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## Derrybrien Wind Farm Project

Gort Windfarms Ltd.

## Remedial Environmental Impact Assessment Report Chapter 17-Interaction of Impacts

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## 17 Interaction between Impacts of Different Factors

### 17.1 Introduction

This Chapter sets out the interactions between impact of different factors. The Derrybrien Wind Farm Project (the Project) was constructed during the period 2003 and 2006 and became commercially operational in March 2006. The project comprises the Derrybrien Wind farm itself and the grid connection (110KV overhead line connecting the windfarm substation to the Agannygal substation constructed as part of the project).

#### 17.1.1 Chapter Scope

The requirement to consider interaction of impacts is set out in Article 3.1 (e) of the European Directive of the parliament and the Counsel of 2014” amending the Environmental Impact Assessment Directive and has been in force since May 2017<sup>1</sup>.

As required by Article 3.1 (e) of the EIA Directive of 2014, the environmental impact assessment is required to identify, describe and assess in an appropriate manner the direct and indirect significant effects of a project on the following factors:

- (a) population and human health;
- (b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;
- (c) land, soil, water, air and climate;
- (d) material assets, cultural heritage and the landscape;
- (e) the interaction between the factors referred to in points (a) to (d).

The likely significant effects of the proposed development on specific environmental topics have been described in individual chapters together with the interaction of the impacts of different factors. A summary of the main interactions between different environmental aspects potentially impacted by the proposed development is provided here.

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<sup>1</sup> DIRECTIVE 2014/52/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment

The requirement to undertake an assessment of the interaction of impacts is also set out in the “European Commission, “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)”, 2017 <sup>2</sup>” amending the Environmental Impact Assessment Directive and has been in force since May 2017.

It is also set out in Section 3.7.6 of the EPA Draft guidelines of 2017<sup>3</sup> on information to be contained in environmental impact assessment reports.

As described in Chapter 2 Project Description, for the purposes of the Remedial Environmental Impact Assessment Report (rEIAR) the Project comprises:

- Derrybrien Wind Farm and associated ancillary works
- Grid connection comprising Derrybrien-Agannygal 110kV Overhead Line and Agannygal Substation connecting into the Shannonbridge -Ennis 110kV Overhead Line and associated ancillary works
- Works undertaken in response to peat slide which occurred during construction of the wind farm and associated ancillary works

Cumulative impacts including intra project cumulative impacts have been considered throughout the environmental impact assessment process and are discussed in each relevant chapter. They are not considered here.

### 17.1.2 Statement of Authority

The assessments with this chapter were undertaken by Dr. Paddy Kavanagh (BSc Hons Chemistry, PhD Chemistry), ESB Engineering and Major Projects. Dr. Kavanagh has over 39 years of experience in the field of chemistry, environment and environmental assessment both in Ireland and internationally. He has led and been involved in the preparation of environmental impact statements/environmental impact assessment reports and environmental management for power generation, transmission systems including the Donegal and Connemara 110 kV overhead lines

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<sup>2</sup> European Commission, “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)”, 2017

<sup>3</sup> EPA, Guidelines on the Information to be contained in Environmental Impact Assessment Reports, Draft 2017

and substations, the North South 400kV Interconnector and wind farm projects including Oweninny, Grousemount, Lissycasey wind farms for example.

### 17.1.3 Assessment Methodology

The assessment methodology has followed the EPA Guidance Section 3.7 Interactions between Impacts of Different Factors which states as follows:

*“The interactions between impacts on different environmental factors should be addressed as relevant throughout the EIAR. For example, where it is established in the Hydrology section that there will be an increase in suspended solids in discharged surface waters during construction then the Biodiversity section should assess the effect of that on sensitive aquatic receptors. Close co-ordination and management within the EIA team is needed to ensure that interactions are adequately addressed throughout an EIAR.....*

*It is general practice to include a matrix to show where interactions between effects on different factors have been addressed. This is usually done using the actual headings used in the EIAR if these differ from the factors contained in the Directive (ref section 3.3.6). This is typically accompanied by brief text describing the interactions. Further coverage of this is provided in the Advice Notes.”*

The interactions between impacts on different environmental factors have been addressed in the respective chapters as relevant throughout the rEIAR with coordination between Chapter authors. For example, where a description is provided in Chapter 10 Land, Soils and Geology of the peat slide event that occurred in 2003 which gave rise to an increase in suspended solids in the drainage system and river then its impact on sensitive species in surface waters has been addressed in the Aquatic Ecology and Surface Water Chapter 8 and in Chapter 7 Biodiversity.

A matrix of the interactions of different factors has been prepared and a summary of the significant cross media interactions that were considered as part of the assessment is provided herein.

Where a statement of significance is included within this chapter this statement refers to the conclusions reached on the different impacts in specific chapters. Where reference is made to conclusions reached in other chapters this conclusion is after mitigation measures are implemented

Separate summaries have been provided for interaction of impacts which have occurred or are occurring (construction, peat slide event and operational) and for interaction of impacts which are likely to occur (operation in the period mid-2020 to circa 2040 and decommissioning circa 2040 to 2042).

## 17.2 Summary of Interaction of Impacts which have occurred

### 17.2.1 Construction period 2003 to 2006

Table 17-1 provides a matrix of the interaction of impacts which have occurred arising during construction of the project.

