deposit on all parts of the surrounding environment.

There are no statutory limits for dust deposition in Ireland. However, EPA guidance suggests that a deposition of 10 mg/m^2/hour can generally be considered as posing a soiling nuisance. This equates to 240 mg/m^2/day. The EPA recommends a maximum daily deposition level of 350 mg/m^2/day when measured according to the TA Luft Standard 2002.

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

6.3.2 Climate

Climate is defined by the EPA as "*the average weather over a period of time*". Climate change is a term that is used to describe a "*significant change in the measures of climate, such as temperature, rainfall, or wind, lasting for an extended period – decades or longer*. [9]"

[8] https://www.who.int/occupational_health/publications/en/oehairbornedust3.pdf

[9] https://www.epa.ie/climate/communicatingclimatescience/whatisclimatechange/

There is scientific evidence[10] which suggests that the current climate is rapidly warming, having reached approximately 1°C above pre-industrial levels in 2017, increasing at a rate of 0.2 °C per decade. Warmer weather places pressure on flora and fauna which cannot adapt to a rapidly changing environment. In Ireland, the pressure on flora and fauna is mitigated due to the dominant influence of the Gulf Stream on Ireland's climate. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitudes.

The climatic conditions for the wider geographical area have been derived from historical meteorological measurements compiled by Met Éireann, the national meteorological service of Ireland. The nearest weather station to the proposed project is the Moorepark weather station which is located in Fermoy, approximately 36km south east of the proposed wind farm and associated infrastructure. These meteorological conditions are presented in Table 6.6 for the period January 2018 – September 2021 (source www.met.ie/climate).

[10]IPCC Special Report "Global Warming of 1.5°C": https://www.ipcc.ch/sr15/download/#chapter

Table 6-10: Climate Records January 2018-September 2021

Total rainfall in millimetres
for MOOREPARK WEATHER STATION

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	72.7	189.9	52.7	22.5	130.8	26.9	62.9	58.3	102.3			
2020	89.7	152.8	47.9	64.8	37.2	72.9	75.7	145.1	43.0	101.5	118.9	152.6
2019	65.9	56.7	114.2	108.3	26.0	87.8	34.6	106.8	71.5	155.0	140.7	114.8
2018	138.4	40.4	88.5	174.8	48.7	32.4	42.9	43.3	60.0	72.4	167.1	168.2
LTA	111.0	80.1	85.5	65.6	69.3	70.2	62.0	83.6	79.5	113.3	105.4	103.9

Mean temperature in degrees Celsius
for MOOREPARK WEATHER STATION

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	4.4	6.3	7.5	7.4	9.8	14.4	17.2	15.6	14.9			
2020	6.1	6.5	6.3	9.7	11.9	13.9	15.3	16.2	13.6	9.7	8.4	5.5
2019	6.5	7.7	7.5	9.2	11.2	13.0	16.5	15.6	13.6	9.6	6.8	6.0
2018	6.3	4.0	4.5	9.0	12.6	16.1	17.4	15.6	12.4	9.8	8.1	8.5
LTA	5.7	5.8	6.9	8.6	11.0	13.8	15.8	15.3	13.1	10.4	7.7	5.8

Mean 10cm soil temperature for
MOORE PARKWEATHER STATION at 0900 UTC

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	3.2	5.2	6.5	8.0	11.1	15.5	18.3	16.3	15.2			
2020	5.3	5.4	5.4	9.5	13.0	15.0	15.8	16.5	13.8	9.4	7.9	5.0
2019	6.3	6.5	7.0	9.2	12.5	14.2	17.8	16.3	13.9	9.9	6.8	5.5
2018	5.1	3.0	4.1	8.7	13.1	17.5	19.5	16.6	13.3	9.7	7.1	7.5
Mean	5	5	5.8	8.9	12.4	15.6	17.7	16.5	13.6	9.7	7.3	6

Global Solar Radiation in Joules/cm^2 for
MOORE PARKWEATHER STATION

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	9230	12648	23438	45185	52732	53182	54018	41742	25290			
2020	9148	14775	27622	41727	63254	44755	45243	41298	32253	20372	8841	7100
2019	7633	13532	29027	39090	57128	48831	51152	42654	33000	19978	9142	6292
2018	8157	15462	24103	32404	53298	62864	58590	41200	32207	21406	8009	5429
Mean	8542	14104	26048	39602	56603	44978	51662	41717	32487	20585	6498	6274

Potential Evapotranspiration (mm) for
MOORE PARKWEATHER STATION

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	8.2	19.2	31.5	56.3	71.2	84.8	92.3	68.3	41.4			
2020	9.0	20.7	35.4	57.3	89.6	75.5	77.1	68.0	47.0	26.4	12.1	8.1
2019	12.0	18.8	37.4	54.6	81.9	78.5	87.9	70.5	47.5	25.3	11.5	9.6
2018	13.3	19.7	31.0	48.3	82.2	105.3	104.7	71.9	46.6	27.1	15.0	11.2
Mean	10.6	19.6	33.8	54.1	81.2	74.3	89.9	70.1	47	19.7	12.9	9.6

Evaporation (mm) for
MOOREPARK WEATHER STATION

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	11.7	27.1	45.1	80.4	102.2	116.3	122.7	92.1	55.3			
2020	12.8	29.2	50.8	80.2	126.1	104.0	105.1	92.2	64.1	36.8	16.7	10.7
2019	16.1	26.0	53.9	78.4	114.7	107.7	117.9	96.2	65.5	35.3	15.8	12.6
2018	17.4	27.3	44.9	68.5	113.0	140.9	138.3	96.2	64.2	37.5	19.6	14.5
Mean	14.5	27.4	48.7	76.9	114	101.1	120.4	142.3	64.6	36.5	17.4	12.6

DEGREE DAYS BELOW 15.5 DEGREE CELSIUS FOR MOOREPARK WEATHER STATION

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	344	257	249	243	180	64	27	38	49	N/A	N/A	N/A
2020	292	262	287	179	126	71	43	32	84	179	213	309
2019	281	218	248	193	144	98	30	39	81	185	262	295
2018	286	322	341	198	115	46	27	54	110	178	223	217

6.4 Impact Assessment

6.4.1 Do-Nothing Impact

If the proposed wind farm does not proceed, local air quality and the microclimate will remain unchanged. On a national scale, there will be an increase in greenhouse gas emissions if increasing future electricity needs are not met by alternative renewable sources which has the potential to contribute to air pollution and climate change. The opportunity to contribute to Ireland's commitments under the Kyoto Protocol and to meet national targets as set out in the Climate Action Plan (2019) would also be lost.

6.4.2 Air Quality

6.4.2.1 Construction Phase Impacts

The principal sources of potential air emissions during the construction of the proposed project will be from the wind farm and grid connection route; from dust arising from earthworks, tree felling activities, trench excavation along cable routes, construction of the new and upgrade of existing access tracks, the temporary storage of excavated materials, the movement of construction vehicles, loading and unloading of aggregates/materials and the movement of material around the site.

Dust emissions arise when particulate matter becomes airborne making it available to be carried downwind from the source. Dust emissions can lead to elevated PM_{10} and $PM_{2.5}$ concentrations and may also cause dust soiling. The amount of dust generated and emitted from a working site and the potential impact on the surrounding areas varies according to:

- The type and quantity of material and working methods;
- Distance between site activities and sensitive receptors;
- Climate/local meteorology and topography.

Table 6.11 details the NRA assessment criteria used for assessing the impact of dust from construction activities sites of varying scale:

Table 6-11: NRA Assessment Criteria for the Impact of Dust Emissions from Construction Activities with Standard Mitigation in Place

Source		Potential Distance for Significant Effects (Distance from source)		
Scale	**Description**	**Soiling**	**PM10**	**Vegetation Effects**
Major	Large construction sites, with high use of haul roads	100 m	25 m	25 m
Moderate	Moderate construction sites, with moderate use of haul roads	50 m	15 m	15 m
Minor	Minor construction sites, with limited use of haul roads	25 m	10 m	10 m

Source: NRA / TII, 2011[11]

[11] https://www.tii.ie/technical-services/environment/planning/Guidelines-for-the-Treatment-of-Air-Quality-during-the-Planning-and-Construction-of-National-Road-Schemes.pdf

Applying the NRA criteria in Table 6.11, the overall construction of the proposed wind farm is considered a major construction site as it will result in soiling effects which have the potential to occur up to 100m from the source, with PM_{10} deposition and vegetation effects occurring up to 25m from the source due to the quantity of construction works which are involved in the development of a wind farm. The nearest receptor is 690m from the proposed turbine locations where the majority of the proposed works will take place, and therefore nearby dwellings will not experience the soiling, deposition or vegetation effects. Construction vehicles and plant emissions have the potential to increase concentrations of compounds such as NO_2, Benzene and PM_{10} in the receiving environment. Due to distance between the nearest receptor and source of emissions the impact from these emissions will be Imperceptible.

The construction of the proposed grid connection route is considered a moderate construction site as it will result in soiling effects which have the potential to occur up to 50m from the source, with PM_{10} deposition and vegetation effects occurring up to 15m from the source. There are approximately 30 one-off houses along the 3.3 km stretch of public road where the proposed grid connection is located. Some houses may experience soiling and deposition of vegetation effects depending on how close to the road corridor they are located. Construction vehicles and plant emissions have the potential to increase concentrations of compounds such as NO_2, Benzene and PM_{10} in the receiving environment. However, due to the nature of construction along the proposed grid connection as described in Chapter 3, which works as a "rolling" construction site, meaning that these works will not be concentrated in any one area of the route for a prolonged period, these effects are considered to be short term, temporary and slight.

It is not predicted that an air quality impact will occur due to traffic at the proposed wind farm as the impacts will fall below the screening criteria set out in the UK DMRB guidance (UK Highways Agency 2007), on which the TII guidance is based. This UK DMRB guidance states that road links meeting one or more of the following criteria can be defined as being 'affected' by a project and should be included in the local air quality assessment:

- Road alignment change of 5 metres or more;
- Daily traffic flow changes by 1,000 AADT or more;
- HGVs flows change by 200 vehicles per day or more;
- Daily average speed changes by 10 km/h or more; or
- Peak hour speed changes by 20 km/h or more.

On the surrounding road network as detailed in Chapter 13 Traffic and Transportation, there will be an average daily increase of 53 HGV trips per day over a construction period of 12 months and 5 HGV trips per day for the construction of the grid connection. LGV traffic is expected to be 34 trips per working day on average for the wind farm site over a 12-month period and 2 trips per day for the grid connection. The combined HGV and LGV average daily increase is 88 trips per day. Therefore, the model is not required in this instance.

Plant and machinery such as generators, excavators etc. will be required at various stages of the construction works. These will be relatively small units which will be operated on an intermittent basis. Although there will be an emission from these units, given their scale and the length of operation time, the impacts of emissions from these units will be imperceptible.

6.4.2.2 Operational Phase Impacts

Once the proposed wind farm and grid connection are constructed there will be no significant direct emissions to atmosphere. A diesel generator will be located at the proposed wind farm substation; however, this will only be operated as a back-up/emergency power supply.

Emissions from the diesel generator will therefore be infrequent. During use, a diesel generator will emit carbon dioxide, nitrogen oxide and particulate matter, however, due to the low usage, the impact will be imperceptible.

Maintenance vehicles will access the proposed wind farm site during the operational period, however, due to the low traffic movements involved, the impact will be imperceptible. The operational phase of the wind farm will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source.

Maintenance vehicles will also access the joint bays for period maintenance and carry out point works along the proposed grid connection route to address any issues during the operational period. However, given the low and infrequent traffic movements involved, the impact will be imperceptible. The operational phase of the grid connection which connects to and operates the proposed wind farm will result in positive impacts on air quality due to the displacement of fossil fuels as an energy source.

6.4.2.3 Decommissioning Phase Impacts

In terms of decommissioning, there will be truck movements associated with removing the wind turbines from the wind farm resulting in vehicular emissions and also dust. However, the number of truck movements would be significantly less than the construction phase and would potentially result in a slight temporary impact. There will also be emissions from machinery on site including for the movement of soil to cover the foundations, however, this is not likely to result in significant impacts.

During the decommissioning phase, the proposed grid connection infrastructure including substations and ancillary electrical equipment will form part of the national grid and shall be left in situ. The internal ducts of the proposed project, and all internal access roads, turbine hardstandings will be left in situ, resulting in no additional truck movements and no impact from emissions from machinery along the grid connection route.

6.4.3 Climate

There is the potential for greenhouse gas emissions to the atmosphere during the construction phase of the proposed wind farm and proposed grid connection such as those arising from construction vehicles, the use of on-site generators, pumps and excavation works. The potential climatic impacts arising from these emissions are assessed hereunder with respect to micro and macro climates.

Microclimate

The significance of impacts associated with the conversion of vegetated surfaces to un-vegetated surfaces is assessed through the consideration of the area of the land experiencing such a change.

The proposed wind farm site is predominately a rural agricultural location with the exception of existing public road ways. The total area of proposed new permanent hardstanding surface is approximately 7% of the wind farm planning development area and consequently there will be no direct or indirect impact on air temperature and microclimate.

There will also be the loss of 12.6 ha of broadleaf forestry within the site. Clear felling will be dispersed over several areas and will not consist of a single clear fell area and there will be no direct or indirect impact on site temperature and microclimate due to clear felling.

Macroclimate

Carbon dioxide (CO_2) is a greenhouse gas which if released in excessive amounts can lead to increases in global temperatures known as 'global warming' or 'greenhouse effect' which can influence climate change. Section 6.4.4 details the carbon savings that have been calculated for the proposed wind farm.

Should the proposed wind farm and proposed grid connection not be developed, fossil fuel power stations will be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other air pollutant emissions, as well as hindering Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

The proposed wind farm project offers Ireland an indigenous form of sustainable electricity and would provide for security of supply against our dependence on imports in addition to the positive impact on the macroclimate.

6.4.4 Carbon Balance

In terms of carbon losses and savings, the online Scottish Windfarm Carbon Assessment Tool (https://informatics.sepa.org.uk/CarbonCalculator/index.jsp) was used to estimate carbon savings as a result of the proposed construction and operation of the wind farm. The assumptions are located in Section 6.2.3 and Appendix 6.1 details the inputs to the model.

Based on the Scottish Windfarm Carbon Assessment Tool, during the manufacturing and transportation of turbines, and construction and decommissioning of the turbines, 34,417 tonnes of CO_2 will be lost to the atmosphere. This represents 2.3% of the total amount of CO_2 emissions that will be offset by the proposed wind farm project. Losses during the construction and decommissioning phases will be due to reduced carbon fixing potential, losses from soil organic matter and losses due to felling forestry. Values for turbine life and felling of forestry are presented in Table 6-12.

In total, it is estimated that **1,503,810** tonnes of CO_2 will be displaced over the proposed thirty five-year lifetime of the wind farm i.e. **42,966** tonnes of CO_2 per annum, which assists in realising the ambitious goals of the Climate Action Plan 2019. From an operational perspective, the proposed wind farm project will displace the emission of CO_2 from other less clean forms of energy generation and will assist Ireland in meeting its renewable energy targets and obligations. The burning of fossil fuels for energy creates greenhouse gases, which contributes significantly to climate change. These and other emissions also create acid rain and air pollution.

For the proposed wind farm development with 6 no. turbines assuming a turbine power rating of 6.2MW, and operational period of 35 years, the payback time for the manufacture, construction and decommissioning phases (including carbon losses from soil, felling of forestry etc.) of the Annagh Project is estimated at approximately 1 years. Should further restoration measures be put in place, the total carbon emissions and carbon payback time would be reduced.

As discussed in Section 6.1.3, the carbon calculator was created to calculate carbon loss from acid bog and fen habitats and the proposed wind farm site does not meet the 0.5m depth of peat required for it to be categorised as peatland. The site does not function as acid bog or fen habitat and therefore does not contain the same high levels of carbon.

It should be noted that the values for carbon loss for the project will be inflated as the Carbon Calculator was designed for assessing impacts on peatlands and there is no peat on this site which means the actual carbon emissions from this project will be lower than the calculator outputs.

In addition, the calculator only takes into account the loss of forestry on site from felling (carbon release) and the loss of forestry growth (carbon sequestration) on site for the lifetime of the project and does not take into account the replanting of forestry outside of the site (there is no option of including external replant lands). Therefore, the carbon loss calculations for the project are slightly overestimated.

Areas cleared of forestry for the project at the Wind Farm Site will be replaced by replanting at an alternative site. A replanting site has been identified at Emlagh, Co. Clare. The total area identified for replanting is 12.6 ha. If these replant lands become unavailable, other similarly approved lands will be used for replanting should the proposed project receive planning permission. A total of 12.6 hectares of new forestry will be replanted at the alternative site to compensate the loss of forestry at the wind farm site which will offset a significant quantum of the 3,881 tonnes of CO_2 lost due to the felling of forestry. An appropriate assessment of forestry replacement lands in the townland of Emlagh, County Clare is found in Appendix 3-3 of Volume 3 of this EIAR.

Table 6-12: Carbon Balance Results

Origin of Losses	**Total CO_2 Losses (tonnes $C0_2$ equivalent)**
Turbine manufacture, construction and decommissioning	34,417
Losses due to Backup	9,546
Felling of Forestry	3,881
Other	-5,252
Total Expected Losses	42,593
Emissions Savings	**Expected $C0_2$ emission savings (tonnes CO_2 per Annum)**
fossil fuel mix electricity generation	42,966
Energy output from windfarm	**MWh**
Estimated Annual Output	95,480
Carbon payback time	**Years**
Fossil fuel mix of electricity generation	1

6.4.5 Cumulative Impacts

The geographic extent of the cumulative assessment is considered on a case-by-case basis, in line with the Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission, 1999).

