16 INTERACTION OF THE FOREGOING

16.1 INTRODUCTION

The Environmental Impact Assessment Report supports the overall Carrownagowan Wind Farm project, (please refer to section 2.3 of chapter 2 for a full description of the project and the proposed development). This EIAR has presented the environmental assessments of the entire project under each required factor. Where relevant, the interaction between the factors, which is the interactions between specific environmental aspects and effects, are already addressed within each of the individual assessment topic areas or chapters of this EIAR.

16.1.1 Scope and Methodology of Assessment

Article 3 of EIA Directive 2014/52/EU stipulates that 'The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors: (a) population and human health; (b) biodiversity, with particular attention to species and habitats protected under 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 purpose of this chapter is to draw attention to important interactions and interdependencies between one factor or topic and another. Consequently, this chapter now highlights those interactions of the environmental aspects and topics previously detailed and assessed throughout this EIAR. The potential for interactions between one aspect of the environment and another can result in direct or indirect effects, which may be positive or negative. This chapter is completed based on a desktop review and by provision of a matrix to present the main interactions. The assessments and results have previously been presented in the preceding chapters of this EIAR.

16.2 INTERACTION OF ENVIRONMENTAL FACTORS

While all environmental aspects can be inter-related to some extent, the following outlines the key potential interactions identified between each of the various environmental factors considered in this EIAR for both the construction and operational phases of the proposed Carrownagowan wind farm project and grid connection. Where the potential for significant effects has been identified, the impacts have been avoided or reduced by mitigation measures, as outlined throughout the chapters of the EIAR.

A matrix has been generated to summarise the relevant interactions between specific environmental factors identified for the Carrownagowan project. The matrix is presented in **Table 16-1**. It contains each of the environmental factors or aspects, which were considered as part of this environmental impact assessment, on both axes. These interactions have been identified for both the construction and operation phases of the project and positive impacts are identified.

Full details of the significance of the effects and the relevant interactions of the environmental aspects along with any proposed mitigation are discussed within each of the individual preceding Chapters which included;

Chapter 5 Population and Human Health
Chapter 6 Biodiversity

Chapter 7	Ornithology
Chapter 8	Water
Chapter 9	Land and Soils
Chapter 10	Noise and Vibration
Chapter 11	Shadow Flicker
Chapter 12	Landscape and Visual Impact
Chapter 13	Cultural Heritage
Chapter 14	Air and Climate Change
Chapter 15	Material Assets

16.2.1 Population and Human Health

Population and Human Health *and* **Noise and Vibration** *and* **Air Quality and Climate Change**

Plant and machinery used during the construction phase has the potential to cause a temporary nuisance through noise and dust emissions. Once operational, there will be noise from the wind turbines and substation, and as assessed in Chapter 10, Noise and Vibration, the project as designed will not result in significant effects.

During the operational phase, the Carrownagowan Wind Farm will contribute towards eventual national decarbonisation which will have beneficial effects on air quality and climate change and a resultant positive effect on the human environment. This is outlined in Chapter 14 Air and Climate Change.

Population and Human Health *and* **Water**

There is potential for water pollution during the construction phase which could impact on different types of receptors including the human population. Chapter 8 has assessed the potential impacts and describes mitigation measures to ensure there are no significant effects from water pollution.

Population and Human Health *and* **Landscape and Visual Resources**

The most visually dominant project infrastructure will be the wind turbines and the erection of the wind turbines will change the landscape to observers. The wind farm would be located in an area of Co. Clare cited as Strategic for wind energy development. Chapter 12 of this EIAR considers the magnitude of landscape change and assesses the landscape and visual impact of the project.

The potential impact on landscape and visual resources during the construction phase will be temporary e.g. use of construction machinery. The operation of the wind farm will introduce wind turbines into a natural, but already highly modified landscape.

Population and Human Health *and* **Material Assets (including Traffic)**

Chapter 15 of this EIAR discusses how the construction phase of the project will give rise to increased traffic including abnormal loads for delivery of turbine components, and is likely to create some short-term inconvenience for other road users. A Construction-phase Traffic Management Plan will be implemented to manage traffic coming to and from the site.

Overall, the interaction with Material Assets is considered a positive effect, resulting from the project's contribution to the electricity supply with the provision of a clean energy source.

16.2.2 Biodiversity (including Ornithology)

Biodiversity *and* **Land and Soil**

There will be some habitat loss during excavation of certain works areas. There will be disturbance to fauna and birds caused by the construction activity. Forestry will be felled to facilitate the construction of infrastructure. The forestry will be replanted elsewhere resulting in no net loss. The likely significant effects and mitigation measures are described in full in Chapter 6, which includes biodiversity enhancement measures for the site. These measures are not a requirement of mitigation or compensation, but rather an opportunity for positive measures to improve the site.

Biodiversity *and* **Water**

There is the potential for water pollution from different sources during the construction works which may cause effects on the quality of aquatic habitats and thereby adversely impact the fauna that depend on the habitat. These impacts and any others including drainage are fully assessed in Chapter 6 and the mitigation measures are also described. A Surface Water Management Plan (Volume III, Appendix 3-2) has been completed as part of the project to manage run-off, particularly of sediment laden water, as a means of protecting water quality and aquatic habitats.

Biodiversity *and* **Noise and Vibration**

The plant and machinery required to do the works will be noisy. Construction noise will likely result in some avoidance behaviour by fauna. This is addressed in Chapter 6. The habit loss and disturbance/ avoidance impacts for birds are assessed in Chapter 7.