The matrix provided covers both the construction period 2003 to 2006 and the peat slide event which occurred in 2003.

The interaction of impacts is briefly summarised in the following subsections.

#### 17.2.1.1 Population and Human Health

The following construction impact interactions were considered:

- Noise and Vibration: Noise from construction vehicles and equipment from the construction activities had the potential to impact on health of human beings. The assessment carried out in Chapter 5 Noise and Vibration in Section 5.6.1.1 indicates that construction noise levels were well within the applicable noise criteria for construction and was not significant. This has been reflected in the population and human health chapter section 4.5.1.1. No significant effect was identified.
- Aquatic Ecology: Not relevant to population and human health during the construction period. Effects on the Gort Regional Water Supply are related to the peat slide and are discussed in Section 17.2.2.1 below.
- Land, Soils and Geology: Land use changes involving tree felling and peat excavation during construction have been described in Chapter 10, section 10.3.2.1.1.2. These changes have the potential to impact on surface and ground waters through sediment release and hydrocarbon spills from construction equipment which could impact on drinking water quality. No significant impact was identified with the implementation of mitigation. Employment which occurred in equipment operation and tree harvesting activities during the construction period brought socio-economic benefit to the area in general and these positive effects have been assessed in the Population and Human Health Chapter, Chapter 4 section 4.3.1.1 and were identified as locally significant.
- Hydrology and Hydrogeology: Human beings require high quality water for everyday life and also for recreational purposes. These can be impacted by pollutants such as sediments in suspension and spillages of hydrocarbons. Chapter 11, Hydrology and Hydrogeology: describes the potential impacts from sediment and hydrocarbon spills on both surface and groundwater. The potential for such factors to impact on drinking water supplies and thus on human health has been assessed in Chapter 4 Population and Human Health, Chapter 4 Table 4-10. No significant impact arising from these interactions were identified, Chapter 4 Table 4-12. Impacts from the potential



to increase flood risk in terms of affecting the local population was considered in the Flood Risk Assessment accompanying Chapter 11. No significant impact was identified.

- Air Climate: Potential impacts on air quality as a result of land use change from excavation and forestry activities arising from construction dust and vehicle emissions were assessed in Chapter 12 (Air and Climate). These impacts can also impact on human health and are described in terms of their significance in Chapter 4 Table 4-12. No significant effects relating to the interaction of impacts occurred.
- Material Assets: Impacts on materials assets as described in Chapter 14 were considered in Chapter 4 No significant effect was identified
- Traffic and Transport: Potential interactions of impacts between construction traffic vehicle movements, road upgrades at Crooked Bridge, along 5km of the Black Road and on local public roads and the population using local roads would have occurred. This gave rise to a minor inconvenience to local road users. As described in Chapter 14 Roads, Traffic and Transport, Section 14.3.1, traffic management measures were agreed with GCC in relation to the works. Impacts to the public during the upgrading of Black Road were **temporary, negative and moderate** and on local roads are described as **temporary, negative and slight**.
- Some temporary road closures occurred during deliveries of large components giving rise to some inconvenience, but these were minor and of short duration. No significant impacts were identified
- Major Accidents and Disasters: Vehicular risks including accidents during the construction stage are discussed in Chapter 16 Major Accidents and Disasters, Section 16.5.1 and Section 16.5.2. Vehicular accidents are classed as **Likely** to occur, categorised as **Minor** social impacts and with a **Low** risk rating. The interaction of impacts as a result of the peat slide incident is discussed in the separate section 17.2.2 below.

#### 17.2.1.2 Biodiversity -Terrestrial

Impacts relating to Biodiversity during the construction period have the potential to be impacted by other environmental aspects as follows:

- Population and Human Health: Disturbance and displacement of biodiversity by the construction workforce travelling to and from work at the development sites giving rise to disturbance to birds, bats and mammals. The effects are described in Chapter 7, Section 7.4.2.1 The likely disturbance to breeding birds due to construction related activities is considered a negative impact of short-term duration. However, at the population level of most breeding species the loss of some breeding pairs for one season would not be a significant effect. The exception to this is breeding snipe where the effect is considered to be significant but temporary Impact on bats and mammals came principally from loss of habitat.