Projects within 20km of the proposed wind farm site and grid connection have been considered for cumulative impacts in relation to air quality and climate as the majority of impacts identified are relating to the construction phase dust and traffic emissions.

A 20km distance is considered a suitable zone of influence considering the emissions associated with proposed project will be focused on the construction site and significant emissions beyond the construction site are not envisaged. Emissions relating to the TDR have been considered, however, these have been screened out of the cumulative assessment as emissions associated with the transport of turbines and construction works relating to the upgrade of TDR nodes are non-significant.

There are a number of projects and activities which are planned, consented, ongoing or operational within the vicinity of the Annagh Wind Farm Project. These are listed in Table 6-12 below. A full list of all proposed and contented projects considered for the cumulative assessment are contained in Appendix 1.2 of Volume 3 of this EIAR.

Table 6-12: Cumulative Impacts

Title	Development	Distance	Planning ref.
Charleville Solar Farm	Consented 67.8 hectare solar farm bordering site to the north. Separate planning application for grid connection.	0.1km to north	175799, 196817
Solar Farm	Consented 102.76 hectare solar farm and 3.4 km grid connection.	1km south east	204041
Boolard Wind Farm	Constructed 2 turbine wind farm (150.5m tip) and grid connection.	2.36km north west of T4	125997, 155521 & ABP PL.04.245560 175292 (Grid connection)
Rathnacally Wind Farm	Constructed 2 turbine wind farm (150.5 tip) and grid connection.	2.27km north east of T1	124446, 155525 166718 (grid connection)
M20 Motorway	N/M20 Cork to Limerick Improvement Scheme	2-4km east	https://corklimerick.ie/

Cumulative impacts may arise if the construction, operational and maintenance period of these projects occurs simultaneously with the construction of the proposed wind farm and grid connection development. This could result in slight increased traffic emissions, however, provided the mitigation measures as detailed in Section 6.5 are implemented and the mitigation measures proposed for other developments are implemented, there will be no significant cumulative effects on air quality.

There will be no net carbon dioxide (CO_2) emissions from operation of the proposed wind farm. Emissions of carbon dioxide (CO_2), oxides of nitrogen (NOx), sulphur dioxide (SO_2) or dust emissions during the operational phase of the Proposed Project will be minimal, relating to the use of operation and maintenance vehicles onsite, and therefore there will be no measurable negative cumulative effect with other developments on air quality and climate.

The nature of the Proposed Project and other energy developments within 20 kilometres are such that, once operational, they will have a cumulative long-term, significant, positive effect on the air quality and climate.

In terms of climate and carbon, the proposed wind farm will act cumulatively with other renewable energy projects in reducing CO_2 emissions by displacing fossil fuel in the production of electricity, resulting in a slight-moderate positive impact on climate.

6.5 Mitigation Measures

6.5.1 Air Quality

6.5.1.1 Construction Phase

A Construction Environmental Management Plan (CEMP) has been prepared and is included in Appendix 3.1 of Volume 3 of this EIAR. This includes for the following mitigation measures during the construction phase of the proposed wind farm relevant to air quality:

- The internal access roads will be constructed/upgraded prior to the commencement of other major construction activities. These roads will be finished with graded aggregate;
- A water bowser will be available to spray work areas (wind turbine area and grid connection route) and haul roads, especially during periods of excavations works coinciding with dry periods of weather, in order to suppress dust migration from the site;
- All loads which could cause a dust nuisance will be covered to minimise the potential for fugitive emissions during transport;
- Gravel will be used at the site exit point to remove any dirt from tyres and tracks before travelling along public roads;
- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- The access and egress of construction vehicles will be controlled to designated locations, along defined routes, with all vehicles required to comply with onsite speed limits;
- Construction vehicles and machinery will be serviced and in good working order;
- Wheel washing facilities will be provided at the entrance/exit point of the proposed wind farm site;
- The developer in association with the contractor will be required to implement a dust control plan as part of the CEMP (a CEMP is contained in Volume 3, Appendix 3.1. In the event the Planning Authority decides to grant permission for the proposed wind farm, the final CEMP will address the requirements of any relevant planning conditions, including any additional mitigation measures which are conditioned by the Planning Authority.
- Receptors which receive dusting and soiling from local routes entering the site; and dwellings directly adjacent to the grid connection route construction that experience dust soiling, where appropriate, and with the agreement of the landowner, will have the facades of their dwelling cleaned if required should soiling have taken place;
- Ensure all vehicles switch off engines when stationary – no idling vehicles; and
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the contractor by ensuring that emissions from vehicles are minimised through regular servicing of machinery.

6.5.1.2 Operational Phase

As the operation of the proposed wind farm will have positive impacts on air quality, mitigation measures are considered unnecessary.

6.5.1.3 Decommissioning Phase

Mitigation measures for the removal of wind turbines from the proposed project site would be similar as per the construction phase with respect to dust control and minimisation. The proposed access tracks across the proposed wind farm site will be left in situ and utilised as agriculture and forest roads following decommissioning and no mitigation measures are proposed. In terms of the underground grid cable, this will be left in situ and so no mitigation measures are proposed.

6.5.2 Climate

It is considered that the proposed wind farm project will have an overall positive impact in terms of carbon reduction and climate change. It will assist Ireland in meeting the new binding renewable energy target for the EU of 32% by 2030. Also, it will aid in increasing the onshore wind capacity, as per the Climate Action Plan 2019. In terms of renewable energy, an increase in electricity generated from renewable sources is to increase to 70% by 2030, with up to 8.2GW of increased onshore wind capacity. This will be achieved by:

- Phasing out fossil fuels
- Harnessing renewable energy
- Micro-generation; and
- Other measures.

As set out in the Climate Action Plan 2019, in terms of harnessing renewable energy, the volumes and frequencies of RESS will increase, so that the 70% target is met. The measures required to achieve this include finalising the design and implementation of RESS 2 and RESS 3.

As no significant impacts on climate are predicted during construction, no mitigation measures are proposed. In terms of the operational phase, the operation of the proposed wind farm project will have a positive effect on climate due to the displacement of fossil fuels.

6.6 Residual Impacts

6.6.1 Air Quality

Following the implementation of the above mitigation measures, the proposed wind farm and proposed grid connection will result in slight to moderate residual impacts arising from fugitive dust emissions during particular construction activities. These will be localised in nature and as they will be associated with particular elements of the construction phase, they will be temporary in nature and will not result in any permanent residual impacts.

Impacts related to vehicle emissions will practically cease following construction and no significant impacts are anticipated. There will be a low level of maintenance traffic during the operational period, which will have an imperceptible impact.

During operations, the proposed wind farm will result in the avoidance of emissions from fossil fuel generators which is a positive effect on air quality.

6.6.2 Climate

There will be residual positive impacts from the operation of the proposed wind farm project in terms of the displacement of fossil fuel energy generation with renewable energy.

Section 6.4.3 assessed the potential impacts on climate as a result of the development of the proposed Annagh Wind Farm Project through microclimate and macroclimate. At the microclimate level, the proposed project encompasses approximately 7% of the entire site area with hardstanding surfaces (hardstandings, access tracks, structures). The assessment found that a 7% increase in hardstanding area would not negatively impact the vegetation necessary to maintain a microclimate. In terms of macroclimate, it is estimated that an annual average output[12] of approximately 37.2 MW for the proposed wind farm development will result in the net displacement of 42,966 tonnes of CO_2 per annum. This results in a positive impact by removing the GHG emissions that would have otherwise been part of the output of traditional energy manufacturing (i.e. biomass, peat, etc). Potential impacts to climate can have the potential to affect human health and the environment. No direct or indirect impact on air temperature, microclimate or macroclimate has been associated with the development of the proposed Annagh Wind Farm Project due to the location of the site which is predominately a rural agricultural location with the exception of existing public road ways.

There are no potential direct or indirect impacts on air temperature, microclimate and macroclimate associated with the proposed grid connection. Due to the nature of construction along the proposed grid route which works as a “rolling” construction site, no works will be concentrated in any one area of the route. Therefore, the construction phase of the Annagh Wind Farm will not have a significant impact on climate.

Should the Annagh Wind Farm Project not be developed, fossil fuel power stations will likely be the primary alternative to provide the required quantities of electricity. This will further contribute to greenhouse gas and other air pollutant emissions, as well as hindering Ireland in its commitment to meet its target to increase electricity production from renewable sources and to reduce greenhouse gas emissions.

It is therefore considered that there will be no residual impacts on climate as a result of the development of the proposed Annagh Wind Farm Project

[12] Per Scottish Wind Farm Calculation Tool

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 7 – NOISE & VIBRATION

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7. NOISE AND VIBRATION

7.1 Introduction

This chapter contains an assessment of the potential noise and vibration impacts associated with the proposed Annagh Wind Farm. The assessment including undertaking of background noise surveys has been carried out by Fehily Timoney and Company, based on information provided by EMPower and in accordance with current guidance and best practice. Descriptions of the proposed development are provided in Chapter 3 – Volume 2 of the EIAR.

Potential construction noise and vibration impacts have been determined with reference to British Standard 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1 Noise.

Potential operational noise impacts associated with the proposed development have been determined with reference to the UK Institute of Acoustics', A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise (2013). Operational noise associated with the proposed development includes noise from the proposed wind turbines and on-site substation. The operational noise is compared with noise limits derived in accordance with the Wind Energy Development Guidelines 2006 currently in force pursuant to section 28 of the Planning and Development Act 2000, as amended and in accordance with current industry best practice..

Decommissioning noise and vibration impacts have been assessed in accordance with the same standards used to determine the construction noise and vibration impacts.

7.2 Description of Noise and Vibration Impacts

7.2.1 Construction Noise & Vibration

Noise is generated from the construction of the turbine foundations, the erection of the turbines, the excavation of trenches for cables, and the construction of associated hard standings and access tracks, and construction of the substations.

Noise from vehicles on local roads and access tracks is also generated from the delivery of the turbine components and construction materials, notably aggregates, concrete and steel reinforcement.

Vibration is generated by construction activities such as rock breaking and passing heavy goods vehicles. The threshold of human perception of vibration is in the range of 0.14mm/s to 0.3mm/s, described as "might just be perceptible". The guideline values for damage to buildings from vibration are 15mm/s at 4Hz increasing to 20mm/s at 15Hz and 50mm/s at 40Hz and above.

Vibration levels generated from the construction activities proposed at Annagh Wind Farm are:

- Tracked excavators and disc cutters from cable trenching (0.8 mm/s at 4m)
- Pneumatic breakers for cable trenching (0.7 mm/s at 10 m)
- Rock breaking at borrow pits (0.03 mm/s at 100 m)

- Excavation of turbine foundations (0.06 mm/s at 100 m)
- HGV traffic on normal road surfaces (0.01 to 0.5 mm/s) at footings of buildings located 20 m from roadway.

The nearest noise sensitive locations are sufficiently distant that vibration will not be perceivable by residents at their dwellings and building damage will not occur from construction incurred vibration. As such, construction vibration will not be considered further in this chapter.

7.2.2 Operational Noise & Vibration

Noise is generated by wind turbines as they rotate to generate power. This only occurs above the 'cut-in' wind speed and below the 'cut-out' wind speed. Below the cut-in wind speed there is insufficient strength in the wind to generate efficiently and above the cut-out wind speed the turbine is automatically shut down to prevent any malfunctions from occurring. The cut-in speed at the turbine hub-height is approximately 3 m/s and the cut-out wind speed is approximately 25 m/s.

The principal sources of noise are from the blades rotating in the air (aerodynamic noise) and from internal machinery, normally the gearbox and, to a lesser extent, the generator (mechanical noise).

The blades are carefully designed to minimize noise whilst optimising power transfer from the wind. See Oerlemans et al. (2008) 'Location and quantification of noise sources on a wind turbine' for further details on the principal sources of noise from a wind turbine.

Noise may also be generated from ancillary equipment such as transformers at on-site substations. However, these generally have low source noise levels compared to wind turbines themselves and, provided they are not located within the immediate vicinity of a residential dwelling, are unlikely to cause disturbance in the context of the other noise sources.

7.2.3 Blade Swish (Amplitude Modulation of Aerodynamic Noise)

This is the periodic variation in noise level associated with turbine operation, at the rate of the blade passing frequency (rotational speed multiplied by number of blades). It is often referred to as blade swish or amplitude / aerodynamic modulation (AM). This effect is discussed in ETSU-R-97, 'The Assessment and Rating of Noise from Wind Farms' (1996), which states that *'… modulation of blade noise may result in variation of the overall A-Weighted noise level by as much as 3 dB(A) (peak to trough) when measured close to a wind turbine... '* and that at distances further from the turbine where there are *'… more than two hard, reflective surfaces, then the increase in modulation depth may be as much as 6 dB(A) (peak to trough)'*. It concludes that *'the noise levels (i.e. limits) recommended in this report take into account the character of noise described ... as blade swish'.*

An observer close to a wind turbine will experience *'blade swish'* because of the directional characteristics of the noise radiated from the trailing edge of the blades as it rotates towards and then away from them. This effect is reduced for an observer on or close to the (horizontal) turbine axis, and therefore would not generally be expected to be significant at typical separation distances, at least on relatively level sites.

In some cases amplitude modulation is observed at large distances from a wind turbine (or turbines). The sound is generally heard as a periodic *'thumping'* or *'whoomphing'* at relatively low frequencies. This is known as *'Other AM or OAM'.*

It was proposed in the RenewableUK 2013 study that the fundamental cause of OAM is transient stall conditions occurring as the blades rotate, giving rise to the periodic thumping at the blade passing frequency. Transient stall represents a fundamentally different mechanism from blade swish and can be heard at relatively large distances, primarily downwind[1] of the rotor blade.

The University of Salford carried out a study on behalf the Department for Business, Enterprise and Regulatory Reform (BERR) to investigate the prevalence of amplitude modulation of aerodynamic noise on UK wind farm sites. The study concluded that AM has occurred at 4 out of 133 wind farms in the UK. A further investigation of the four sites by the Local Authority showed that the conditions associated with AM might occur between 7% and 15% of the time.

The most recent research into AM was conducted by RenewableUK, 'Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect' (December 2013).

This research focused on the less understood *'Other AM or OAM'* where reported incidents are relatively limited and infrequent but is a recognised phenomenon. However, the occurrence and intensity of Other AM is specific to a location and its likelihood of occurrence cannot be reliably predicted.

Section 6 of the 'Summary of Research into Amplitude Modulation of Aerodynamic Noise from Wind Turbines - Wind Turbine Amplitude Modulation: Research to Improve Understanding as to its Cause and Effect' states that *'At present there is no way of predicting OAM at any particular location before turbines begin operation due to the general features of a site or the known attributes of a particular turbine.'*

However, the Guidance Note on Noise Assessment of Wind Turbine Operations at EPA Licensed Sites (NG3) states…

'features which are thought to enhance this effect are:

- *close spacing of turbines in linear rows;*
- *tower height to rotor diameter ratio less than approximately 0.75;*
- *stable atmospheric conditions;*
- *topography leading to different wind directions being seen by the blades at different points in their rotation'.*

The RenewableUK study *'has found that by minimising the onset of blade stall, the occurrence of OAM is also likely to be minimised.'* It goes on to discuss *'the future involvement of turbine manufacturers in developing methods of avoiding or minimising the partial stall mechanism identified as a primary cause of OAM; and suggests that in future changes to blade design and the way in which the blade pitch (the angle of attack of the blade to the incoming air flow) is controlled are likely to have a role to play in achieving better management of the phenomenon.'* Ultimately, further work is required to identify the exact on-blade conditions required for OAM to occur. The further work will aid in the development of a measure to fully mitigate the OAM. If OAM occurs from the proposed project, the wind turbine(s) will be operated in a manner to address this by way of implementation of blade pitch regulation, vortex generators or shut downs.

In 2016, the IoA published 'A Method for Rating Amplitude Modulation in Wind Turbine Noise'. It sets out a procedure for obtaining input noise data.

[1] The stall source mechanism radiates equally upwind and downwind, but propagation effects reduce noise levels upwind.

The procedure proposed in the IoA guidance document is recommended by the Department of Business, Energy & Industrial Strategy (BEIS) who have published a study on amplitude modulation.

At present there is no method for predicting OAM at any particular location before turbines begin operation based on the general features of a site or the known attributes of a particular turbine. Therefore, it is not possible to predict an occurrence of AM at the planning stage. It should also be noted that it is a rare event associated with a limited number of wind farms. While it can occur, it is the exception rather than the rule. The RenewableUK study states that "even on those limited sites where it has been reported, its frequency of occurrence appears to be at best infrequent and intermittent.", and "There is nothing at the planning stage that can presently be used to indicate a positive likelihood of OAM occurring at any given proposed wind farm site, based either on the site's general characteristics or on the known characteristics of the wind turbines to be installed."