16.2.3 Land and Soil

Land and Soil *and* **Water** *and* **Biodiversity** *and* **Cultural Heritage**

The civil engineering works will require the excavation and movement of overburden and rock. This will lead to habitat loss and potential sources of pollution for surface and underground water. There is also the potential for previously unrecorded sites of archaeological interest to be disturbed during excavation works. The potential for all these interactions and the resultant effects are assessed in detail in the relevant chapters. The likely impacts will be avoided or minimised through the topic specific mitigation measures.

16.2.4 Air and Climate Change

Air and Climate Change *and* **Water** *and* **Biodiversity**

A surface water management plan has been completed as part of the project to outline the drainage system particularly for the upland wind farm site. The runoff control measures for the wind farm site have been designed in the context of storm events of varying duration and intensity (outlined in Chapter 3 Civil Engineering). The drainage design is modular to manage run-off from each turbine area as a unit which includes keeping clean water isolated from the works area to limit the volume of sediment laden run-off to be managed and also to maximise natural recharge of run-off. Since the surface water management plan is designed for the construction phase (worst case), no additional allowance is made for a possible increase in rainfall intensity due to climate change in the future. While the design remains the same, the potential for extreme rainfall events may be more frequent which may result in more incidences of stopped works during heavy rainfall. Therefore, the interaction between Climate Change and Water may see construction work stoppages due to weather conditions happening more frequently.

In terms of Climate Change, increasing global temperatures adversely affects ecosystems and biodiversity. The Carrownagowan Project is a renewable energy project which will contribute to Ireland's commitments in the 2019 Climate Action Plan, in the Paris agreement and contribute to UN Sustainable Development Goal 13. The Project has been designed to avoid areas of biodiversity value with infrastructure predominantly sited within conifer forest (Chapter 6 Biodiversity). Biodiversity enhancement measures are also outlined for the site where opportunities to improve biodiversity can be achieved (Volume III, Appendix 6-10).

16.2.5 Landscape and Visual

Landscape and Visual *and* **Cultural Heritage**

The development site infrastructure has the potential to alter the landscape setting of recorded sites and monuments in the area. The potential impacts and mitigations are described in detail in Chapter 12. The wind farm is not situated in a designated landscape nor are there recorded monuments within the site.

16.2.6 Shadow Flicker

Shadow Flicker *and* **Population and Human Health**

During the operational phase, the spinning turbines have the potential to cause shadow flicker within dwellings, which can be a nuisance to room occupants. However, at distances of 1 km and 1.36 km to the houses in the study area, and with natural meteorological conditions and the presence of significant screening at these locations, shadow flicker effects will be minimum and within the guide limits. Turbine Control Modules can also be implemented if required to shut down a particular turbine within particular parameters. The full shadow flicker assessment is described in Chapter 11.

Table 16-1 Matrix of Environmental Factor Interactions

	POPULATION AND HUMAN HEALTH	BIODIVERSITY (+ ORNITHOLOGY)	LAND AND SOIL	WATER	AIR AND CLIMATE CHANGE	NOISE AND VIBRATION	LANDSCAPE AND VISUAL	CULTURAL HERITAGE	SHADOW FLICKER	MATERIAL ASSETS
POPULATION AND HUMAN HEALTH										
					+ +					
BIODIVERSITY (+ ORNITHOLOGY)										
					+ +					
LAND AND SOIL										
WATER										
AIR AND CLIMATE CHANGE										
	+ +	+ +								+ +
NOISE AND VIBRATION										
LANDSCAPE AND VISUAL										
CULTURAL HERITAGE										
SHADOW FLICKER										
MATERIAL ASSETS										
					+ +					

Construction
Operation
+ + Positive effect

16.3 NOTE ON RISKS OF MAJOR ACCIDENTS AND DISASTERS

Overall it is not expected that the Project will result in significant effects resulting in the risk of major accidents and disasters, nor is the project considered vulnerable to risks of major accidents and disasters. Threats to the environment are inherently assessed within environmental impact assessment. Landslide susceptibility is covered within the Peat Stability Risk Assessment (Volume III, Appendix 9-2) and the Project has been designed using Mitigation by Avoidance to ensure no infrastructure is situated in deep peat and the outcome of the risk assessment was that landslide presented a Negligible to Low Level of risk to the Wind Farm Infrastructure.

A Flood Risk Assessment was also carried out for the wind farm site as part of the project (Volume III, Appendix 8-2). The assessment found the proposed wind farm and associated infrastructure is located within a low risk area and as such is appropriate from a flood risk perspective. Furthermore, no instances of historical flooding were identified and no instances of recurring flooding were identified.

Large scale wind farms are typically located in remote upland sites and this is the case with Carrownagowan, situated on the north-western slopes of the Slieve Bernagh Mountains. There are no industrial sites or regulated manufacturing sites at Slieve Bernagh. Carrownagowan Wind Farm is not associated with any other regulated activity or industry and is a renewable energy development which is not associated with large volumes of chemicals or hazardous materials. It is not adjacent to or associated with any Seveso site and is not governed by the Control of Major Accident Hazards Involving Dangerous Substances Regulations. The risk to humans of major accidents and disasters associated with industrial activities is therefore absent.

During the operational life of the wind farm, particularly in the context of climate change, there is the potential for increased storm events and severe weather. Wind turbines are designed for specific wind parameters and will shut down during high wind speed events. Therefore, the potential effects of climate change on the operational development may involve curtailment where the turbines will be restricted from operation due to severe winds but does not present a likely risk of a major accident and disaster.