- Noise and Vibration: Disturbance effects to fauna (particularly avifauna) as a consequence of noise and vibration arising from construction and delivery traffic is likely to have occurred and has been assessed in the Biodiversity Chapter in terms of overall construction effects, Chapter 7, Section 7.4.2. The effect on breeding birds is considered to be a negative impact of short-term duration. However, at the population level of most breeding species the loss of some breeding pairs for one season would not be a significant effect.
- Landscape and Visual: Construction of the wind farm led to a change in the nature of the landscape from being forest cover to clear felled areas with a wind farm infrastructure in situ. The impact of the landscape change has been assessed in terms of impact on terrestrial biodiversity in the Biodiversity Chapter (Chapter 7), Section 7.4.2.1.1. While there were some negative impacts, such as the loss of 42ha of stands which were in the pre thicket phase which would have likely provided suitable habitat for foraging hen harriers for perhaps another 5 years overall the change in landscape is seen as largely positive and long term for birds, Chapter 7, Section 7.4.2.1.2. No significant adverse effect on bats was identified during the construction period.
- Land, Soils, Geology: Construction of the wind farm has led to the physical change of habitat from forest cover to open areas and with forest tracks and structure foundation footprint as described in Chapter 10 Land, Soils and Geology. The impacts from these have been assessed in the Biodiversity Chapter, Section 7.4.2. and are largely seen as a significant positive effect in the long term.
- Hydrology and Hydrogeology, Drainage developed during construction would have also contributed to habitat change impacting on biodiversity. The potential for pollutants to impact upon ecological receptors via surface soil/water and groundwater pathways were considered and assessed in the Biodiversity Chapter, Chapter 7 section 7.4.2.1.1. No significant effect was identified.
- Air and Climate: Air emissions potentially could have given rise to effects on biodiversity from dust arising from construction (such as effects on photosynthesis, transpiration and respiration in plant species). No significant air quality effects were identified.
- Traffic and Transport: Noise from construction traffic along access routes could also impact birds and mammals through disturbance or displacement. This factor was taken into account in the assessment of impacts in the biodiversity chapter, Chapter 7 Section 7.4.2.1.2. Road widening and bridge upgrade works undertaken to facilitate increased construction traffic has also been assessed. No significant effect was identified.
- Major Accidents and Disasters: The interaction of impacts with biodiversity as a result of the peat slide incident is discussed in the separate section 17.2.2 below

### 17.2.1.3 Aquatic Ecology

Effects arising from several topics have the potential to effect aquatic ecology and these were taken into account in Chapter 8 Aquatic Ecology. These effects are summarised briefly as follows:

- Land, Soils and Geology: Impacts on land soils and geology arising from excavations and land change use such as forestry clearfell are the primary drivers for sediment and nutrient load (from decaying forest residues left on site) to the aquatic environment and could have given rise to impacts on aquatic biodiversity. These effects were considered in Chapter 8 Aquatic Ecology, Section 8.3.2.1. Moderate, adverse but temporary to short-term impacts were identified as having occurred.
- Hydrology and Hydrogeology: Drainage from the site construction locations is considered in detail in Chapter 8 in terms of its impacts on water quality and fisheries as it provides a pathway for suspended matter, pollutants like cement and hydrocarbons to enter the aquatic environment. The impacts of the drainage work undertaken for the project in terms of providing pathways between surface soil/water and groundwater and the potential for leachate generation to impact surface waterbodies and aquatic ecology were considered. The assessment in Chapter 8, Section 8.3.2.1 concluded that the combined impact of forestry felling, road construction, cable trenching, drain digging, peat repositories and all other on-site construction activities on the wind farm site is likely to have resulted in a **moderate, negative but temporary to short-term** impact on the water quality of the small streams draining from the wind farm with **slight negative and temporary** impacts from the grid connection construction. The risk arising from hydrocarbons and cement causing significant effect was not significant.
- Roads, Traffic and Transport: Consideration has been given to the potential impact of road widening, resurfacing and road and bridge upgrading, to accommodate the increased level of construction traffic, which could generate sediment load and effect aquatic ecology in Chapter 8 Aquatic Ecology. Effects of construction traffic giving rise to direct impact on aquatic ecology and indirectly through site generated sediment load were also considered. Moderate, adverse but temporary to short-term impact was identified as having occurred.
- Major Accidents and Disasters: The effects of the peat slide incident which occurred during construction is discussed separately in Section 17.2.2 below.

### 17.2.1.4 Landscape and Visual

- Land, Soil and Geology: The significance of the landscape effect of the construction impacts were considered in the Landscape and Visual Chapter, Chapter 9 section 9.4.1 and assessed as being moderately adverse.

#### 17.2.1.5 Land, Soils and Geology

- Population and Human Health: The requirements for sanitary facilities such as proprietary wastewater treatment system installed at Derrybrien during construction could lead to impact on soils and geology through the discharge of treated/untreated wastewater. The effects of this were addressed in the Land, Soils and Geology Chapter and no significant impact was identified as having occurred.
- Roads and Traffic: Access track widening and upgrading as well as external upgrading of local roads and bridges occurred as part of the project construction. Surcharging of peat by construction traffic also occurred and this was assessed in Chapter 10 in Section 10.3.2.1.

#### 17.2.1.6 Hydrology and Hydrogeology

- Impacts relating to Surface and Groundwater have the potential to be impacted by Land, Soils and Geology. The changes to the hydrology of the system from construction activities such as drainage, forest clearfelling and ground works were considered as were the pollutant pathways between surface soil/water and groundwater and the potential for leachate generation to impact surface waterbodies were considered. Most effects were temporary and localised.

#### 17.2.1.7 Air and Climate

- Drainage and its impact on greenhouse gas emissions and peat degradation was taken account of in the air and climate chapter in terms of carbon losses calculated for the Project. The carbon losses associated with the drainage and its impacts on peat degradation are described in Chapter 12, Section 12.4.6.Air and Climate
- Land, Soils and Geology: The interaction of impacts on air quality and climate arising from land use change and, construction activities were considered in the Air and Climate Chapter 12. No significant impacts on air quality were identified. The change of land use from forest cover to bare open areas and the removal of large quantities of peat resulted in significant impact on stored carbon and carbon sequestration potential.