Assessment of AM Research and Guidance is ongoing, with recent publications being issued by the Institute of Acoustics (IoA) Noise working Group (Wind Turbine Noise) Amplitude Modulation Working Group (AMWG) :"A Method for Rating Amplitude Modulation in Wind Turbine Noise (August 2016)". The document proposes an objective method for measuring and rating AM. The AMWG does not propose what level of AM is likely to result in adverse community response or propose any limits for AM. The purpose of the group is simply to use existing research to develop a Reference Methodology for the measurement and rating of AM. The definition of any limits of acceptability for AM, or consideration of how such limits might be incorporated into a wind farm planning condition, is outside the scope of the AMWG's work. There has been no adoption of endorsement of an AM 'penalty' scheme by any government. The IOA GPG states in "The evidence in relation to "Excess" or "Other" Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM."

Where it occurs, AM is typically an intermittent occurrence, therefore assessment may involve long-term measurements. The 'Reference Method' for measuring AM outlined in the IoA AMWG document will provide a robust and reliable indicator of AM and yield important information on the frequency and duration of occurrence, which can be used to evaluate different operational conditions which will be implemented to avoid the occurrence.

7.2.4 Infrasound & Low Frequency Noise

The definition of low frequency noise can vary, but it is generally accepted that low frequency noise is noise that occurs within the frequency range of 10 Hz to 160 Hz.

Infrasound is noise occurring at frequencies below that at which sound is normally audible, that is, less than about 20 Hz, due to the significantly reduced sensitivity of the ear at such frequencies. In this frequency range, for sound to be perceptible, it must be at very high amplitude, and it is generally considered that when such sounds are perceptible then they can cause considerable annoyance. However, wind turbines do not produce infrasound at amplitudes capable of causing annoyance as outlined in the following paragraphs.

The UK Department of Trade and Industry study, 'The Measurement of Low Frequency Noise at Three UK Windfarms', concluded that:

> *infrasound noise emissions from wind turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Even assuming that the most sensitive members of the population have a hearing threshold which is 12 dB lower than the median hearing threshold, measured infrasound levels are well below this criterion.*

It goes on to state that, based on information from the World Health Organisation, 'there is no reliable evidence that infrasound below the hearing threshold produce physiological or psychological effects' and that 'it may therefore be concluded that infrasound associated with modern wind turbines is not a source which may be injurious to the health of a wind farm neighbour'.

The study reports that low frequency noise is measurable but below the DEFRA low frequency noise criterion. The study also assessed low frequency measurements against the Danish criterion of LpA,LF = 20 dB. It was found that internal levels do not exceed 20dB when measurements are undertaken within rooms with the windows closed. However, the study acknowledges that wind turbine noise (low frequency) may result in an internal noise level that is just above the threshold of audibility as defined in ISO 226. The study goes on to say… *'However, at all the measurement sites, low frequency noise associated with traffic movement along local roads has been found to be greater than that from the neighbouring wind farm.'*

Bowdler et al. (2009) concludes that *'there is no robust evidence that low frequency noise (including 'infrasound') or ground-borne vibration from wind farms generally has adverse effects on wind farm neighbours'.*

In January 2013, the Environmental Protection Authority of South Australia published the results of a study into infrasound levels near wind farms. Measurements were undertaken at seven locations in urban areas and four locations in rural areas including two residences approximately 1.5 km from the wind turbines. The study concluded *'that the level of infrasound at houses near the wind turbines … is no greater than that experienced in other urban and rural environments and is also significantly below the human perception threshold.'*

In 2016, the State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in Germany published a report entitled *'Low-frequency noise incl. infrasound from wind turbines and other sources.'* It assessed infrasound and low frequency sound from wind turbines and other sources. It found that for *'the measurements carried out even at close range, the infrasound levels in the vicinity of wind turbines – at distances between 150 and 300 m – were well below the threshold of what humans can perceive in accordance with DIN 45680 (2013).'*

We conclude that infrasound noise emissions from wind turbines are significantly below the recognised threshold of perception for acoustic energy within this frequency range. Infrasound is not a source which may be injurious to the health of a wind farm neighbour.

Wind turbines may produce low frequency noise at levels above the threshold of audibility. However, there is no evidence of health effects arising from low frequency noise generated by wind turbines. Given the evidence described above, an assessment of infrasound and low frequency noise from the wind farm has been scoped out.

7.2.5 Tonal Noise

ETSU-R-97 describes tonal noise as *'noise containing a discrete frequency component most often of mechanical origin'.* Wind turbine sound can be tonal in some cases, for example if there is a defect in a turbine blade or a fault in the mechanical equipment such as the gearbox. Tonality from wind turbines is generally caused by structural resonances in the mechanical parts of the turbine and thus is highly specific not only to the turbine model but the specific components used, including tower height. However, a correctly operating wind turbine is not considered to have tonal sound emission. In the event of tonal noise being present and following establishment of the likely cause, this can be addressed by turbine manufacturers and/or operator as and when it occurs. A warranty will be provided by the manufacturers of the turbine to ensure that the noise output will not require a tonal noise correction under ETSU R-97 best practice guidance.

7.2.6 Vibration

Vibration from operational wind turbines is low and will not result in perceptible levels at nearby sensitive receptors nor will the levels of vibration result in any structural damage. Research undertaken by Snow[2] found that levels of ground-borne vibration 100 m from the nearest wind turbine were significantly below criteria for 'critical working areas' given by British Standard BS 6472:1992 Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz) and were lower than limits specified for residential premises by an even greater margin. Hence, the level of vibration produced by wind turbines at this distance is low and does not pose a risk to human health.

More recently, the Low Frequency Noise Report[3] published by the Federal State of Baden-Württemberg simultaneously measured vibration at several locations, ranging from directly at the wind turbine tower to up to 285m distance from an operational Nordex N117 – 2.4 MW wind turbine with a hub height of 140.6m. The report concluded that at less than 300m from the turbine, the vibration levels had reduced such that they could no longer be differentiated from the background vibration levels.

Considering that the curtilage of the nearest sensitive receptor is over 670m from the nearest turbine, the level of vibration is significantly below any thresholds of perceptibility. Vibration from the turbines is too low to be perceived at neighbouring residential dwellings.

Vibration levels will also be significantly below levels that would result in damage to the nearest buildings (including farm buildings). Therefore, operational vibration has been scoped out.

7.2.7 Decommissioning Noise & Vibration

The impacts associated with decommissioning of the project are comparable to those described for the construction phase.

[2] ETSU (1997), Low Frequency Noise and Vibrations Measurement at a Modern Wind Farm, prepared by D J Snow.

[3] Low-frequency noise incl. infrasound from wind turbines and other sources', State Office for the Environment, Measurement and Nature Conservation of the Federal State of Baden-Württemberg in Germany, 2016.

7.3 Methodology

The methodology adopted for this noise and vibration assessment is as follows:

- Review of appropriate guidance and specification of suitable construction and operational noise / vibration criteria;
- Characterisation of the receiving noise environment;
- Prediction of the noise impact associated with the proposed development, and;
- Evaluation of noise impacts;
- Propose mitigation, and;
- Assess residual impacts.

7.3.1 Relevant Guidance

A list of relevant guidance documents is provided below. These have been referred to where referenced or applied in the sections hereafter.

EIA Guidance:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports, Environmental Protection Agency (Draft), 2017
- Advice Notes on Current Practice, Environmental Protection Agency, Draft 2015
- Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU).

Noise Modelling Standards and Technical Advice:

- International Standard *ISO 9613-2: 1996 Attenuation of sound during propagation outdoors, Part 2: General method of calculation;*
- UK Institute of Acoustics', *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment at Rating of Wind Turbine Noise* (2013) and supplementary notes;
- British Standard *BS 5228 Part 1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites Part 1: Noise;*
- Irish Wind Energy Association, *Best Practice Guidelines for the Irish Wind Energy Industry* (2012);
- UK Department of Trade and Industry (DTI), ETSU-R-97, *The Assessment and Rating of Noise from Wind Farms* (1996);
- British Standard 4142:2014+A1:2019, *Methods for rating and assessing industrial and commercial sound.*

Guideline Noise Levels:

- Wind Energy Development Planning Guidelines, Department of the Environment, Heritage and Local Government (2006);
- Draft Revised Wind Energy Development Guidelines (December 2019), Department of Housing, Planning and Local Government, 2019;
- Cork County Development Plan 2022 – 2028;
- Cork County Wind Energy Strategy 2014.

7.3.2 Study Area

Construction and decommissioning noise have been assessed by comparing predicted construction activities against best practice construction noise criteria at the nearest residential dwellings to the construction activities. As such, if the construction noise meets the relevant noise limits at the nearest locations, it will also be below the relevant noise limits at more distant residential locations.

The operational noise study area includes all residential dwellings with a predicted noise level greater than 35 dB L_{A90} (which is the lowest limit prescribed in the 2006 Department of the Environment, Heritage, and Local Government, *Wind Energy Development Guidelines*). The study area is also in accordance with the UK Institute of Acoustics', *A Good Practice Guide to the Application of ETSU-R-97 for the Assessment at Rating of Wind Turbine Noise* (2013) whereby the guidance document defines the study area as "*the area within which noise levels from the proposed, consented and existing wind turbine(s) may exceed 35dB L_{A90} at up to 10 m/s wind speed*."

The IOA guidance documents also states… *"During scoping of a new wind farm development consideration should be given to cumulative noise impacts from any other wind farms in the locality. If the proposed wind farm produces noise levels within 10 dB of any existing wind farm/s at the same receptor location, then a cumulative noise impact assessment is necessary."* There are two wind farms within 3 km from the proposed Annagh Wind Farm, Rathnacally Wind Farm consists of 2 no. turbines and Boolard Wind Farm consists of 2 no. of turbines. These wind farms have been considered in the cumulative assessment as they are sufficiently close to the proposed wind farm to result in a potential cumulative impact. Other more distant wind farms have not been considered as they are not anticipated to produce noise within 10dB of the proposed windfarm. The operational study area is presented in Figure 13.1. It includes 94 noise sensitive locations.

Since construction and operational vibration have been scoped out, as detailed in sections 7.2.1 and 7.2.6, there is no requirement to set study areas for each as they do not need to be assessed. Vibration is not an environmental concern for assessment due to the large distance between the source and the receiver.

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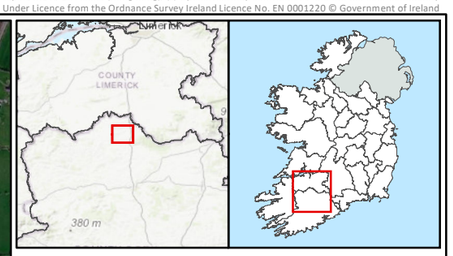

Legend

- Site Boundary
- Turbine Layout
- Met Mast
- Turbine Layout 700m Buffer
- Turbine Layout 1.5km Buffer
- Turbine Delivery Route
- Underground Cable Route
- Substation
- Construction Compound
- Turbine Hardstanding Area

Roads

- New
- Upgrade

Noise Sensitive Locations

- Residential
- Commercial
- Mixed Use

TITLE: Noise Sensitive Locations within Study Area			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	7.1		
CLIENT:	EMPower		
SCALE:	1:25000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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7.3.3 Evaluation Criteria

7.3.3.1 Construction Noise Criteria

There is no statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. In the absence of specific noise limits, appropriate emission criteria relating to permissible construction noise levels for a project of this scale may be found in the British Standard *BS 5228-1:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Noise.*

BS 5228-1:2009+A1:2014 contains several methods for the assessment of the potential significance of noise effects. The ABC Method was used to derive appropriate noise limits for the proposed project. The threshold limit to be applied (as defined in Table 7.1) is dependent on the existing ambient noise levels (rounded to the nearest 5dB).

Table 7.1: Threshold of Potential Significant Effect during Construction and Decommissioning

Threshold value period (L_{Aeq})	Threshold Value, in decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00 - 07:00hrs)	45	50	55
Evenings (19:00 – 23:00 hrs) and weekends (13:00 – 22:00 Saturdays) and (07:00 – 19:00 hrs Sundays)	55	60	65
Daytime (07:00 – 19:00) and Saturdays (08:00 – 16:30)	65	70	75
Note Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.			

The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. For the appropriate period (e.g. daytime), the ambient noise level is determined and rounded to the nearest 5dB.

The baseline noise survey results ambient (free-field) noise levels were analysed. A correction of +3dB was added to the noise levels to convert free-field noise levels to façade noise levels. The ambient façade noise level when rounded to the nearest 5dB varies, but for the most part it is less than 60 dB L_{Aeq}. The nearest residential dwellings to the proposed development are afforded Category A designation (65 dB $L_{Aeq,1hr}$ during daytime periods).

Section 7.5.2 provides the detailed assessment of construction activity in relation to this site.

If the modelled construction noise level exceeds the appropriate category value (e.g. 65 dB $L_{Aeq,1hr}$ during daytime periods) then a potential significant effect is predicted and mitigation measures may be required to reduce the noise levels below the $L_{Aeq,1hr}$ daytime noise limit.

7.3.3.2 Wind Farm Operational Noise Criteria

The operational noise assessment summarised in the following sections has been based on guidance in relation to acceptable levels of noise from wind farms as contained in the document Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government (2006).

ETSU-R-97, The Assessment and Rating of Noise from Wind Farms (1996) published by the Department of Trade & Industry (UK) Energy Technology Support Unit (ETSU) and Institute of Acoustics' A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, (May 2013) has been used to supplement the guidance contained within the 'Wind Energy Development Guidelines' publication where necessary.

Currently Cork have published a Draft County Development Plan 2021. This was open for public consultation until 1st July 2021. Following consultation, the final plan will be adopted in April 2022 and will come into effect from June 2022.

The Draft Cork County Development Plan states the following regarding wind energy development:

> *"ET 13.6: Acceptable in Principle*
>
> *Commercial wind energy development is normally encouraged in these areas subject to protection of residential amenity particularly in respect of noise, shadow flicker, visual impact and the requirements of the Habitats, Birds, Water Framework, Floods and EIA Directives."*

The draft county development plan includes the following objective with respect to wind energy:

> *"ET 13.10: Development in line with Best Practice*
>
> *Ensure that wind energy developments in County Cork are undertaken in observance with best industry practices, and with full engagement of communities potentially impacted by the development. In accordance with the Code of Practice 'Good Practice for Wind Energy Development Guidelines 2016', wind energy development operators are required to put in place an effective complaints procedure in relation to all aspects of wind energy development projects, where members of the public can bring any concerns they have about operational difficulties, including noise and nuisance to the attention of the wind energy development operator"*

The "Good Practice for Wind Energy Development Guidelines 2016" does not provide guidance on appropriate noise limit but provides guidelines for community engagement.

Cork County Development Plan Review Energy Background Document No 9, August 2019 states in section 4.28:

> *"Chapter 9 of County Development Plan 2014 sets out the wind energy policy for the county. At this stage it is not envisaged that any significant changes are required to the policy. However, the department has indicated that revisions to the national wind energy guidelines are due to be published at the end of 2019. The provisions of the revised guidelines will be reflected in the Draft Plan / Amendments as appropriate."*

The noise criteria used to assess operational noise from the proposed development is based on a Best Practice Approach, currently used by the acoustics industry This best practice approach is based on:

- Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government (2006);
- ETSU-R-97, The Assessment and Rating of Noise from Wind Farms (1996);
- Institute of Acoustics' A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, (May 2013).

The DoEHLG guidelines (2006) contain recommended noise limits to control operational noise from wind farms and state...

> *In general, a lower fixed limit of 45 dB(A) or a maximum increase of 5dB(A) above background noise at nearby noise sensitive locations is considered appropriate to provide protection to wind energy development neighbours. However, in very quiet areas, the use of a margin of 5dB(A) above background noise at nearby noise sensitive properties is not necessary to offer a reasonable degree of protection and may unduly restrict wind energy developments which should be recognised as having wider national and global benefits. Instead, in low noise environments where background noise is less than 30 dB(A), it is recommended that the daytime level of the LA90,10min of the wind energy development noise be limited to an absolute level within the range of 35-40 dB(A).*
>
> *Separate noise limits should apply for day-time and for night-time. During the night, the protection of external amenity becomes less important and the emphasis should be on preventing sleep disturbance. A fixed limit of 43dB(A) will protect sleep inside properties during the night.*

In the absence of detailed guidance from the Wind Energy Development Guidelines 2006, best practice has typically been to consider the guidance contained in ETSU-R-97 and more recently the detailed guidance contained in the Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (May 2013) and its six supplementary guidance notes.

Where background noise is less than 30 dB(A), an absolute level within the range of 35-40 dB(A) is applicable. However, there is no appropriate approach in relation to the identification of low noise environments *"where background noise is less than 30dB(A)"* nor is there details on the application of *"an absolute level within the range of 35-40 dB(A)."* In the absence of detailed guidance from the Wind Energy Development Guidelines 2006, on what range of *35-40 dB* to use, we have referred to guidance from ETSU-R-97[4] which states...

> "*The actual value chosen for the day-time lower limit, within the range of 35-40dB(A), should depend upon a number of factors:*
>
> - *Number of dwellings in the neighbourhood of the wind farm.*
> - *The effect of noise limits on the number of kWh generated.*
> - *Duration and level of exposure."*

[4] See Page 65 of *The Assessment and rating of noise from wind farms (ETSU-R-97)*: ETSU (Energy Technology Support Unit) for more details.

The 2006 DoEHLG Wind Energy Development Guidelines do not provide the specific periods which are represented by daytime and night-time hours, therefore the definitions from ETSU-R-97 are taken as 07:00 to 23:00 hrs for daytime and 23:00 to 07:00 hrs for night-time.

The operational noise criteria include noise from wind turbines and any other ancillary noise sources such as the on-site substation transformer.