#### 17.2.1.8 Noise

- The effects of noise impacts during construction have been considered in the Population and Human Health Chapter, Table 10-12 and the Biodiversity Chapter. No significant effects were identified.
- Transport of materials noise and other construction machinery were also assessed as part of the overall construction noise assessment in Chapter 5, Section 5.6.1.

#### 17.2.1.9 Material Assets

- Impacts relating to Material Assets had the potential to be impacted by other environmental aspects including Population and Human Health and Climate and Air.

#### 17.2.1.10 Traffic and Transport

- Effects relating to Traffic and Transport could have impacted on Population and Human Health through disturbance and noise generation and impact on climate and air through GHG emissions from transport vehicles. Road widening can also impact on aquatic ecology and biodiversity. These have been considered in the respective chapters, Chapter 14 Section 14.3.1 and Chapter 4 Table 4-12.

#### 17.2.1.11 Cultural Heritage

- No cross media impacts have been identified.

### 17.2.2 Offsite peat slide works: Oct 2003-end 2005

The matrix showing the interaction of impacts which arose due to the peat slide incident is provided in Table 17-1 below. A summary of the interactions is provided in the following sections

#### 17.2.2.1 Population and Human Health

The interaction of impacts relating to population and human health are summarised as follows:

- Noise and Vibration: Noise from construction vehicles and equipment related to the remedial works associated with the peat slide could have also affected the population health of human beings. The effect of noise from the peat slide works has been described in the Chapter 5 Noise and Vibration, section 5.6.1.2 and considered in the population and human health chapter. Noise levels associated with these works were well within the noise criteria for construction equipment use at noise sensitive locations and was not significant.
- Biodiversity: The effects of the peat slide described in detail on Land, soils and geology on terrestrial habitats, birds, bats and mammals is discussed in Chapter 7, Section 7.4.2. Impacts on habitat are considered to have had **no significant effects** in terms of habitat loss. The development of the new vegetation in the slide area after a short number of years is considered a **significant positive effect of long-term duration**. **Permanent negative impacts** on several bat species occurred as a result of the peat slide and are described as **permanent negative significant effects** at site level.

- Aquatic Ecology: The effects of the peat slide on the supply of drinking water for the Gort Regional supply were described in Chapter 8, section 8.3.2.2 and considered in the assessment of effects on human health in Chapter 4, Table 4-13. The effect was negative but of short duration.
- Land, Soils and Geology: Land use changes occurred as a result of the peat slide and these have been considered in terms of their effect on population and human health in Chapter 4.
- Hydrology and Hydrogeology: The effect of the peat slide on the hydrology of the receiving water was described in Chapter 11 and the potential for such factors to impact on drinking water supplies and thus on human health has been assessed in Chapter 4 Population and Human Health, Table 4-13.
- Air Climate: Impacts on population and human health arising from the peat slide took into consideration its effects on air quality and climate. No significant effects relating to the interaction of impacts occurred.
- Traffic and Transport: Interactions of impacts between construction traffic vehicle movements and the population using local roads occurred which resulted in temporary road closures in the area. The effects of these were considered in Chapter 4, section 4.5.1.4
- Major Accidents and Disasters: The effects of the peat slide were described in detail in Chapter 10, Land, Soils and Geology and also discussed in Chapter 16 Major Accidents. The effects of the peat slide on population and human health was considered in Chapter 4. Although the potential to have a significant effect on human health was identified no direct impact occurred.

#### 17.2.2.2 Biodiversity -Terrestrial

Impacts on terrestrial biodiversity arising from the peat slide and the remedial activities undertaken have been considered in the Biodiversity Chapter, Section 7.4.2.2 and are summarised below:

- Population and Human Health: Disturbance and displacement of biodiversity could have occurred by the construction workforce travelling to and from work at the peat slide location and areas effected downstream.
- Noise and Vibration: Disturbance effects to fauna (particularly avifauna) as a consequence of noise and vibration arising from equipment, transport vehicles and peat slide remedial works occurred and has been assessed in the Biodiversity Chapter. No significant effects were identified
- Landscape and Visual: The peat slide led to a change in the nature of the landscape leaving a visible scar from being forest cover to almost bare areas. The impact of the landscape change has been assessed in terms of impact on terrestrial biodiversity in the Biodiversity Chapter. No significant impacts were identified.
- Land, Soils, Geology: The land use change that occurred as a result of the peat slide led to a loss or change of habitat in the slide footprint and areas effected downstream of the slide area. The impacts of the effect of these have been assessed in the Biodiversity Chapter, section 7.4.2.2. In terms of impact



and effect the loss and transport of peat lead to extensive disturbance of low value habitat and was a **direct moderate negative impact of medium-term duration** which resulted in **no significant effect** extending to the Black Road Bridge, with **minor medium-term negative impact** to the Flaggy Bridge and with **moderate, short-term negative impacts** to the area extending below this. The impact on birds is described as **positive impact of long-term duration** resulting in **no significant effects** with **permanent negative impacts and permanent negative significant effects** on several bat species occurring from damage to three bridges.