The Supreme Court decision in Balz and Heubach v An Bord Pleanála and others [2018] IEHC 309 does not change the legal position of the Wind Energy Development Guidelines, 2006 (WEDGs). It has however clarified the extent of the duty on planning authorities to consider submissions in relation to the continued relevance of the WEDGs. The EIAR considered the application of other noise guidelines. However, the Draft Revised Wind Energy Development Guidelines, published in December 2019 (dWEGs) which is the most recent publication from the Department of Housing, Planning and Local Government have a number of technical errors, ambiguities and inconsistencies and requires further detailed review and amendment. This is a fact supported by several acoustic consultant from Ireland and the UK. In assessing the dWEGs, the WHO 45 dB Lden noise criterion was considered. The WHO document is based on a very limited data set, which only estimated the Lden for the sites studied, rather than assessing it directly from wind statistics. Furthermore, the WHO recommendation is "conditional". The guidelines also state… *"it may be concluded that the acoustical description of wind turbine noise by means of Lden or Lnight may be a poor characterization of wind turbine noise and may limit the ability to observe associations between wind turbine noise and health outcomes."* Therefore, it would be premature to adopt the WHO recommendations without further careful and detailed consideration and therefore this has not been adopted. The best practice guidance contained in ETSU-R-97 together with the detailed guidance contained in the Institute of Acoustics 'A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise' (May 2013) and its six supplementary guidance notes have been considered and applied to ensure a robust and best practice approach to the assessment.

7.3.4 Significance of Impact

The criteria for determining the significance of impacts and the effects are set out in the EPAs 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (Draft), August 2017'. The EPA guidelines do not quantify the impacts in decibel terms. In absence of such information, reference is made to relevant standards and guidance documents noise limits. If the predicted impact from the construction or operational phase are below the respective noise limits, it is considered that no significant effect occurs.

For this assessment, it has been assumed that dwellings have a medium to high sensitivity. Table 7.2 presents the impact significance criteria from the EPA guidelines:

Table 7.2: Impact Significance Criteria

Impact Significance	Criteria
Imperceptible	An impact capable of measurement but without noticeable consequences
Not significant	An impact which causes noticeable changes in the character of environment but without significant consequences
Slight impacts	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities

Impact Significance	Criteria
Moderate impacts	An impact that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant impacts	An impact which, by its character, magnitude, duration or intensity significantly alters a sensitive aspect of the environment
Very Significant	An impact which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound impacts	An impact which obliterates sensitive characteristics

7.3.5 Consultation Requirements

Chapter 5 of the EIAR refers to scoping consultation. Submissions and comments from various consultees have informed the project's assessment methodology throughout the EIAR. No relevant EIAR Scoping Response were received in relation to noise assessment during the scoping process. During the pre-planning meeting with Cork County Council, it was recommended that noise assessment be carried out in line with the latest guidance. As detailed in this Chapter, noise assessment has been carried out in line with best practice guidance. .

7.4 Existing Environment

Baseline noise monitoring was undertaken at ten receptor locations surrounding the proposed Annagh Wind Farm to establish the existing background noise levels in the vicinity of the proposed development. These are some of the closest locations to the proposed development as well as representing different noise environments in the vicinity of the proposed development.

The 35 dB L_{A90} study area as described in Section 7.3.2 and Figure 7.1 was reviewed to determine receivers to be considered for noise monitoring. Permission to access the noise measurement locations was arranged by the applicant, with Fehily Timoney & Company setting up the noise monitoring equipment. Baseline noise data was collected at the ten locations, shown in Figure 7.2 and details of the noise monitoring locations are presented in Table 7.3. The rationale for the selection of these monitoring locations is described in Appendix 7.1 which presents details on the baseline measurements and data analysis.

Table 7.3: Noise monitoring location details

Location ID	Easting	Northing	Description	Photograph
N1	550163	616080	On raised lawn to rear of a dwelling, approximately 5m from the rear façade.	Plate 7.1-1
N2	550457	616240	At the end of drive past farm buildings and overlooking proposed wind farm. Approximately 55m from the dwelling, as there was no suitable location immediately next to the property. The location is near trees, but this is representative of this location.	Plate 7.1-2

Location ID	Easting	Northing	Description	Photograph
			This location also has a clear line of sight to the proposed windfarm and is not screened by farm buildings.	
N3	551232	616474	In rear garden of a dwelling approximately 18m from the rear façade of the dwelling in the direction of the proposed wind farm. To rear of garden shed.	Plate 7.1-3
N4	551526	616833	In the front garden of a dwelling next to wooden fence beside the dwelling, approximately 12m from the façade.	Plate 7.1-4
N5	551795	617479	In field behind a dwelling approximately 25 m from the rear façade away from trees.	Plate 7.1-5
N6	551780	617941	In layby approximately 35m northwest of façade of the dwelling.	Plate 7.1-6
N7	550362	618658	In garden south of a dwelling (derelict being reconstructed), approximately 12m from façade of building, approximately 27m south of road.	Plate 7.1-7
N8	549787	618434	Located 16m east of façade of building on paved area in garden by a pergola.	Plate 7.1-8
N9	549455	618157	In field just south of a dwelling approximately 9m from rear façade.	Plate 7.1-9
N10	548208	617215	In field approximately 11m southeast of a dwelling.	Plate 7.1-10

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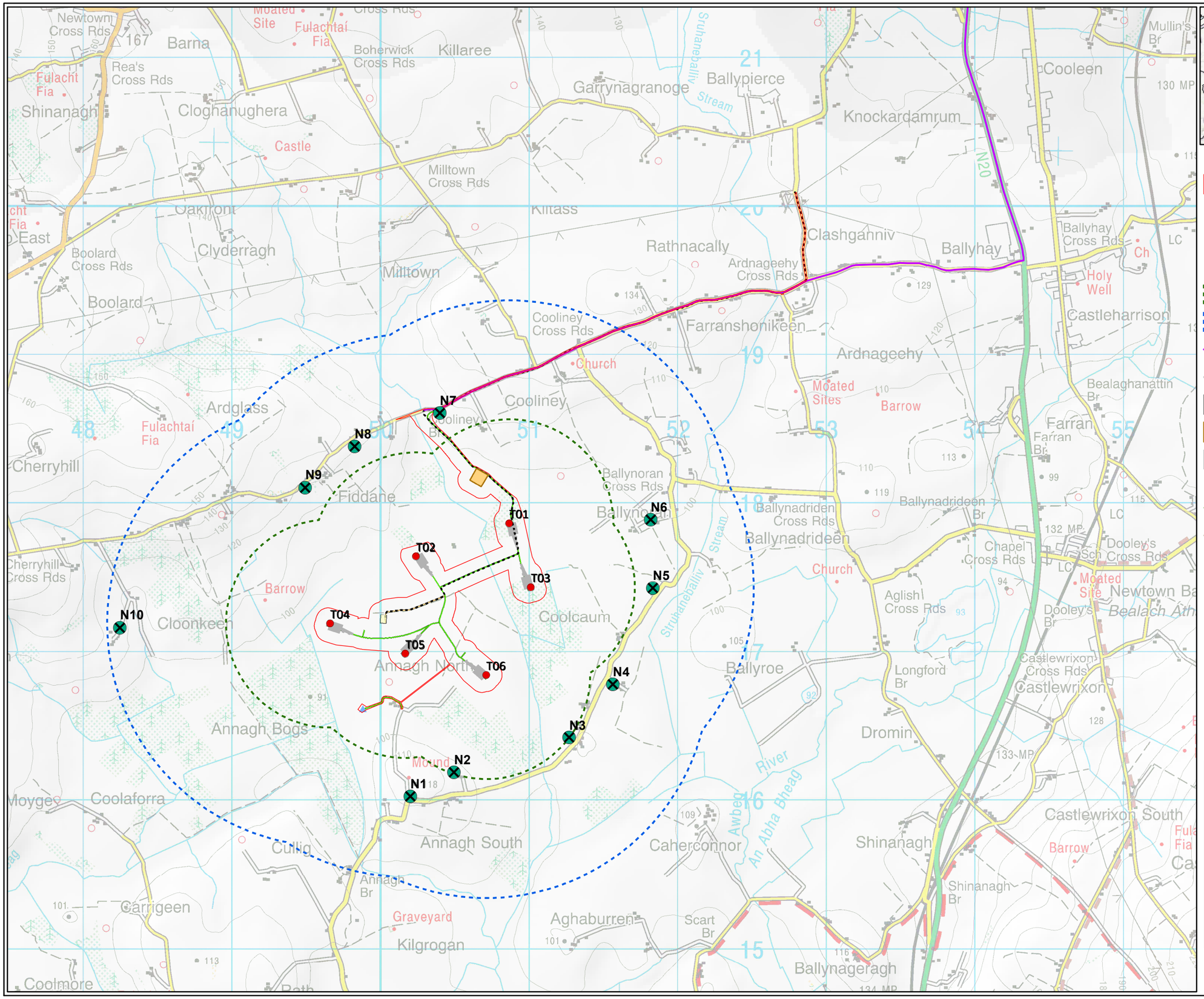
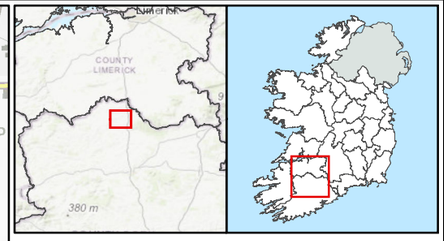


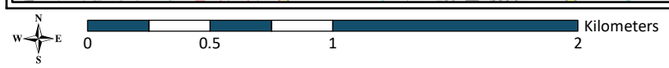


Legend

- Site Boundary
- Noise Monitoring Locations
- Turbine Layout
- Met Mast
- Turbine Layout 700m Buffer
- Turbine Layout 1.5km Buffer
- Turbine Delivery Route
- Underground Cable Route
- Substation
- Construction Compound
- Turbine Hardstanding Area

Roads

- New
- Upgrade



TITLE: Noise Monitoring Location Details			
PROJECT: Annagh Wind Farm, Co. Cork			
FIGURE NO:	7.2		
CLIENT:	EMPower		
SCALE:	1:25000	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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7.4.1 Analysis of the Baseline Data

The raw baseline L_{A90} noise data was reviewed to determine whether there are any periods of non-consistent noise level due to equipment malfunction. Any inconsistent data points were removed from the raw noise level data. The raw noise level data was then correlated with the time synchronised 10 m standardised wind speed and rainfall data. Periods of rainfall, data affected by dawn chorus and atypical data was removed from the analysis. Once the remaining data sets were found to be representative of the noise environment, they were analysed to ensure that sufficient data sets remained to provide sufficient data coverage over the necessary wind speeds. A 'best fit' trend (not higher than a fourth order polynomial) was then derived to present the prevailing background noise level at each monitoring location. Appendix 7.1 presents the results of the data analysis.

The prevailing daytime amenity noise levels at the ten noise monitoring locations are presented in Table 7.4. In some instances, the prevailing background noise is higher at lower wind speeds, in keeping with the IoA guidelines, the lowest derived background noise level is adopted for all wind speeds below where this derived minimum occurs. Furthermore, the derived prevailing background noise polynomial curve was not extended beyond the range covered by adequate data points. Where a noise limit is required at higher wind speeds; it was restricted to the highest derived point.

Table 7.4: Prevailing Background Noise during Daytime Amenity Periods

Location	Prevailing Background Noise $L_{A90,10min}$ (dB) at Standardised 10 m Height Wind Speed (m/s)										
	2	3	4	5	6	7	8	9	10	11	12
N1	24.1	25.8	28.0	30.4	32.9	35.6	38.4	41.1	43.8	46.2	46.2§
N2	23.3	25.8	28.7	31.7	35.0	38.3	41.7	45.0	48.2	51.2	51.2§
N3	23.5	24.8	26.5	28.5	30.9	33.5	36.4	39.5	42.9	46.4	46.4§
N4	25.8	26.1	26.5	27.1	28.4	30.4	33.4	37.8	37.8§	37.8§	37.8§
N5	26.3	26.8	27.7	28.9	30.5	32.5	34.7	37.2	40.0	42.9	42.9§
N6	30.1	30.2	30.6	31.6	33.4	36.4	40.8	46.9	46.9§	46.9§	46.9§
N7	28.2	28.4	29.1	30.2	31.9	34.0	36.5	39.4	42.7	46.4	50.4
N8	25.6	26.2	27.4	29.1	31.2	33.7	36.6	39.7	43.0	46.4	49.9
N9	31.9*	31.9*	31.9	32.3	33.5	35.8	39.0	42.9	46.9	50.4	52.4
N10	24.7	24.8	26.2	28.7	32.0	35.9	40.1	44.4	48.6	52.4	55.5

* - lowest derived background noise level is adopted for all wind speeds below where this derived minimum occurs. For example, at monitoring location N9 the lowest derived background noise level occurs at a wind speed of 4 m/s. The trend line fitted to noise data showed a higher noise level at 2 and 3 m/s. Therefore, using this criterion, the noise level at 2 and 3 m/s has been assumed to be equal to that of the noise level at 4 m/s.

§ - noise level restricted to the highest derived point

7.4.2 Derived Wind Farm Noise Limits

The standard approach (outlined in the IoA GPG) to derivation of noise limits is to carry out background measurements at several locations representative of different noise environments around the proposed site. As it is not usually possible to carry out measurements at every noise sensitive location (NSL), NSLs near to the measurement location are then assigned the same limits as the measurement location. The operational impact at each of the measurement locations was assessed in accordance with the IoA GPG.

As detailed in previous sections the noise criteria used to assess operational noise from the proposed development is based on a Best Practice Approach, currently used by the acoustics fraternity. This best practice approach is based on:

- Wind Energy Development Guidelines published by the Department of the Environment, Heritage and Local Government (2006);
- ETSU-R-97, The Assessment and Rating of Noise from Wind Farms (1996);
- Institute of Acoustics' A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind Turbine Noise, (May 2013).

The 2006 guidelines state that a fixed limit of 43 dB L_{A90} applies during night-time periods. However, the derivation of the daytime noise limit uses the prevailing daytime amenity background noise data. Where low background noise levels are found, the 2006 guidelines recommend a limit of 35 to 40 dB L_{A90}. There is no further detail provided on which to determine how the appropriate noise limit be derived as stated previously above. However, the guidelines state… "An appropriate balance must be achieved between power generation and noise impact." Reference has also been made to planning permissions for adjacent wind farms. Finally, reference is also made to ETSU-R-97 which recommends that the following three factors be considered when determining the fixed limit:

1) *Number of dwellings in neighbourhood of the wind farm.*
2) *The effect of noise limits on the kWh.*
3) *Duration and level of exposure.*

The IOA GPG states the following with respect to the ETSU-R-97 criteria… *"It can be argued that assessing these factors do not represent an acoustic consideration but ultimately a planning consideration."*

The first factor to be considered is the "*Number of dwellings in neighbourhood of the wind farm*". ETSU-R-97 describes this factor as balancing the benefits from a wind energy project with the local environment impact, "*The more dwellings that are in the vicinity of a wind farm the tighter the limits should be as the total environmental impact will be greater. Conversely if only a few dwellings are affected, then the environmental impact is less and noise limits towards the upper end of the range may be appropriate.*" The number of noise sensitive locations (includes planning permissions) within the 35dB L_{A90} study area is 94 indicating that a mid-range limit of 37.5 dB L_{A90} is appropriate.

The second factor is the effect of noise limits on the power output of the wind farm. Similarly, to the first factor, this balances the planning merit of the project against the local impact. The proposed project has 6 turbines. If the limit is lowered, then, based on the noise modelling results, curtailment would be required. Since this project is considered to have merit in assisting Ireland in meeting its renewable energy targets, the upper end of the limit range is appropriate.

The final ETSU factor relates to the duration and level of exposure. The prevailing background noise levels are described in detail in Section 7.4.1 and Appendix 7.1.

The wind rose for the proposed development shows that wind speeds of 2, 3, 4, 5 and 6 m/s occur 9.8, 14.1, 17.3, 17.5 and 13.7 % of the time and on that basis a decrease in the limit towards the lower range level of 35 dB L_{A90} is appropriate.

The Wind Energy Development Guidelines (2006) states that "An appropriate balance must be achieved between power generation and noise impact." and the mid-range limit of 37.5 dB L_{A90} represents that balance.

It is also noted that the planning conditions for the adjacent Rathnacally Wind Farm and Boolard Wind Farm developments have a low background noise level of 40 dB L_{A90} and a more onerous noise limit of 37.5 dB L_{A90} is proposed for Annagh Wind Farm.

Given the information above, it is recommended that a fixed limit of 37.5 dB L_{A90} for low background noise conditions should apply for the proposed project. It represents an appropriate balance between power generation and noise impact it is also 2.5 dB lower than the adjacent wind farm developments at these wind speeds.

Table 7.5: Derived Noise Limits

Location	Period	Prevailing Background Noise $L_{A90,10min}$ (dB) at Standardised 10 m Height Wind Speed (m/s)									
		3	4	5	6	7	8	9	10	11	12
N1	Daytime	37.5	37.5	45.0	45.0	45.0	45.0	46.1	48.8	51.2	51.2
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N2	Daytime	37.5	37.5	45.0	45.0	45.0	46.7	50.0	53.2	56.2	56.2
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N3	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	45.0	47.9	51.4	51.4
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N4	Daytime	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N5	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.9	47.9
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N6	Daytime	45.0	45.0	45.0	45.0	45.0	45.8	51.9	51.9	51.9	51.9
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

Location	Period	Prevailing Background Noise $L_{A90,10min}$ (dB) at Standardised 10 m Height Wind Speed (m/s)									
		3	4	5	6	7	8	9	10	11	12
N7	Daytime	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.7	51.4	55.4
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N8	Daytime	37.5	37.5	37.5	45.0	45.0	45.0	45.0	48.0	51.4	54.9
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N9	Daytime	45.0	45.0	45.0	45.0	45.0	45.0	47.9	51.9	55.4	57.4
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
N10	Daytime	37.5	37.5	37.5	45.0	45.0	45.1	49.4	53.6	57.4	60.5
	Night-time	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0

7.5 Potential Impacts

7.5.1 Do Nothing Scenario

Under the Do-Nothing scenario, the proposed development is not constructed or operated. The noise environment remains largely unchanged.

7.5.2 Potential Impacts during Construction

Noise predictions were undertaken to determine the likely impact during the construction works. BS 5228-1:2009+A1:2014 sets out sound power levels and L_{Aeq} noise levels of plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. Construction noise modelling is based on the details presented in Section 3.7 of this EIAR as well as a review of other chapters of the EIAR. Noise modelling was carried out using guidance and plant noise data from BS 5228:2009+A1:2014. The ground cover is predominately acoustically soft (G=1)[5]. The noise model assumes that the ground cover is a mix between acoustically hard and soft ground with a ground cover of G=0.75 to allow for pockets of acoustically hard ground. Percentage on time[6] for plant is outlined for each of the plant items used during construction.

The construction noise model assessed several tasks with the potential to generate noise. These tasks included: deliveries and/or removal of material to and from site, preparation of access roads, preparation of hardstands and drainage, pouring of foundations, installation of wind turbines and works associated with grid connection.

[5] G denotes the ground cover from an acoustic perspective. G=0 refers to acoustically hard or reflective surface and G=1 refers to acoustic soft or absorptive surface.

[6] Percentage on-time refers to the percentage of the assessment period for which the activity takes place.

Site Traffic

Detailed information on construction traffic is presented in Chapter 13. To summarise, additional light goods vehicles travelling to and from the site during the construction phase would be expected to peak during the morning (arrival of contractors at the site) and evening (departure of contractors from the site) and are envisaged not to be a continuous source of noise emissions from the site during a typical working day. The noise impact from construction personnel movements to and from the site is expected to be low.

All deliveries of turbine components to the site will only be by way of the proposed transport route outlined in Chapter 13. The most intensive period of the works programme will be Months 8 and 9. The busiest period is during turbine foundations construction, turbine installation, substation works, grid connection cable works, and internal electrical works will be ongoing in parallel. The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. For example, during turbine erection and foundation pours, an extension to the working day may be required, i.e. 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. If turbine deliveries are required at night, it will be subject to agreement with the relevant planning authority and it would be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

Preparation of Access roads, Hardstands and Drainage

Table 7.6 presents the likely plant required for the preparation of access roads, hardstanding and drainage. The predicted noise levels at the nearest dwelling (R247) to located to the nearest access road. Assuming all construction activities required for the preparation of the access road occur simultaneously, the predicted noise level from the construction activities is 62.3 dB $L_{Aeq,1hr}$ which is below the 65dB $L_{Aeq,1hr}$ noise limit. The preparation of access roads, hardstands and drainage are expected to have a moderate impact and temporary in duration.

Table 7.6: Preparation of Access roads, Hardstands and Drainage - Likely Plant and Predicted Levels

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R247
Tracked Excavator (25t)	C2.19	Ground excavation/ earthworks	80	57.4
Articulated Dump Truck (23t)	C2.32	Tipping Fill	20	47.9
Dozer (14t)	C5.12	Spreading chipping/fill	80	56.6
Vibratory roller (3t)	C5.27	Rolling and Compaction	80	46.5
Excavator (21t)	C4.65	Trench for drainage	80	51.2

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R247
Lorry*	56.5	Delivery of Material	Maximum 47 trips per day	56.5
Cumulative				62.3
* - Drive-by maximum sound level				

Preparation of Wind Turbine Foundations

Table 7.7 presents the likely plant required for the preparation of wind turbine foundations. Predicted noise levels at R247 is presented. This represents the highest levels from this activity and is predominantly related to vehicle movements on site. Assuming all construction activities required for the preparation of the turbine foundations occur simultaneously, the predicted noise level from the construction activities are 57.9 dB $L_{Aeq,1hr}$. The predicted noise levels are below the 65dB $L_{Aeq,1hr}$ noise limit. The construction works associated with the preparation of the turbine foundations are expected to have a slight to moderate impact and temporary in duration.

Table 7.7: Preparation of Wind Turbine Foundations - Likely Plant and Predicted Levels

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R247
Tracked Excavator (25t)	C2.19	Ground excavation/earthworks	80	28.4
Excavator (23t)	C10.8	Loading sand / soil	80	31.0
Diesel Pump	C4.88	Pump water	100	20.6
Mobile telescopic crane	C4.41	Lifting reinforcing steel	80	22.0
Concrete mixer truck & concrete pump	C4.32	Concrete mixer truck + truck mounted concrete pump + boom arm	100	29.7
Lorry*	C11.9	Delivery and removal of material	Maximum 47 trips per day	57.9
Cumulative				57.9
* - Drive-by maximum sound level				

Installation of Wind Turbines

Turbine components will be delivered to site and a mobile telescopic crane will lift the turbine components into place. A worst case of the two cranes lifting turbine components 100% of the time is assumed along with delivery of turbine components. The predicted noise levels are presented in Table 7.8. The predicted cumulative noise level at receptor R247 is presented. This represents the highest levels from this activity and is predominantly related to vehicle movements on site. The predicted noise levels are below the 65 dB $L_{Aeq,1hr}$ noise limit. The construction works associated with the installation of the wind turbines are expected to have a slight to moderate impact and temporary in duration.

Table 7.8: Installation of Wind Turbines - Likely Plant and Predicted Levels

Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level	
				R247 (north)	R205 (South)
Mobile telescopic crane (x2)	C4.41	Lifting turbine components	100	23.6	30
Lorry *	C11.9	Delivery of Turbine Components	Maximum 47 trips per day	58.0	41.2
Cumulative				58.0	41.5
* - Drive-by maximum sound level					

Construction of Substation

The construction of the substation buildings will occur during the construction phase of the proposed development. The construction works will be progressed in several phases:

- Site clearance and Preparation;
- Preparation and pouring of foundations and floor areas;
- Preparation of hardstanding areas ;
- Erection of blockwork/ installation concrete slabs;
- General Construction including installation of electrical and mechanical plant.

Table 7.9 presents the assumed plant required for the different construction phases of the proposed buildings to be constructed on site. The nearest dwellings are at the southern entrance at R138. R138 is approximately 1 km from the substation area. The cumulative predicted noise levels for the worst combination of plant (Site Clearance and Preparation) is predicted to be 43.6 dB $L_{Aeq,1hr}$ at the nearest occupied dwelling which is below the construction noise limit of 65 dB $L_{Aeq,1hr}$. The works associated with the construction of the substation are expected to have a slight impact and temporary in duration.

Table 7.9: Construction of Substation - Likely Plant and Predicted Levels

Phase	Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R138
Site Clearance and Preparation	Tracked excavator (22t)	C2.3	Clearing Site	80	39.2
	Dozer (11t)	C2.12	Ground excavation/ earthworks	80	38.9
	Loading Lorry	C10.8	Loading Sand to Lorry	80	38.4
	Cumulative				43.6
Preparation and pouring of Foundations	Tracked Excavator (25t)	C2.19	Ground excavation/ earthworks	80	35.7
	Concrete mixer truck + truck mounted concrete pump + boom arm	C4.32	Concrete pumping	80	36.1
	Lorry*	C11.9	Delivery of material	Maximum of 47 trips per day	43.5
	Cumulative				44.8
Preparation of hardstanding areas	Articulated Dump Truck (23t)	C2.32	Delivery/Removal of Material	Maximum of 47 trips per day	26.2
	Tracked Excavator (25t)	*C2.19*	Ground excavation/earthworks	80	35.7
	Articulated Dump Truck (23t)	C2.32	Tipping Fill	20	26.2
	Dozer (14t)	C5.12	Spreading chipping/fill	80	34.9
	Vibratory roller (3t)	C5.27	Rolling and Compaction	80	24.8
	Lorry*	C11.9	Delivery of material	Maximum of 47 trips per day	43.5
	Cumulative				44.8
Erection of blockwork/ installation concrete slabs	Mobile telescopic crane (80t)	C4.39	Lifting concrete slabs	80	34.9
	Lorry* (32t)	C11.9	Delivery of material	Maximum of 47 trips per day	40.4
	Cumulative				41.5
General Construction including installation of	Generator	C4.84	Power for site cabins	100	32.9
	Telescopic handler	C4.54	Lifting Plant	80	36.8

Phase	Plant	BS 5228 Ref.	Activity	Percentage on-time (%)	Predicted Noise Level at R138
electrical and mechanical plant	Angle grinder (grinding steel)	C4.93	Miscellaneous	80	38.9
	Cumulative				41.6

Grid Connection Works including Link between Onsite Substation

It is proposed to construct 1 no. onsite electricity substation within the proposed development site as shown in Figure 3-2 in Chapter 3 of this EIAR. This will provide a connection point between the proposed wind turbines and the proposed grid connection point at the existing Charleville substation. Each turbine will be connected to the on-site electricity substation via underground electricity cables. The cable route will follow the proposed access tracks between each turbine. There will be sections where the cable route will be routed along public road.

The grid connection works will likely be carried out over a 2-month period and 'rolling road closures' will be implemented, whereby the site will progress each day along a road, which will have the effect of reducing the impact for residents. The likely plant required during the construction works is presented in Table 7.10:

Table 7.10: Grid Connection Works – Likely Plant and Predicted Noise Levels

Plant	Activity	Percentage on-time (%)	A-Weighted Sound Pressure Level, L_{Aeq}, dB			
			10m	25m	50m	100m
Road sweeper (C4.90)	Sweeping and dust suppression	10	49.5	41.6	35.6	29.6
Mini excavator with hydraulic breaker (C5.2)	Breaking Road Surface	25	78.9	71.4	65.5	59.5
Vibratory roller (C5.27)	Rolling and Compaction	50	66.3	58.6	52.6	46.6
Wheeled excavator (C5.34)	Trenching	50	69.9	62	56	50
Hand-held circular saw (petrol) (C5.36)	Cutting Concrete Slabs	10	79	71.6	65.6	59.6
Dump truck (tipping fill) (C2.30)	Tipping Fill	10	71.8	64.1	58.1	52.1
Vibratory plate (petrol) (C2.41)	Compaction	10	72.7	65.1	59.1	53.1

Table 7.10 also presents predicted noise level for a range of construction activities at distances of 10 m, 25 m, 50 m and 100 m from the works. The noise levels presented are predicted maximum expected levels and are expected to occur for only short periods of time at a very limited number of dwellings. There is one dwelling within 10 m of the grid connection works, 17 dwellings within 25 m of the works, 13 dwellings between 25 – 50 m and no dwellings between 50 - 100 m.

There are 6 commercial properties between 10-50m of the works but these are not considered noise sensitive, as they are industrial in nature.

In some instances, the maximum predicted noise levels may be above the noise limit of 65 dB $L_{Aeq,1hr}$. However, these elevated noise levels will only occur for short durations at a limited number of dwellings. Given the nature of the grid connection works, construction activities will not occur over an extended period at any one location.

Mitigation measures will be employed to reduce any potential impacts. Mitigation measures are discussed in Section 7.6.1. With mitigation measures, there is potential for temporary elevated noise levels due to the grid connection works. However, these works will be for a short duration at a particular property (i.e. typically less than 3 days) and where the works are to occur over an extended period, a temporary barrier or screen will be used to reduce noise level below the noise limit. The works are expected to have a significant temporary impact.

7.5.3 Potential Impacts during Operation

Noise predictions have been carried out using International Standard ISO 9613, *Acoustics – Attenuation of Sound during Propagation Outdoors*. The propagation model described in Part 2 of this standard provides for the prediction of sound pressure levels based on either short-term downwind (i.e. worst case) conditions or long-term overall averages.

Only the worst-case downwind condition has been considered in this assessment, that is – for wind blowing from the proposed turbines towards the nearby houses. When the wind is blowing in the opposite direction noise levels may be significantly lower, especially where there is any shielding between the turbines and the houses.

The ISO propagation model calculates the predicted sound pressure level by taking the source sound power level for each turbine in separate octave bands and subtracting a number of attenuation factors according to the following:

$$\text{Predicted Octave Band Noise Level} = L_W + D - A_{geo} - A_{atm} - A_{gr} - A_{bar} - A_{misc}$$

These factors are discussed in detail below.

The predicted octave band levels from the turbine are summed together to give the overall 'A' weighted predicted sound level.

L_W - Source Sound Power Level

The sound power level of a noise source is normally expressed in dB re:1pW. Sound power level data for Vestas V150 turbine to be installed as part of the proposed development has been modelled. Further details on the wind turbine are provided later in this section. Sound Power Level data is presented in Appendix 7.4.

D – Directivity Factor

The directivity factor allows for an adjustment to be made where the sound radiated in the direction of interest is higher than that for which the sound power level is specified. In this case the sound power level is measured in a downwind direction, corresponding to the worst-case propagation conditions considered here and needs no further adjustment.

A_{geo} – Geometrical Divergence

The geometrical divergence accounts for spherical spreading in the free-field from a point sound source resulting in attenuation depending on distance according to the following:

$A_{geo} = 20 \times \log(d) + 11$
where, d = distance from the turbine

A wind turbine may be considered as a point source beyond distances corresponding to one rotor diameter.

A_{atm} - Atmospheric Absorption

The atmospheric absorption accounts for the frequency dependant linear attenuation with distance of sound power over the frequency spectrum according to:

$A_{atm} = d \times \alpha$
where, α = the atmospheric absorption coefficient of the relevant frequency band

Published values of 'α' from ISO9613 Part 1[7] have been used, corresponding to a temperature of 10^0C and a relative humidity of 70%, the values specified in the IoA GPG, which give relatively low levels of atmospheric attenuation, and subsequently conservative noise predictions as given in Table 7.11:

Table 7.11: Atmospheric Octave Band Attenuation coefficients, dB/m

Octave Band Centre Frequency (Hz)							
63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
0.00012	0.00041	0.00104	0.00193	0.00366	0.00966	0.03280	0.11700

A_{gr} - Ground Effect

Ground effect is the interference of sound reflected by the ground with the sound propagating directly from source to receiver. The prediction of ground effects is inherently complex and depends on the source height, receiver height, propagation height between the source and receiver and the ground conditions.

The ground conditions are described according to a variable G which varies between 0 for 'hard' ground (includes paving, water, ice, concrete and any sites with low porosity) and 1 for 'soft' ground (includes ground covered by grass, trees or other vegetation). The IoA GPG states that use of G = 0.5 and a receptor height of 4 m should be used to predict the resultant turbine noise level at dwellings neighbouring a proposed development provided that an appropriate allowance for measurement uncertainty is accounted for within the stated source noise levels. Therefore, predictions in this report are based on G = 0.5 with a receptor height of 4 m and, due to the inclusion of the assumed uncertainty (see 'Overview of Input Datasets' for more details) within the source noise levels, these predictions are considered to be worst case.

[7] ISO 9613-1, Acoustics - Attenuation of sound during propagation outdoors, Part 1: Method of calculation of the attenuation of sound by atmospheric absorption, International Organization for Standardization, 1992

A_{bar} - Barrier Attenuation

The effect of any barrier between the noise source and the receiver position is that noise will be reduced according to the relative heights of the source, receiver and barrier and the frequency spectrum of the noise. The barrier attenuations predicted by the ISO 9613 model have, however, been shown to be significantly greater than that measured in practice under downwind conditions.

The results of a study of propagation of noise from wind farm sites carried out for ETSU concludes that an attenuation of just 2 dB(A) should be allowed where the direct line of site between the source and receiver is just interrupted and that 10 dB(A) should be allowed where a barrier lies within 5 m of a receiver and provides a significant interruption to the line of site.

The IoA GPG states that *'Topographic screening effects of the terrain (ISO 9613-2, Equation 2) should be limited to a reduction of no more than 2 dB, and then only if there is no direct line of sight between the highest point on the turbine rotor and the receiver location'*. As a conservative approach, this has not been accounted for in the noise model predictions.

A_{misc} – Miscellaneous Other Effects

ISO 9613 includes effects of propagation through foliage and industrial plants as additional attenuation effects. The attenuation due to forestry has not been included here and any such effects are unlikely to significantly reduce noise levels below those predicted.

The site topography was also analysed to determine if there is a valley correction (+3 dB) for concave ground profile, or where the ground falls away significantly, between the turbine and the receiver location. The IoA guidelines provide a criterion of application and it was determined that no valley correction is applicable.

Predicted Noise Levels

The predicted turbine noise L_{Aeq} has been adjusted by subtracting 2 dB to give the equivalent L_{A90} as suggested in the IoA GPG.

Overview of Input Datasets

In order to calculate the noise levels at noise sensitive locations, an accurate representation of the source and receiver positions (See Appendix 7.3 for details) was necessary for the prediction modelling. The turbine locations are presented in Table 3.1 in Section 3.5.3 of Chapter 3 of this EIAR and noise sensitive locations are presented in Appendix 7.3. The closest dwellings are at least 670 m from the nearest turbine. For the purpose of this assessment a 20 m offset from the building façade was used for the calculation of predicted operational noise impacts. The 20 m offset was to account for the curtilage of the dwelling.