- Hydrology and Hydrogeology, Alteration to drainage occurred as a result of the peat slide, described in Chapter 11 and would have also contributed to habitat change impacting on biodiversity. The potential for such drainage changes on terrestrial ecology were considered and assessed in the Biodiversity Chapter. Their effect was not significant.
- Traffic and Transport: Noise from peat slide remedial works traffic along access routes could also impact birds and mammals through disturbance or displacement. This factor was taken into account in the assessment of impacts in the biodiversity chapter. The effects were not significant.

#### 17.2.2.3 Aquatic Ecology

Peat slide effects on several factors occurred which could also have effected aquatic ecology. The factors where this occurred as a result of the slide are summarised as follows:

- Land, Soils and Geology: Significant changes in land use occurred with the loss of vegetative cover and movement of large quantities of sediment and debris into the drainage and river channels. These effects were considered in Chapter 8 Aquatic Ecology. The effects of the peat slide on aquatic ecology, in terms of water quality and fisheries is considered in Chapter 8, Section 8.3.2.2. Water quality impacts ranged from very significant negative, short-term impact to significant to moderate negative impact, of short-term duration depending on the distance downstream from the slide area. The impact on fish is described as locally profound, negative and short-term in the immediate impact area and very significant or significant, negative and short-term in the main Owendalulleagh River channel.
- Hydrology and Hydrogeology: The impact on drainage, hydrology and hydromorphology which occurred as a result of the peat slide ranged from slight to moderate and these effects on aquatic ecology were considered.
- Major Accidents and Disasters: Consideration has can been given to the effects of the peat slide described in Land Soils and Geology in Chapter 16 on the aquatic ecology. The chapter describes the peat slide vent as likely to occur, with very serious impact and high risk, see Chapter 16, Section 16.5.2.3.

#### 17.2.2.4 Landscape and Visual:

- Land, Soil and Geology: The land use change resulting from the peat slide were considered in the Landscape and Visual Chapter. The peat slide was considered as having been locally significant from a landscape perspective in the short term. On a wider landscape scale, the landscape effects were not considered to be significant.

#### 17.2.2.5 Land. Soils and Geology

- The effects of the peat slide described in the Lands, Soil and Geology Chapter on human health aquatic ecology, biodiversity, roads and traffic were considered in their relevant chapters as outlined in this section.

#### 17.2.2.6 Hydrology and Hydrogeology

- Changes to the drainage that occurred as a result of the peat slide as described in Land, Soils and Geology were considered in the Hydrology and Hydrogeology Chapter 11. The impacts of these were considered to be slight to moderate but not significant overall on hydrology or morphology.

#### 17.2.2.7 Air and Climate

- Land, Soils and Geology: The impacts of the change of land use (displacement of peat and loss of forest plantation and the effect this had on the carbon balance of the interaction of impacts on air quality and climate arising from land use change and, construction activities were considered in the Air and Climate Chapter 12. The carbon loss and loss of sequestration contributed negatively to the carbon balance of the project.

#### 17.2.2.8 Noise

- The effects of noise impacts arising from the peat slide remedial activities was considered in the Population and Human Health Chapter, Table 4-13 and the Biodiversity Chapter.

#### 17.2.2.9 Material Assets

- The effects of the peat slide described in Land Soils and Geology have been considered in the Chapter on Material Assets. Temporary closure of local and regional roads during the response to the peat slide occurred as well as land use changes as a result of the slide. The effect of the road closures was not significant.

#### 17.2.2.10 Traffic and Transport

- Land, Soils and Geology: Impacts on roads, traffic and transport from the effects of the peat slide described in the Land Soils and Geology Chapter were considered. These included for example the temporary closure of roads,



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new access track development and delivery of materials for remedial works. Temporary, significant, negative effects were experienced by users of the local road network and short-term, imperceptible, negative effects were experienced by users of the national network.

#### 17.2.2.11 Cultural Heritage

- No cross media impacts have been identified.

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**Table 17-1 Interaction of Significant Cross Media Impacts which have occurred – Construction phase 2003 to 2006 and resulting from the Peat Slide**

Interaction	Population and Human Health		Noise and Vibration		Shadow Flicker		Biodiversity (Terrestrial ecology)		Aquatic Ecology and Fisheries		Landscape and Visual		Land, Soil Geology		Hydrology and Hydrogeology		Air and Climate		Material Assets		Roads, Traffic and Transport		Cultural Heritage		Major Accidents and Disasters	
Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide	Construction	Peat Slide
Population and Human Health			✓	✓	✓	✗	✓	✓	✗	✓	✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓
Noise and Vibration					✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✓	✗	✗	✗	✓
Shadow Flicker							✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Biodiversity (Terrestrial Ecology)									✗	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✗	✗	✗	✓
Aquatic Ecology and Fisheries											✗	✗	✓	✓	✓	✓	✗	✗	✗	✗	✓	✗	✗	✗	✗	✓
Landscape and Visual													✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓
Land, Soils, Geology and Groundwater															✓	✓	✓	✓	✗	✗	✓	✓	✗	✗	✗	✓
Hydrology and Hydrogeology																	✓	✓	✗	✗	✗	✗	✗	✗	✗	✓
Air and Climate																			✓	✓	✓	✓	✗	✗	✗	✓
Material Assets																					✓	✓	✗	✗	✗	✓
Roads, Traffic and Transport																							✓	✓	✓	✓
Cultural heritage																									✗	✗
Major Accidents and Disasters																										

✓ Interaction

✗ No interaction

### 17.2.3 Operational period 2006 – mid-2020

This section summarises the main interactions of impacts which have occurred during the operational period to mid-2020 which principally relate to Population and Human Health with operational effects potentially arising from noise, vibration, shadow flicker and air and climate. These are summarised briefly in the following sections and the interactions of factors are indicated in the matrix in Table 17-2.

#### 17.2.3.1 Population and Human Health

The interaction of impacts relating to population and human health which have occurred or are occurring are summarised as follows:

- Noise and Vibration: Excessive wind turbine noise during operation could have given rise to breaches of noise conditions leading to a public health nuisance, disturbed sleep and potentially illness. Excessive vibrations could also have impacted on dwellings in the vicinity of the wind farm. The assessments of noise and vibration undertaken in Chapter 5 (Noise and Vibration), section 5.6.1.4 was considered in the assessment of effects on Population and Health. No adverse effect was identified
- Shadow Flicker: Excessive shadow flicker can also give rise to nuisance and health effects and the effect of shadow flicker from the project have been considered in the Population and Human Health Chapter. Impacts are described in Sections 4.3.2 and 4.3.3 No effect of shadow flicker was identified.
- Landscape and Visual: The visual effect of the presence of the project in the landscape was considered in the population and human health chapter. Impacts are described in Sections 4.3.2 and 4.3.3 No significant impact was identified on human health.
- Air and Climate: The positive effects of the project in reducing greenhouse gas emissions and its impact on climate change, together with the economic benefit through displacement of imported fuel costs has been considered in the Population and Human Health Chapter. Impacts are described in Sections 4.3.2 and 4.3.3 The effect is described as moderate, positive and of medium term duration.
- Traffic and Transport: Effects of traffic and transport activities which occurred during the operational period to date which arose from routine maintenance, road repairs and upgrades to electrical control systems were considered in the Population and Human Health Chapter. Impacts are described in Sections 4.3.2 and 4.3.3 No significant effect has been identified.

#### 17.2.3.2 Biodiversity

- Noise effect from the operational project were considered in the biodiversity Chapter in terms of disturbance and displacement effects. No significant effect was identified.

### 17.2.3.3 Air and Climate

- Hydrology and Hydrogeology: The carbon cost of the drainage of peatland was accounted for in the payback period of the wind farm during the operational period 2006 to mid-2020.

## 17.3 Summary of Interaction of Impacts which are likely to occur 2020 to circa 2040

### 17.3.1 Operational period 2020 – circa 2040

This section summarises the main interactions of impacts which are likely to occur due to continued operation of the project to circa 2040. Again, these relate principally to Population and Human Health with operational effects potentially arising from noise, vibration, shadow flicker and air and climate. The effects are summarised in the following sections and indicated in the matrix provided in Table 17-2.

#### 17.3.1.1 Population and Human Health

The interaction of impacts relating to population and human health which are likely to occur are summarised as follows:

- Noise and Vibration: The noise and vibration effects of the continued operation of the wind farm to circa 2040 was assessed in Chapter 5 (Noise and Vibration) and was considered in terms of effect on human health in Chapter 4, section 5.6.2.2. This included an assessment of the likely compliance with the requirements of the draft Wind Energy Development Guidelines published in 2019 for consultation and which are likely to be finalised in 2020. The noise assessment indicated compliance with likely future noise criteria and no impact on human beings would be likely to occur. No significant effect will likely occur.
- Shadow Flicker: Shadow flicker was also assessed to circa 2040, including an assessment of requirements of the draft Wind Energy Development guidelines, 2019 which indicated conformity with the draft Guidance, and this was considered in the Population and Human Health Chapter. No significant effect will likely occur
- Landscape and Visual : The visual effect of the presence of the project in the landscape was considered in the population and human health chapter. No significant impact was identified on human health.
- Air and Climate: The beneficial effects of the continued operation of the wind farm project in reducing greenhouse gas emissions and its impact on climate change to circa 2040 has been considered in the Population and Human Health Chapter. The positive economic benefit from displacing imported fossil fuel was also considered. The effect will likely remain moderate and positive in the medium term.

- Traffic and Transport: Effects of traffic and transport activities which are likely to occur during the continued operational period to circa 2040 from routine maintenance and road repairs were considered in the Population and Human Health Chapter and no effect was identified.

#### 17.3.1.2 Biodiversity

- Noise effect from the continued operation of the project out to circa 2040 were considered in the biodiversity Chapter in terms of disturbance and displacement effects. No significant effect was identified.