The Vestas V150 turbine with a hub height of 100m is proposed to be installed. The sound power level and octave band values for the turbine are based on the noise levels provided by the manufacturers. The sound power levels at standardised 10 m height wind speeds are presented in Table 7.12 and octave band data in dB(A) is presented in Table 7.13. The wind turbine data used as part of the cumulative assessment is presented in Appendix 7.4.

Table 7.12: Wind Turbine (Vestas V150) Sound Power Levels, dB L_{WA}

Turbine	Standardised 10 m Height Wind Speed (m/s)						
	2	3	4	5	6	7	8 – Cut-out
Vestas V150	91.3	92.5	96.2	100.5	103.5	104.1	104.9

Table 7.13: Wind Turbine (Vestas V150) Octave Band Noise Levels, dB(A) for a range of Standardised 10 m Height Wind Speeds

Standardised 10 m Height Wind Speed (m/s)	Octave Band Level Centre Frequency in Hz								
	31.5	63	125	250	500	1000	2000	4000	8000
2	62.1	72.6	80.1	84.7	86.4	85.3	81.1	74.2	64.3
3	62.8	73.5	81.2	85.9	87.7	86.4	82.3	75.1	65.0
4	66.4	77.2	84.8	89.5	91.3	90.2	86.0	78.9	68.8
5	70.7	81.4	89.1	93.8	95.6	94.5	90.3	83.2	73.2
6	73.3	84.2	92.0	96.8	98.7	97.6	93.4	86.3	76.2
7	73.7	84.7	92.6	97.4	99.3	98.2	94.0	87.0	76.8
8	75.2	85.9	93.5	98.3	100.1	98.9	94.8	87.8	77.8
9	75.9	86.2	93.7	98.2	100.0	98.9	94.9	88.1	78.4
10	75.7	86.1	93.5	98.1	100.0	98.9	95.1	88.5	79.0
11	75.3	85.7	93.2	97.9	99.9	99.1	95.4	89.0	79.7
12	74.7	85.2	92.9	97.7	99.9	99.2	95.7	89.5	80.4
13	73.9	84.6	92.5	97.5	99.8	99.3	96.0	90.0	81.1
14	72.6	83.6	91.8	97.1	99.7	99.5	96.5	90.7	82.1

The IoA GPG states that it should be ensured that a margin of uncertainty is included within source wind turbine noise data used in noise predictions. A 2 dB correction is added to the sound power level to account for a margin of uncertainty.

It is possible to run all turbine models in noise reduced modes of operation (NROs) whereby the noise level is lessened by reducing the rotational speed of the turbines, with a resultant loss of electrical energy production.

This assessment includes the cumulative noise from all on-site noise sources from the proposed project. In addition to the noise from wind turbines, noise will be produced by the transformer located in the substation. The noise level is likely to depend on the load on the transformer which is dependent on the wind speed (as the wind turbines producing more energy in high wind speeds).

Predictions have been carried out based on an example transformer; the Siemens TLPN7747 40000 / 50000 kVA. The sound power level for the transformer is 93 dB(A). The octave band profile for the transformer has been sourced from 'An Introduction to Sound Level Data for Mechanical and Electrical Equipment' published by CED Engineering.

The A-weighted octave band data is presented in Table 7.14. If an alternative transformer is selected this will not exceed a sound power level of 93 dB(A):

Table 7.14: Octave Band Sound Power Level Data

Equipment	A-weighted Octave Band Centre Frequency (Hz)									Overall L_{WA}
	31.5	63	125	250	500	1k	2k	4k	8k	
Transformer Ω	81.0	87.0	89.0	84.0	84.0	78.0	73.0	68.0	61.0	93.0
Ω - Manufacturer's datasheet provided information on overall sound power levels. Octave band data was sourced from 'An Introduction to Sound Level Data for Mechanical and Electrical Equipment' CED Engineering										

Noise predictions have also been carried out using International Standard ISO 9613, *Acoustics – Attenuation of Sound during Propagation Outdoors*. A worst case with plant producing their highest noise emissions has been assumed. Wind turbine noise predictions are presented in terms of the L_{A90} noise indicator. However, the on-site substation transformer is typically assessed in terms of the L_{Aeq} noise indicator. The noise limits for the proposed project are in terms of L_{A90}. For the purpose of assessing the cumulative impact from all noise sources on site, it has been assumed that noise from the on-site substation transformer other noise sources is a constant level and the L_{Aeq} noise level is equal to the L_{A90} noise level. This is a conservative approach, but it facilitates the calculation of cumulative noise. Predicted results are presented in the next section.

7.5.3.1 Potential Operational Impact – Predicted Noise Levels

Noise predictions were performed for the 6-wind turbine layout using the highest noise levels at each wind speed, for the proposed turbine models have been selected for a range of standardised 10m height wind speeds from 2 m/s up to 14 m/s (to cut-out[8]). Receptors within the 35 dB L_{A90} noise contour of the turbines were modelled. A number of the receptors were identified as farm buildings and these have not been considered as part of the impact assessment and were not assessed against the derived daytime and night-time noise levels. Predicted noise levels from other on-site noise sources were also modelled and cumulative noise from all on-site noise sources from the proposed project are assessed against the derived noise limits.

Table 7.15 presents predicted noise levels adjacent to 10 receptor locations closest to the wind farm and at controlling properties adjacent to neighbouring wind farms. The predicted noise levels at all receptor locations are presented in Appendix 7.5. Note: the predicted noise levels are for a worst-case scenario with noise sensitive receptors downwind of the proposed wind farm.

In practice, receptor locations will not be downwind of all noise sources and the actual noise levels will be lower than those presented in Table 7.15 and Appendix 7.5.

Table 7.15 also presents derived daytime and night-time noise limits at each of these locations. The predicted noise levels from the proposed project are below the daytime and night-time noise levels except at receptor R167 during daytime periods at a wind speed of 6 m/s. Mitigation measures are outlined in Section 7.6.2. At some receptor locations, a new source of noise will be introduced into the soundscape and it is expected that there will be a long-term moderate significance of impact on the closest dwellings to the proposed wind farm.

In order to protect residents, the cumulative impact from other nearby operational and consented wind farm developments must also be considered and this is assessed in Section 7.5.5.

[8] Noise emissions from the wind turbines plateau at wind speeds above 14 m/s

Table 7.15: Assessment of Predicted L_{A90} Noise Levels for Annagh Wind Farm against Noise Limits

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB												
		2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s
R4	Predicted Level	28.1	29.0	32.0	34.2	37.1	37.7	38.4	38.4	38.4	38.3	38.2	38.1	38.0
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	45.0	46.1	48.8	51.2	51.2	51.2	51.2
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R10	Predicted Level	29.3	30.3	33.5	35.6	38.6	39.2	40.0	39.9	39.9	39.8	39.8	39.7	39.6
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	46.7	50.0	53.2	56.2	56.2	56.2	56.2
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R86	Predicted Level	26.4	27.5	31.0	35.2	38.2	38.8	39.6	39.6	39.5	39.5	39.4	39.3	39.2
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	47.7	50.9	50.9	50.9	50.9
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R138	Predicted Level	25.2	26.0	28.8	30.8	33.7	34.3	35.0	35.0	34.9	34.8	34.8	34.7	34.5
	Daytime limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.9	51.9	55.4	57.4	57.4	57.4
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB												
		2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s
R145	Predicted Level	27.6	28.6	32.0	34.2	37.2	37.8	38.6	38.6	38.6	38.5	38.4	38.3	38.2
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.1	49.4	53.6	57.4	60.5	60.5	60.5
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R167	Predicted Level	28.3	29.2	32.3	34.4	37.3	37.8	38.6	38.6	38.6	38.5	38.4	38.3	38.2
	Daytime limit	37.5	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Daytime Excess	-	-	-	-	0.2	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R197	Predicted Level	24.6	25.6	28.9	31.1	34.1	34.7	35.5	35.5	35.4	35.3	35.3	35.1	34.9
	Daytime limit	45.0	45.0	45.0	45.0	45.0	45.0	45.8	51.9	51.9	51.9	51.9	51.9	51.9
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R205	Predicted Level	23.0	23.9	27.1	29.3	32.3	32.9	33.7	33.7	33.6	33.5	33.4	33.2	33.0
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.9	47.9	47.9	47.9
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R248	Predicted Level	24.9	25.9	29.3	31.4	34.4	35.0	35.8	35.8	35.7	35.6	35.6	35.4	35.3
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	48.0	51.4	54.9	54.9	54.9

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB												
		2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R263	Predicted Level	19.9	21.1	24.7	27.0	30.1	30.6	31.5	31.5	31.4	31.3	31.2	31.0	30.8
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.7	51.4	55.4	55.4	55.4
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-

7.5.4 Potential Impacts during Decommissioning

On decommissioning, cranes will disassemble the above ground turbine components which would be removed off site for recycling. All the major component parts are bolted together, so this is a relatively straightforward process. The foundations will be covered over and allowed to re-vegetate naturally. It is proposed that the internal site access tracks will be left in place.

Grid connection infrastructure including substations and ancillary electrical equipment shall form part of the national grid and will be left in situ.

These activities will be undertaken during daytime hours, and noise, which will be of a lesser impact than for construction, will be controlled through the relevant guidance and standards in place at the time of decommissioning.

A detailed decommissioning plan will be agreed in advance of construction with Cork County Council. A decommissioning plan is contained in the CEMP in Appendix 3-1 of Volume 3.

7.5.5 Potential Cumulative Impacts

7.5.5.1 Construction Phase

There are several solar farms, and wind farms within 7 km of Annagh Wind Farm. It is not expected that there will be cumulative impacts with other large or small scale developments in the vicinity of the proposed wind farm given the distance between the developments and nature of the works proposed as part of these developments. Only adjacent windfarms that generate noise greater than 10dB below the proposed windfarm were assessed.

7.5.5.2 Operational Phase

There are two wind farms within 3 km from the proposed Annagh Wind Farm, Rathnacally Wind Farm consists of 2 no. of turbines and Boolard Wind Farm consists of 2 no. of turbines. Using the IOA GPG criteria, the cumulative noise from all these wind farms has been considered as the predicted noise from these wind farms is within 10 dB less of the predicted levels of the proposed Annagh Wind Farm, there will be a negligible cumulative impact.

Table 7.16 presents predicted cumulative noise levels adjacent to 10 receptor locations closest to the wind farm. The predicted cumulative noise levels at all receptor locations are presented in Appendix 7.6. Note: the predicted noise levels are for a worst-case scenario with noise sensitive receptors downwind of the proposed wind farm. In practice, receptor locations will not be downwind of all noise sources and the actual noise levels will be lower than those presented in Table 7.16 and Appendix 7.6.

The predicted cumulative noise levels comply with the daytime and night-time limits at the majority of noise sensitive locations. However, an exceedance is observed at receptor R167 during daytime periods at standardised 10m height wind speeds of 6 m/s. The noise modelling assumed that this receptor is downwind of all wind turbines. In practice, this will not occur all the time and the actual noise levels at the receptor will be lower when the receptor is upwind or cross wind of the wind farm. Nonetheless, mitigation measures are outlined in Section 7.6.2.

Table 7.16: Assessment of Cumulative Predicted L_{A90} Noise Levels for Annagh Wind Farm and Adjacent Wind Farms against Noise Limits

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB												
		2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s
R4	Predicted Level	28.2	29.1	32.1	34.2	37.2	37.7	38.5	38.4	38.4	38.3	38.3	38.2	38.0
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	45.0	46.1	48.8	51.2	51.2	51.2	51.2
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R10	Predicted Level	29.4	30.4	33.6	35.7	38.7	39.3	40.1	40.0	40.0	39.9	39.8	39.7	39.6
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	46.7	50.0	53.2	56.2	56.2	56.2	56.2
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R86	Predicted Level	28.4	29.5	33.0	35.3	38.3	38.9	39.7	39.6	39.6	39.5	39.5	39.4	39.3
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	47.7	50.9	50.9	50.9	50.9
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R138	Predicted Level	26.6	27.2	29.9	32.2	35.2	36.0	36.5	36.4	36.3	36.2	36.2	36.1	36.0
	Daytime limit	45.0	45.0	45.0	45.0	45.0	45.0	45.0	47.9	51.9	55.4	57.4	57.4	57.4
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB												
		2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s
R145	Predicted Level	27.9	28.9	32.2	34.5	37.5	38.1	38.8	38.8	38.8	38.7	38.6	38.5	38.4
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.1	49.4	53.6	57.4	60.5	60.5	60.5
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R167	Predicted Level	28.8	29.6	32.6	34.9	37.8	38.4	39.1	39.1	39.0	38.9	38.9	38.8	38.7
	Daytime limit	37.5	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
	Daytime Excess	-	-	-	-	**0.3**	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R197	Predicted Level	25.9	26.8	29.9	32.4	35.3	35.8	36.4	36.3	36.3	36.2	36.1	36.1	35.9
	Daytime limit	45.0	45.0	45.0	45.0	45.0	45.0	45.8	51.9	51.9	51.9	51.9	51.9	51.9
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R205	Predicted Level	24.7	25.5	28.5	31.1	33.9	34.4	35.0	34.9	34.8	34.7	34.6	34.6	34.4
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.9	47.9	47.9	47.9
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R248	Predicted Level	26.9	27.7	30.8	33.4	36.2	36.7	37.2	37.1	37.1	37.0	37.0	36.9	36.8
	Daytime limit	37.5	37.5	37.5	37.5	45.0	45.0	45.0	45.0	48.0	51.4	54.9	54.9	54.9

Receptor ID	Description	Predicted L_{A90} Sound Pressure Level at 10m Standardised Wind Speed, dB												
		2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s	9 m/s	10 m/s	11 m/s	12 m/s	13 m/s	14 m/s
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
R263	Predicted Level	29.1	29.3	31.6	35.0	38.4	39.4	39.5	39.3	39.3	39.3	39.3	39.2	39.2
	Daytime limit	37.5	37.5	37.5	45.0	45.0	45.0	45.0	45.0	47.7	51.4	55.4	55.4	55.4
	Daytime Excess	-	-	-	-	-	-	-	-	-	-	-	-	-
	Night-time limit	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0
	Night-time Excess	-	-	-	-	-	-	-	-	-	-	-	-	-

7.6 Mitigation Measures

7.6.1 Mitigation Measures During Construction

The predicted noise levels from on-site activity from the proposed project is below the noise limits in BS 5228-1:2009+A1:2014. Nonetheless, several mitigation measures will be employed to minimise any potential impacts from the proposed project.

The noise impact for construction works traffic will be mitigated by generally restricting movements along access routes to the standard working hours and exclude Sundays, unless specifically agreed otherwise. For example, during turbine erection, an extension to the working day may be required, i.e. 05:00 to 21:00, but this would be necessary only on a relatively small number of occasions. If turbine deliveries are required at night it will be ensured that vehicles on local roads do not wait outside residential properties with their engines idling, and that the local residents will be informed of any activities likely to occur outside of normal working hours.

Consultation with the local community is important in minimising the impacts and therefore construction will be undertaken in consultation with the local authority as well as the residents being informed of construction activities through the Community Liaison Officer.

The construction works on site will be carried out in accordance with the guidance set out in BS 5228:2009+A1:2014, and the noise control measures set out Section 4.3.2 of the Construction Environmental Management Plan (CEMP) which is included in Appendix 3.1 of Volume 3 of this EIAR. Proper maintenance of plant will be employed to minimise the noise produced by any site operations.

All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the project. Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

The hours of construction activity will be limited to avoid unsociable hours where possible. Construction operations shall generally be restricted to between 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 hours on Saturdays. However, to ensure that optimal use is made of fair-weather windows, or at critical periods within the programme, it could occasionally be necessary to work outside these hours. Any such out of hours working would be agreed in advance with the local planning authority.

The on-site construction and decommissioning noise levels will be below the relevant noise limit of 65 dB $L_{Aeq,1hr}$ for operations exceeding one month, and therefore construction noise impacts are not considered to be significant. However, there is potential for temporary elevated noise levels due to the grid connection works. However, the impact of these works at any particular receptor will be for a short duration (i.e. less than 3 days). Where the works at elevated noise levels are required over an extended period at a given location, a temporary barrier or screen will be used to reduce noise levels below the noise limit where required. The noise impact will also be minimised by limiting the number of plant items operating simultaneously where reasonably practicable.

7.6.2 Mitigation Measures during Wind Farm Operation

The predicted noise from the proposed wind farm is below the daytime and night-time noise limits at all but one noise sensitive location. There is an exceedance at location R167 during daytime periods at a wind speed of 6 m/s. The noise modelling assumed that this receptor is downwind of all wind turbines. In practice, this will not occur all the time and when the receptor is upwind or cross-wind the actual noise levels will be lower.

To ensure the proposed wind farm is compliant with the daytime noise limit at receptor R167, some of the turbines will need to be operated in noise reduced modes of operation[9]. Table 7.17 presents the sound power levels for the Vestas V150 for noise reduced modes of operation and a range of standardised 10m height wind speeds.