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Table 17-2 Interaction of Significant Cross Media Operational Impacts which have occurred 2006 to mid-2020 and are likely to occur 2020 to circa 2040

Interaction	Population and Human Health		Noise and Vibration		Shadow Flicker		Biodiversity (Terrestrial ecology)		Aquatic Ecology and Fisheries		Landscape and Visual		Land, Soil Geology		Hydrology and Hydrogeology		Air and Climate		Material Assets		Roads, Traffic and Transport		Cultural Heritage		Major Accidents and Disasters	
	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040	2006 to mid-2020	Mid-2020 to circa 2040
Population and Human Health			✓	✓	✓	✓	✗	✗	✗	✗	✓	✓	✗	✗	✗	✗	✓	✓	✗	✗	✓	✓	✗	✗	✗	✗
Noise and Vibration					✗	✗	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Shadow Flicker							✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Biodiversity (Terrestrial Ecology)									✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Aquatic Ecology and Fisheries											✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Landscape and Visual													✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Land, Soils, Geology and Groundwater															✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
Hydrology and Hydrogeology																	✓	✓	✗	✗	✗	✗	✗	✗	✗	✗
Air and Climate																			✗	✗	✗	✗	✗	✗	✗	✗
Material Assets																					✗	✗	✗	✗	✗	✗
Roads, Traffic and Transport																							✗	✗	✗	✗
Cultural heritage																									✗	✗
Major Accidents and Disasters																										

✓ Interaction

✗ No interaction

## 17.3.2 Decommissioning circa 2040 – 2042

Decommissioning of the Project is expected to occur circa 2040 to 2042 and will involve removal of surface structures in the wind farm (turbines, meteorological mast and substation), along the overhead line (conductors, towers and pole sets), at the Agannygal Substation (substation building) and at a number of barrages. Access tracks, hardstand areas and foundations will remain in situ. The factors to be considered during decommissioning are similar to the construction phase but significantly fewer physical works will be undertaken on the project site as described in Chapter 2. The interactions likely to occur during the decommissioning phase are summarised in this section and the matrix of these interaction is provided in Table 17-3.

### 17.3.2.1 Population and Human Health

The interaction of impacts relating to population and human health associated with project decommissioning are summarised as follows:

- **Noise and Vibration:** Noise from equipment used in the decommissioning of the project, see Chapter 5, Section 5.6.3.2 has been considered in the assessment of effects on population and human health. No effect from decommissioning noise is predicted to occur, see Chapter 4, Section 4.5.3. Following decommissioning there will be no wind farm noise from the project site.
- **Shadow Flicker:** As the wind turbines will be dismantled and removed from site no possibility of shadow flicker will arise and no interaction of impacts and no effect on population and Human Health will occur.
- **Aquatic Ecology:** Potential effects on aquatic ecology such as sediment or hydrocarbon run off could also affect the drinking water supply of the local population and the assessment of effects has been taken into account with respect to population and human health – no impact is predicted to occur, see Chapter 4, Section 4.5.3.3..
- **Landscape and Visual:** Changes to the landscape which are likely to occur during and post decommissioning are described in Chapter 9, Section 9.4.3.2. Landscape changes are described as medium with respect to wind turbine removal, and low with respect to other elements and are classed as slight to moderate significance. The magnitude of the change is considered to be Medium to high in terms of visual effects in the immediate site vicinity and low in the wider landscape. These have been considered in Chapter 4 and no effects are predicted to occur on population and human health Chapter 4, Section 4.5.3.
- **Hydrology and Hydrogeology:** The effects on hydrology and hydrogeology arising from decommissioning activities and their potential to contribute to effect on human health in terms of pollution of surface or groundwater were considered in Chapter 4, Section 4.5.3.3 and no significant impacts are predicted as likely to occur. Impacts from the potential to increase flood risk in terms of affecting the local population was considered in the Flood Risk

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Assessment accompanying Chapter 11. No impact from the project decommissioning or post decommissioning is predicted as likely to occur

- Air Climate: Potential impacts on air quality from dust and vehicle emissions as a result of land use change arising from decommissioning were assessed in Chapter 12 (Air and Climate), Section 12.4.4.3. These impacts can also impact on human health and are described in terms of their significance in Chapter 4, Section 4.3.3.3 No significant effects relating to the interaction of impacts are predicted to occur.
- Traffic and Transport: Potential impacts on roads, traffic and transport as a result of decommissioning activities are likely to be similar to but occurring to a lesser extent than those experienced during the construction of the Project. The effects of traffic and transport associated with decommissioning were considered and no significant impacts are predicted to occur, See Chapter 4, Section 4.5.3.3.
- Major Accidents and Disasters: The risk of a major accident occurring during decommissioning is assessed as being very unlikely in terms of occurrence, minor in impact if it occurred and in the low risk category, see Chapter 16, Section 16.5.4.

#### 17.3.2.2 Biodiversity -Terrestrial

Impacts relating to Biodiversity during the decommissioning period have the potential to be impacted by other environmental factors as follows:

- Population and Human Health: Disturbance and displacement of biodiversity by the decommissioning workforce travelling to and from work at the development sites. No significant impacts from disturbance were identified
- Noise and Vibration: Disturbance effects to fauna (particularly avifauna) as a consequence of noise and vibration arising from decommissioning has been assessed in the Biodiversity Chapter. No significant impacts were identified
- Land, Soils, Geology: The effects of changes from decommissioning activities as described in Chapter 10, such as some turbary road widening, dismantling of wind farm components and demolition of surface structures, were considered in the biodiversity chapter. No significant effects on birds with minor negative effects on foraging bats are predicted with minor temporary changes to terrestrial habitat likely to occur, see Chapter 7, Section 7.4.3.2. A slight, negative and short term impact with no significant effects on otters and other mammals is likely to occur also.
- Hydrology and Hydrogeology: The effects of the removal of two barrages constructed as part of the peat slide remedial works were considered in terms of its effect on terrestrial biodiversity, Chapter 7, Section 7.4.3.2. No impacts were identified and no interaction of impact will likely occur.
- Traffic and Transport: Noise from construction traffic along access routes during decommissioning could also impact birds and mammals through disturbance or displacement. This factor was taken into account in the



assessment of impacts in the biodiversity chapter. No significant effect was identified.

#### 17.3.2.3 Aquatic Ecology

Effects arising from several topics have the potential to effect aquatic ecology and these were taken into account in Chapter 8 Aquatic Ecology. These effects are summarised briefly as follows:

- Land, Soils and Geology: Decommissioning effects on land, soil and geology have been taken into account in the assessment of effects on aquatic ecology. Minimal ground disturbance on the wind farm site during decommissioning has been taken into account in Chapter 8, with likely minor, negative and temporary impacts on downstream watercourses close to the wind farm boundary. The impacts would be confined mainly to aquatic invertebrates with the possibility of slight negative impacts on spawning success in the streams concerned, depending on the degree of siltation. The decommissioning of the grid connection is assessed as likely to have slight to moderate, negative temporary impacts. The removal of the barrages could potentially give rise to moderate to significant negative, localised and short-term impact on aquatic ecology including fish if not properly managed and the impacts mitigated. Chapter 8, Section 8.3.4.2
- Hydrology and Hydrogeology: The effects of the removal of two barrages have been assessed in Chapter 8, Section 8.3.4.2 and in the absence of mitigation were considered as likely to cause a moderate to significant negative, localised and short-term impact on aquatic ecology.
- Roads, Traffic and Transport: Consideration has been given to the potential impact of road widening in the Aquatic Ecology Chapter. Section 8.3.4.2 describe this activity along the 1km of narrow turbary road between T31 and T45 in places where the track is too narrow for the crane that will need to travel along it. Widening will be achieved using steel plates, bog mats or equivalent means as required. Properly planned and supervised, these activities will likely have at most **minor, negative and temporary impacts** on downstream watercourses close to the wind farm boundary.

#### 17.3.2.4 Landscape and Visual:

- Land, Soil and Geology: The significance of the decommissioning effects on the landscape and visual character of the area were considered in Chapter 9 with visual effects ranging from neutral mainly to slight -moderate depending on location of viewpoint.

#### 17.3.2.5 Hydrology and Hydrogeology

- Impacts relating to Surface and Groundwater have the potential to be impacted by Land, Soils and Geology during the decommissioning phase.

The impacts on hydrology and hydrogeology were considered to be slight and temporary but of no significant effect.

#### 17.3.2.6 Air and Climate

- Land, Soils and Geology: The interaction of impacts on air quality and climate arising from land use change and, construction activities were considered in the Air and Climate Chapter 12. Impacts on air quality are likely to be localised and limited compared to construction and no significant effect will occur. The positive effect on the reduction of greenhouse gas emissions by the project will no longer occur post decommissioning.

#### 17.3.2.7 Noise

- The effects of noise impacts during construction have been considered in the Population and Human Health Chapter and the Biodiversity Chapter.

#### 17.3.2.8 Material Assets

- Impacts relating to Material Assets have the potential to be impacted by other environmental aspects including Population and Human Health and Climate and Air. No significant impact was identified as likely to occur.

#### 17.3.2.9 Traffic and Transport

- Effects relating to Traffic and Transport could impact on Population and Human Health through disturbance and noise generation and impact on climate and air through GHG emissions from transport vehicles during decommissioning. Road widening can also impact on aquatic ecology and biodiversity. These have been considered in the respective chapters.

#### 17.3.2.10 Cultural Heritage

- No cross media impacts have been identified.

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**Table 17-3 Interaction of Significant Cross Media Impacts which are likely to occur – Decommissioning circa 2040 to 2042**

Interaction	Population and Human Health	Noise and Vibration	Shadow Flicker	Biodiversity (Terrestrial ecology)	Aquatic Ecology and Fisheries	Landscape and Visual	Land, Soil Geology	Hydrology and Hydrogeology	Air and Climate	Material Assets	Roads, Traffic and Transport	Cultural Heritage	Major Accidents and Disasters
Population and Human Health		✓	✓	✓	✓	✓	✕	✓	✓	✓	✓	✕	✕
Noise and Vibration			✕	✓	✕	✕	✕	✕	✕	✕	✓	✕	✕
Shadow Flicker				✕	✕	✕	✕	✕	✕	✕	✕	✕	✕
Biodiversity (Terrestrial Ecology)					✕	✕	✓	✓	✕	✕	✓	✕	✕
Aquatic Ecology and Fisheries						✕	✓	✓	✕	✕	✓	✕	✕
Landscape and Visual							✓	✕	✕	✕	✕	✕	✕
Land, Soils, Geology and Groundwater								✓	✓	✕	✓	✕	✓
Hydrology and Hydrogeology									✕	✕	✕	✕	✕
Air and Climate										✓	✓	✕	✕
Material Assets											✕	✕	✕
Roads, Traffic and Transport												✕	✕
Cultural heritage													✕
Major Accidents and Disasters													

✓ Interaction

✕ No interaction