Table 7.17: Vestas V150 – Sound Power Levels for a range of Noise Reduced Modes

Modes of Operation	Sound Power Levels for a range of Standardised 10m Height Wind Speeds						
	2 m/s	3 m/s	4 m/s	5 m/s	6 m/s	7 m/s	8 m/s
Normal Operation	91.3	92.5	96.2	100.5	103.5	104.1	104.9
SO0	91.3	92.5	96.2	100.4	103.3	103.9	104.0
SO2	91.3	92.2	96.1	100.1	102.0	102.0	102.0
SO3	91.3	92.2	96.1	99.9	101.0	101.0	101.0
SO4	91.3	92.2	96.1	99.6	100.0	100.0	100.0
SO5	91.3	92.2	96.1	98.8	99.0	99.0	99.0
SO6	91.3	92.2	96.1	97.8	98.0	98.0	98.0

Table 7.18 presents mitigation measures to ensure compliance with the daytime noise limit at receptor R167. The operational noise resulting from the proposed project will meet the noise limits set out in Section 7.4.2 and the predicted noise levels are presented in Appendix 7.7.

Table 7.18: Required Turbine Curtailment/Mitigation to Meet Daytime Noise Limits

Turbine ID	Required Noise Reduced Modes to meet Daytime Noise Limit L_{A90}
	Standardised 10m Height Wind Speeds (m/s)
	6
T06	SO2

With mitigation, for some receptors sufficiently far from adjacent wind farms, a new source of noise will be introduced into the soundscape and it is expected that there will be a long-term slight to moderate significance of impact for dwellings within the 35 dB L_{A90} study area with a moderate significance of impact on the closest dwellings to the proposed wind farm.

[9] It is possible to run the turbines in noise reduced modes of operation (NROs) whereby the noise level is lessened by reducing the rotational speed of the turbines, with a resultant loss of electrical energy production. Mode SO0 refers to a noise reduced mode with a sound power of 104.0 dB rather than 104.9 dB when the turbine operates in normal mode of operation at a standardised 10m height wind speed of 8 m/s.

Should the project be granted permission, an operational noise survey will be undertaken to ensure the project complies with the noise limits. If an exceedance in the noise limit occurs, mitigation measures will be refined to ensure compliance with the noise limits is achieved at all noise sensitive locations. The requirements of the operational noise survey will be in accordance with any relevant planning conditions, but will as a minimum involve noise monitoring at a number of representative noise sensitive locations over a period after the windfarm becomes operational.

7.6.3 Mitigation Measures during Decommissioning

The noise impact for construction works traffic will be mitigated by restricting movements along access routes to the standard working hours and exclude working on Sundays, unless specifically agreed otherwise with the local authority.

The decommissioning works, which will be of a lower impact than construction works, will be carried out in accordance with the policies and guidance required at the time of the works, and restricted to normal working hours, 07:00 - 19:00 hours Monday to Friday and 07:00 - 13:00 on Saturdays in accordance with best practice. .

7.7 Residual Impacts

Construction and decommissioning on-site activities with a duration longer than one month will be below the construction noise limit of 65 dB $L_{Aeq,1hr}$ at residential dwellings. As a result, residual construction impacts range between not significant to slight impact with the duration of impact described as temporary.

There is potential for elevated noise levels due to the grid connection works resulting in a temporary significant impact. However, these works will be for a short duration at a particular property (i.e. typically less than 3 days at any particular receptor) and where the works are to occur over an extended period at a given location, a temporary barrier or screen will be used to reduce noise level below the noise limit and reduce any potential impact resulting in a moderate short-term residual impact.

The operational wind farm noise levels meet the night-time noise limit derived using the Wind Energy Development Guidelines 2006. As detailed in the criteria section this is considered to be a current best practice approach. The predicted noise from the proposed wind farm is below the at all but one noise sensitive locations. There is an exceedance at location R167 during daytime periods at a wind speed of 6 m/s. With mitigation measures, cumulative operational noise levels from the proposed wind farm and adjacent wind farms meet the daytime and night-time noise limit derived using the Wind Energy Development Guidelines 2006 which is not considered to be a significant impact. However, for some receptors a new source of noise will be introduced into the soundscape and it is expected that there will be a slight to moderate significance of impact, with dwellings closest to the project with a long-term moderate significance of impact.

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED ANNAGH WIND FARM, CO. CORK

VOLUME 2 – MAIN EIAR

CHAPTER 8 - BIODIVERSITY

Prepared for: EMPower Ltd.

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8. BIODIVERSITY

8.1 Introduction

This chapter has been prepared to describe the existing ecological environment of the study area and examines the potential effects that the proposed project (described in Chapter 3) may have on biodiversity, flora and fauna including ornithology. This assessment considers the potential effects with regard to each phase of the development: construction phase, operational phase and decommissioning phase. Appropriate mitigation measures are described to avoid, reduce or offset potential negative impact(s) to an acceptable level. The mitigation measures detailed within this chapter should be read in conjunction with mitigation measures contained in Chapter 10 Hydrology and Water Quality and those contained in the CEMP (Volume 3, Appendix 3.1).

- A detailed description of the project assessed in this EIAR is provided in Chapter 3 and is comprised of the following main elements: The wind farm site (referred to in this EIAR as 'the Site');
- The grid connection route (referred to in this EIAR as the 'GCR');
- The turbine delivery route (referred to in this EIAR as the 'TDR');
- Replant Lands.

The main wind farm site includes the wind turbines, internal access tracks, hard standings, the permanent meteorological mast, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm.

The grid connection includes the buried grid connection cable route from the on-site substation to the 110 kV substation at Charleville, Co. Cork.

The turbine delivery route includes all aspects of the route from the port of Foynes in Co. Limerick to the site entrance including proposed temporary accommodation works to facilitate the delivery of wind turbine components.

Replanting lands at Emlagh, Co. Clare have also been assessed. The environmental assessment carried out on the replanting lands at Emlagh, Co. Clare is detailed within this EIAR. Felling to facilitate the project is assessed as part of the main project, however ongoing commercial forestry operations are assessed cumulatively. An NIS has also been prepared for the replant lands (See Appendix 8.1).

An ecological appraisal of the proposed project was undertaken by Fehily Timoney and Company (FT) to inform this chapter.

Ecological walkover surveys, habitat surveys, botanical surveys, invasive species surveys and mammal surveys were carried out by Ben O'Dwyer (FT Ecologist; BSc. Wildlife Biology). David Daly (FT Ecologist; BSc. Ecology; MSc. Species Identification and Survey Skills) also carried out mammal surveys.

Bat activity and bat roost surveys were undertaken by Karen Banks (BSc. Environment and Development, MCIEEM; NPWS Bat Disturbance Licence holder); static bat detectors surveys were undertaken by Ben O'Dwyer (FT Ecologist; BSc. Wildlife Biology).

Bird surveys of the study area following SNH (2017) guidance were carried out during the winters of 2019-2020 and 2020-2021, as well as the summers of 2019, 2020 and spring 2021. A total of 144 hours of survey effort pr VP was completed between April 2019 – April 2021 inclusive. This fulfils the minimum survey effort requirement; however, it is noted that part of the survey effort for summer 2020 was completed in April 2021. Therefore, while a minor departure from SNH guidance occurred, the surveys captured sufficient data on bird activity at the site to permit a detailed and rigorous assessment of avifauna and as such are robust and fit for purpose.

Bird surveys were completed by Joseph Adamson (MSc. Environmental Resource Management, MCIEEM), Sinéad Clifford (FT Ecologist; BSc. Wildlife Biology; GradCIEEM), Jonathon Dunn (FT Ecologist; BA Natural Sciences; MSc. Ecology, Evolution and Conservation, PhD Avian Ecology, MCIEEM), Luke Myers (FT Ecologist; BSc. Wildlife Biology), Jon Keaney (FT Principal Ecologist; BSc. Applied Ecology MSc. Ecological Management and Biological Conservation; MCIEEM), Sean Ronayne (FT Ecologist; BSc. Zoology; MSc. Marine Biology; MSc. Ecological Assessment), Orla Coffey (FT Ecologist; BSc. Botany; MSc. Biological Sciences), Rory Dalton (BSc. BSc. Environmental and Earth Science) and Barry O'Mahony (BSc. Zoology, Biochemistry, Microbiology, H.Dip. Education; Nat.Dip. Food Science & Technology; Licensed Bird Ringer).

Triturus Environmental Services (Ross Macklin BSc. Applied Ecology; Ph.D. candidate in fish ecology, H.Dip GIS, Dip. Integrated Pest management, MCIEEM, MIFM and Bill Brazier B.Sc. Freshwater Biology, Ph.D. candidate in fish ecology & genetics, MIFM) undertook surveys of the aquatic ecology in 2020 and 2021 (walkover surveys, catchment wide electro-fishing, White-clawed Crayfish survey including conventional and eDNA methods, Freshwater Pearl Mussel survey, biological water quality surveys) as well the evaluation of the impact of the proposed development on aquatic ecology.

Ecological surveys and assessment reports of proposed replant lands were undertaken by Ciaran Ryan (Kerry Ecological services; B.Sc. Analytical Science; M.Sc. Environmental Science) and Karina Dingerkus (Giorria Environmental Services; PhD. Ecology and Distribution of the Irish hare in Northern Ireland).

The purpose of this evaluation was to:

- Provide a baseline by undertaking a desktop review of available ecological data for both the receiving environment and greater area, including a review of European sites within the potential zone of influence (ZoI) and NHAs / pNHAs within 15 km of the study area;
- Further add to baseline information by undertaking ecological field surveys of the receiving environment including, where required, the proposed Annagh Wind Farm Site, turbine delivery routes and grid connection routes;
- Identify flora and fauna present within the footprint of all elements of the project so as to identify the receiving environment;
- Evaluate the ecological significance of the receiving environment;
- Appraise the potential impacts of the project on the ecology of the receiving environment including the proposed Annagh wind farm site, turbine delivery route, grid connection route and replant lands;
- Prescribe measures to mitigate the potential negative impact(s) of the project on the ecology of the receiving environment.

8.2 Methodology

8.2.1 Relevant Guidance

The methodology for this appraisal has been devised in consideration of the following relevant guidance published by the Environmental Protection Agency (EPA) including '*Guidelines on the information to be contained in Environmental Impact Statements* (2002), reference was also made to the revised draft (August 2017) '*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)*', reference was also made to *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015) and '*Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*' (DoHPLG, 2018).

Additional guidance available from the EU such as '*Guidance document on wind energy developments and EU nature legislation*' (2020) and '*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment'* (2013) has also been considered. The appraisal also considers *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine* (Version 1.1) published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (2018; updated September 2019).

The Heritage Council publication '*Best Practice Guidance for Habitat Survey and Mapping'* (Smith *et al*., 2011) was used in the completion of habitat surveys and production of habitat mapping.

Relevant guidance published by the National Roads Authority (NRA) such as '*Guidelines for Assessment of Ecological Impacts of National Road Schemes*' (2009a), and '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' (2008a) have also been followed.

Relevant guidance from Scottish Natural Heritage (SNH) in relation to birds such as SNH *Recommended bird survey methods to inform impact assessment of onshore windfarms (2017)*. *'Survey Methods for use in assessing the impacts of onshore wind farms on bird communities (2010)*' and '*Assessing the cumulative impact of onshore wind energy developments (2012)*' have also been utilised.

The following guidelines in relation to bats were referenced:

- *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH, 2019, 2021)
- *Bat Survey Guidelines: Traditional Farm Buildings Scheme* (Aughney *et al*., 2008)
- *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn).* (BCT/Collins, 2016) *The Bat Conservation Trust, London.*
- *Bat Surveys: Best Practice Guidelines* (2nd edition) (Hundt, 2012);
- *Wind Turbine/Wind Farm Development Bat Survey Guidelines* (Bat Conservation Ireland, 2012);
- *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (NRA, 2006a);*
- *Bats and Onshore Wind Turbines – Interim Guidance (3nd Edition) (Carlin, 2014);*
- *Guidelines for the Treatment of Bats during the Construction of National Road Schemes (NRA, 2006b);*
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Relevant guidance published by the National Roads Authority (NRA), and applicable to assessing watercourses in Ireland, was also followed, including '*Guidelines for the Assessment of Ecological Impacts of National Road Schemes – Revision 2*' (NRA 2009a), '*Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2*' (NRA 2009b), '*Environmental Impact Assessment of National Road Schemes – A practical guide*' (NRA 2008b). '*Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*' (NRA 2008a) and '*Guidelines on protection of fisheries during construction works in and adjacent to waters*' (IFI, 2016).

8.2.2 Legislative Context

A diversity of flora and fauna, rare at a national level, are protected under the provisions of the Wildlife Act 1976, as amended, and the orders and regulations made thereunder, such as the Flora Protection Order (2015).

The Habitats Directive and Birds Directive have been transposed into Irish law, for the purposes of this application for permission by Part XAB of the Planning and Development Act 2000, as inserted. In addition, certain other obligations of the Habitats and Birds Directives have been transposed by the European Communities (Birds and Natural Habitats) Regulations 2011, as amended.

The EU Water Framework Directive (2000/60/EC) requires all Member States to protect and improve water quality in all waters in order to achieve good ecological status by 2015 or, at the latest, by 2027. This was transposed into Irish Law by the European Communities (Water Policy) Regulations 2003 (S.I. No. 722 of 2003). It applies to rivers, lakes, groundwater, and transitional coastal waters. The Directive requires management plans to be prepared on a river basin basis and specifies a structured method for developing these plans.

Section 171 of the Fisheries (Consolidation) Act 1959 creates the offence of throwing, emptying, permitting or causing to fall onto any waters deleterious matter. Deleterious matter is defined as not only as any substance that is liable to injure fish but is also liable to damage their spawning grounds or the food of any fish or to injure fish in their value as human food or to impair the usefulness of the bed and soil of any waters as spawning grounds or other capacity to produce the food of fish.

Under Section 3 of the Local Government (Water Pollution) Act, 1977 (as amended by Sections 3 and 24 of the 1990 Act) it is an offence to cause or permit any polluting matter to enter waters.

8.2.3 Consultation

The full list of the bodies consulted as part of the proposed development assessment are presented in Chapter 5, EIA Scoping, Consultation and Key Issues.

Consultation was undertaken with the following list of consultees specifically related to Biodiversity:

- The Development Application Unit (DAU)/ National Parks and Wildlife Service (NPWS)
- Inland Fisheries Ireland (IFI)
- Birdwatch Ireland
- The Environmental Protection Agency (EPA)
- An Taisce
- Irish Peatland Conservation Council
- Irish Raptor Study Group
- Irish Wildlife Trust (IWT)
- Biodiversity Ireland (National Biodiversity Data Centre)
- Butterfly Conservation Ireland.
- Cork Co. Council Ecology Office

In addition, on the 12th March 2021 a formal request was made to the NPWS (through the DAU) by email for a meeting; no reply has been received to date. The district Conservation Officer was also contacted on 30th September 2021 but noted there are currently no rangers covering the area where the proposed site is located and as such site-specific consultation was not possible.

The IFI south-western office was also contacted on 27th September 2021 to confirm receipt of the scoping report and whether any issues had been identified by Fisheries Officers. No response has been received to date.

It is noted that Bat Conservation Ireland (BCI) have indicated they are not able to consult on individual projects. Bat roost records and data were obtained by request from BCI as detailed below in *8.3.7 Bats*.

A response from Cork Co. Council Ecology office identified potential for impact on designated sites, habitats of high natural value and negative effects on populations of protected species as key ecological concerns. The response indicated primary areas of concern are: assessment of impact on designated sites; potential negative effects on freshwater habitats; assessment of impact on habitats; requirement for any species specific surveys be completed by qualified and experienced practitioners following best practise methods; information gathered during the survey stage should be used to inform design to ensure impacts to sensitive bird species are avoided; where possible, commuting and foraging routes of bats relative to proposals should be presented, in particular relative to any overlapping habitat loss; provision of planting to offset any such loss of bat commuting/foraging habitat; assessment of cumulative effects with regard to solar developments in the area, and that decommissioning and reinstatement should be considered in detail and include opportunities for biodiversity enhancement where possible.

No other responses excepting acknowledgement of receipt of the scoping report have been received to date.

8.2.4 Desktop Study

8.2.4.1 Designated Nature Conservation Sites

Nationally designated sites within 15 km of this project, such as Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) have been identified.

European sites within 15 km and potential ZoI (zone of influence) of the proposed development namely Special Areas of Conservation (SACs)[1] and Special Protection Areas (SPAs) for birds were identified as part of this ecological assessment using the Map Viewer at www.npws.ie. These designated sites are described in Section 8.3. A separate Natura Impact Statement (NIS) was prepared to evaluate potential significant effects to European sites as a result of the proposed development.

Other categories of designated site such as nature reserves, RAMSAR sites and wildfowl sanctuaries were also searched for during the desktop study.

8.2.4.2 Flora and Fauna

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the site's natural environment.

Records available on the NPWS and the National Biodiversity Data Centre websites were reviewed, in addition to records of rare/sensitive species within the 10km grid squares overlapped by a 5 km buffer surrounding the study area obtained by request from NPWS (received 22nd March 2021).

Other data sources include Ireland's Wetlands and their Waterbirds: Status and Distribution (Crowe 2005), the Atlas of Wintering Birds in Britain and Ireland (Lack, 1986), the Atlas of Breeding Birds in Britain and Ireland (Sharrock, 1976) and the Breeding and Winter Birds of Britain and Ireland Bird Atlas 2007-11 (Balmar *et al*., 2013).

Botanical species were assessed in accordance with their occurrence on the Flora Protection Order 2015 and the Ireland Red List No. 10: Vascular Plants (Wyse *et al*., 2016).

Other sources included:

- County Cork Biodiversity Action Plan 2009-2014
- OSI Aerial photography and 1:50000 mapping;
- NPWS website (mapviewer; Article 17 mapping; FPO Bryophyte viewer)
- NPWS rare and protected species records obtained by request on 22nd March 2021;
- EIAR Biodiversity chapters for nearby development (accessed via EIA Portal)
- National Biodiversity Data Centre (NBDC) website and data obtained on 14th April 2021;
- Birdwatch Ireland – Bird Sensitivity to Wind Energy mapping (accessed via NBDC)
- Teagasc Soil area maps;
- Bat Conservation Ireland records obtained by request on 30th March 2021;
- Geological Survey Ireland (GSI) area maps;
- Map of Irish Wetlands (wetland surveys Ireland/Foss Environmental)
- OPW drainage maps
- EPA website datasets (soil, surface water quality, ground water quality, designated sites);
- IFI website & guidance documents

[1] Note: At present many SACs in Ireland are currently 'candidate' SACs, and referred to as cSACs. The relevant Statutory Instruments for the SACs in Ireland have not yet been made, however, these "candidate" sites must still be afforded the same level of protection as if they were SACs in accordance with the Habitats Directive.

8.2.5 Field Study

The study areas used for different disciplines and different survey types within study areas relative to specific project elements are detailed below in Table 8-1. Please see Figure 8-10 for Land Ownership Boundary.

Table 8-1: Definition of Study Areas

Discipline/Survey	Project Element		
	Wind Farm	GCR	TDR
Habitat, Botanical & Invasive Species	Land Ownership Boundary & Site Entrance (see Figure 8-10).	GCR footprint and adjacent lands	TDR Nodes and adjacent lands
Mammals			
General Mammals	150m buffer[a] around infrastructure in open habitats. Entirety of felling buffers plus 50m buffer.	GCR footprint and adjacent lands	TDR Nodes and adjacent lands
Otter	150m up and downstream[b] of proposed internal access track crossing.	150m up and downstream of Rathnacally Stream Crossing	Node 10.5 (Rathnacally Stream Crossing)
Bats	Land Ownership Boundary plus 275m buffer[c]	Rathnacally Stream Crossing	TDR Nodes and adjacent lands
Lepidoptera/Invertebrates			
Marsh Fritillary	Areas with larval foodplant (main focus) (see Figure 8-1); Land Ownership Boundary	N/A	N/A
Lepidoptera	Land Ownership Boundary	N/A	N/A
General Invertebrates	Land Ownership Boundary	N/A	N/A
Avifauna			
VP Surveys	VP viewsheds and 500m turbine buffer	N/A	N/A
Transect surveys	Land Ownership Boundary	N/A	N/A
Barn Owl	Land Ownership Boundary	Adjacent lands	Adjacent lands (TDR Nodes)
Nightjar	Land Ownership Boundary	N/A	N/A
Hinterland surveys	Within 10 km of wind farm	N/A	N/A
Kingfisher	Aquatic ecology study area	150m up and downstream of Rathnacally Stream Crossing[b]	Node 10.5 (Rathnacally Stream Crossing)

Discipline/Survey	Project Element		
	Wind Farm	GCR	TDR
Aquatic Ecology	Survey points on watercourses draining the wind farm, GCR and surrounding area	Rathnacally Stream Crossing	Node 10.5 (Rathnacally Stream Crossing)

a) Based on maximum buffering distance recommended for Badger in NRA's *'Guidelines for the treatment of badgers prior to the construction of national road schemes.*

b) Based on maximum buffering distance recommended for Otter in NRA's *'Guidelines for the treatment of otters prior to the construction of national road schemes.*

c) Based on requirement in SNH (2019) *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* to undertake roost surveys within 200m of the proposed development boundary plus rotor radius (75m). It is noted that the land ownership boundary used when surveys were initiated has been superceded by a smaller planning boundary (the land ownership boundary) and as such the roost survey study area exceeds requirements.

8.2.5.1 Habitats

The habitats within the study area (land ownership boundary) encompassing the main wind farm site, the footprint of the proposed grid connection route and turbine delivery route (TDR) nodes were identified and classified, according to 'A Guide to Habitats in Ireland' (Fossitt, 2000). The habitat survey of the main wind farm site was undertaken during 29th June, 2nd, 14th and 15th July 2020. A habitat survey along the grid connection (outside the main wind farm site) and turbine delivery route were undertaken between the 10th – 11th June 2021. All plant species present in each habitat type, and information on dominant species and plant assemblages were also recorded. Habitats have been appraised and evaluated according to their occurrence as protected habitats under Annex I of the EU Habitats Directive (92/43/EEC) and for their capacity to support rare, threatened and endangered species. The methodology used to assess the impact on habitats is based on NRA guidelines (2009 a and b), CIEEM guidelines (CIEEM, 2019) and EPA guidelines (EPA, 2017).

The habitat mapping exercise followed 'Best Practice Guidance for Habitat Survey and Mapping' (Smith *et al*., 2011) published by the Heritage Council.

Scientific and common names for vascular plants follow Parnell and Curtis (2012) and Blamey *et al*., (1996), respectively. In addition to habitat identification, each habitat was assessed for its ecological significance, based on the National Roads Authority (NRA) Site Evaluation Scheme (NRA, 2009a) (see Table 8-13**Error! Reference source not found.**).

Habitat boundaries and associated attribute data were mapped using desk-based GIS software, namely ArcGIS 10.4.1, which was also used to calculate habitat areas and lengths.

8.2.5.2 Mammals

Mammal surveys at the proposed wind farm site were undertaken on 6th May and 12th October 2021, and at TDR Nodes and along the GCR on 10-11th June 2021. During surveys at the wind farm site, the footprint of the development was surveyed for signs of mammal activity; this included the footprint of vegetation clearance and earthworks, as well as a buffering distance of 150m from all proposed infrastructure, which encompassed 50m beyond the extent of proposed felling buffers in wooded areas.

Surveys along the TDR Nodes and GCR covered the footprint of these elements, plus searches of any potentially suitable habitat within 50m of proposed works.

Sightings, tracks or signs (including droppings, resting places, burrows and setts) of mammals occurring within, or in the vicinity, of the site footprint were recorded using field notes and/or handheld GPS units subsequently digitised using ArcGIS. The mammal survey also included a Drey search within the wind farm study area identified above; deciduous trees in the plantation woodlands within the infrastructure and felling buffer footprint were just beginning to out leaves at the time of survey and as such crowns of these trees were unobscured. Trees at TDR Nodes and along the GCR were also examined for their potential to host Dreys, however it is noted their location beside public roads subject to disturbance makes them sub-optimal for Red Squirrel Dreys.

Otter surveys were undertaken along watercourses covering 150m up and down-stream of the proposed new internal access track crossing (Oakfront stream) at the wind farm site (6th May and 12th October 2021) and 150m up and down-stream of the existing crossing where the grid connection intersects the Rathnacally stream (11th June 2021).

Surveys were undertaken in accordance with the NRA's (2009b) '*Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes'* and the JNCC's (2004) '*Common Standards Monitoring Guidance for Mammals'*.

Trail cameras were placed at potentially active badger setts under NPWS licence 75-2021. These cameras were deployed on 6th May 2021 and collected on 10th June giving a total of 35 field days.

Natural watercourses were searched for otter holts and signs of otter at and up to 150m up and downstream of proposed crossing points (access tracks and grid connection). A trail camera was placed on the Oakfront River in an area where otter signs were observed from 11th June – 11th July giving a total of 30 field days. A trail camera was placed beside a mammal trail associated with a potential holt location downstream of the grid connection crossing point on the Rathnacally stream from 11th June – 11th July giving a total of 30 field days.

Otter were also surveyed as part of the aquatic ecology surveys and this is described in section 8.2.5.5.

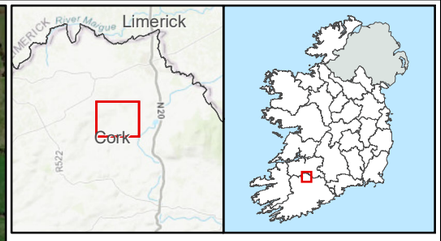
8.2.5.3 Marsh Fritillary/Lepitoptera

Lepidoptera surveys were undertaken on September 16th, 17th and 25th September 2020. Insects were recorded from daytime observation of flying specimens as well as from leaf-mines and other feeding signs. A 15W Actinic light-trap was used in the woodland clearing within the oak/birch plantation north of proposed turbine T04. Insects were sampled in this area, including a number of leaf-miners on birch, oak and Rowan.

Areas of higher floristic diversity were assessed for possible occurrence of Marsh Fritillary *Euphydryas aurinia*. While very small, scattered patches of the butterfly's foodplant, devil's-bit scabious *Succisa pratensis* were found locally on the site, including the margins of wet grassland in the central part; the most extensive area of *S. pratensis* was found in the triangular field in which the proposed turbine T02 is located (Figure 8-1), and this (marsh fritillary study area) was inspected in detail on September 25th 2020. Larval web searches were carried out along a series of transects walked over a period of 2 hours, in accordance with NRA methodology (*Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*) (NRA, 2009). The circular clearing in plantation woodland in the western part of the study area (see Figure 8-1) was also searched for signs of Marsh Fritillary on September 25th 2020.

See Appendix 8-2 for Marsh Fritillary Report.

Path: R:\Map Production\2020\P2359\Workspace\EIAR\P2359_GIS_Fig8-1_MarshSurveyAreas_A3.mxd



Legend

- Site Boundary
- Marsh Fritillary Survey Areas

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0 0.25 0.5 1 Kilometers

TITLE: Marsh Fritillary Survey Areas			
PROJECT: Annagh Wind Farm			
FIGURE NO:	8.1		
CLIENT:	EMP Group		
SCALE:	1:12500	**REVISION:**	0
DATE:	12/10/2021	**PAGE SIZE:**	A3

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8.2.5.4 Bats

Bat surveys have been completed within the study area (wind farm site land ownership boundary plus 275m buffer) during the years 2020 and 2021. The surveys encompassed preliminary roost assessments, summer roost and winter roost inspections (focused on buildings), bridge and tree inspections, activity surveys (transects) and static detector surveys. The methodologies for surveys undertaken within the wind farm study area described here are extracted from the 2020/2021 Bat Report and Bat Roost Survey Report (Appendices 8.2 and 8.3).

These surveys followed the specific guidelines set out by the Bat Conservation Trust in Bat Surveys: Good Practice Guidelines (Hundt, 2012 and Collins, 2016). The locations of static detectors and methodology for static detector surveys followed the requirements of 'Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation' (SNH, 2019; 2021).

Preliminary Ecological Appraisal

A walkover survey of areas identified as potential roosting habitats during the desk top study were undertaken in March 2021. Roosting habitat was assessed using the criteria outlined in Table 8-2:

Table 8-2: Potential Suitability of Habitats for Bats (Collins, 2016)

Suitability	Description of Roosting Habitats	Commuting and Foraging Habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation). A tree of sufficient size and age to contain PRFs but with none seen from the ground or features seen with only very limited roosting potential.	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only- the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.

Suitability	Description of Roosting Habitats	Commuting and Foraging Habitats
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	Continuous, high quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

Bat Roost Inspection Survey (See Appendix 8.3 for Detailed Bat Roost Survey Report)

Trees

Inspections of the exterior of trees were undertaken on 18th March 2021 to look for features that bats could use for roosting (Potential Roost Features, or PRFs) from ground level. The aim of the surveys was to determine the actual or potential presence of bats and the need for further survey and/or mitigation. Tree inspections and identification of PRFs had regard to the guidance document '*A Guide to Identification and Assessment for Tree-Care and Ecology Professionals*' (Bat Tree Habitat Key, 2018).

Inspections of each potential tree roost within the study area were undertaken. The inspections were carried out in daylight hours from ground level, and information was compiled on the tree, PRFs and evidence of bats. All trees surveyed were numbered and marked on a map and a description of each PRF observed was recorded. PRFs that may be used by bats include:

- Rot holes;
- Hazard beams;
- Other horizontal or vertical cracks or splits (e.g. frost cracks) in stems or branches;
- Lifting bark;
- Knotholes arising from naturally shed branches or branches previously pruned back to the branch collar;
- Man-made holes (e.g. flush cuts) or cavities created by branches tearing out from parent stems;
- Cankers in which cavities have developed;
- Other hollows or cavities;
- Double leaders forming compression forks with included bark and potential cavities;
- Gaps between overlapping stems or branches;
- Partially detached ivy with stem diameters in excess of 50mm; and
- Bat or bird boxes.

Signs of a bat roost (excluding the actual presence of bats), include:

- Smoothing of internal crevices
- Bat droppings in, around or below a PRF;
- Odour emanating from a PRF;
- Audible squeaking at dusk or in warm weather; and
- Staining below the PRF.

It should be noted that bats or bat droppings are the only conclusive evidence of a roost, and many roosts have no external signs. Therefore, this survey and evaluation was relatively basic as only those PRFs at ground level could be inspected closely to ascertain their true potential to support roosting bats. Trees were categorised according to the highest suitability PRF present.

Inspections of the exterior of trees for PRFs were undertaken at all TDR Nodes on 10th June 2021.

Structures

Buildings and bridges within the proposed wind farm study area for bats were subject to a visual inspection for evidence of, and potential for, bats in March 2021 and June 2021. The exterior of the structures was visually assessed for potential bat access points and evidence of bat activity using binoculars, a high-powered torch and an endoscope (Explorer Premium 8803 with 9mm camera) (endoscope surveys carried out under Photography Licence 15/2021). Features such as crevices and small gaps in the bridge or building structure, such as between the brick or stonework, beneath roofing material, at eaves and around window frames which had potential as bat access points into the buildings were inspected. Evidence that these features/ access points were actively being used by bats includes staining within the gaps, urine staining and bat droppings. Indicators that potential access points are not actively used by bats include general detritus and cobwebs within the access point. A note of potential features used by bats was made where present.

Where possible, internal inspections of these structures were undertaken. Internal inspections involved looking for features that may be suitable for roosting bats, such as joints and crevices in wood, holes or crevices between stonework in the walls and searching for bat droppings, urine stains and feeding signs on the floor.

The existing crossing structure (cast concrete culvert bridge) over the Rathnacally stream (located along grid connection) was inspected and assessed for it's potential to host roosting bats on 10th June 2021.

Emergence Roost Survey

Dusk surveys of structures within the study area for bats that were identified as being of moderate to high potential for bats during the roost inspection surveys were undertaken between 10th June and 19th June 2021. The purpose of the surveys was to watch and listen for bats exiting from bat roosts to determine the presence or absence of bats at the time of survey. The dusk emergence surveys commenced approximately 15 minutes before sunset and ended approximately 90 minutes after sunset. The survey was undertaken in suitable weather conditions (avoiding periods of very heavy rain, strong winds (> Beaufort Force 5), mists and dusk temperatures below (12°C)). Two operatives surveyed the structures (see Appendix 2 of the Bat Roost Survey Report contained in Appendix 8.3 for details).

Anabat Walkabout detectors were utilised for the survey, which record bat echolocation calls directly on to an internal SD memory card.

Each time a bat is detected, an individual time-stamped (date and time to the second) file is recorded. Data were then downloaded and all recordings were analysed using the Anabat Insight spectrogram sound analysis software Version 1.9.7.

Bat Activity/Transect Surveys

Transects of bat favourable habitats within the study area were walked and activity recorded using an Echo Meter Touch Pro (Full Spectrum). Transects were undertaken between May and September 2020 (Table 8-3).

Surveys targeted a range of foraging and commuting habitats present within the study area, those associated with linear features such as roadside margins, woodland plantation edges, hedgerows, treelines and waterbodies. Full details of transects are shown in Table 8-3 and Figure 8-2 below.

Bat surveying was conducted using a Frequency Division Detector System. Frequency Division detectors record bat ultrasonic calls on a continuous basis and stores the information onto an internal SD memory card. Frequency Division is a technique used to convert the inaudible bat echolocation calls to audible sounds. The bat detectors used a Full Spectrum Analysis to make the real-time recorded calls visible for display purposes. It is these sonograms (2-d sound pictures) that are digitally stored on a SD card and downloaded for analysis. Each time a bat is detected, an individual time and GPS stamped (date and time to the second) file is recorded.

Bat activity is governed by the activity of their insect prey and insect abundance is in turn governed by weather conditions and climate. Insects, and therefore bats, are unlikely to be present at temperatures below 7°C or during periods of strong winds or heavy rainfall so surveying in such conditions is not possible. All field surveys were undertaken within the active bat season and during good weather conditions (dry conditions and temperature at 8°C and greater).

Nocturnal bat activity is mainly bi-modal taking advantage of increased insect numbers on the wing in the periods after dusk and before dawn, with a lull in activity in the middle of the night. This is particularly true of 'hawking' species – i.e. bats which capture prey in the open air. However, 'gleaning' species remain active throughout the night as prey is available on foliage for longer periods. Gleaning is the term for taking prey from foliage or the ground.

Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (BatExplorer spectrogram sound analysis software Version 2.1.6.0).

Table 8-3: Bat Activity Survey Details 2020

Transect	Date	Start Time	End Time
1	08/05/2020	21:05	23:30
2	25/06/2020	21:45	00:00
3	28/06/2020	21:45	23:45
4	28/07/2020	21:15	23:30
5	27/08/2020	20:15	22:50
6	21/09/2020	19:20	21:55