



Cush Wind Farm
Phase II

Chapter 15: Interactions of the Foregoing

Cush Wind Limited

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15.1 INTRODUCTION

This chapter identifies interactions between the separate environmental assessments discussed in the preceding chapters which might otherwise not be noticed but which are required to be assessed to ensure all likely significant effects on the environment are identified and assessed.

The interactions between environmental factors have also been assessed throughout this EIAR by ensuring cross-assessments between factors, as relevant. As described in **Chapter 1**, close coordination and management of the EIAR project team, and careful read-across editing, ensured that competent experts were vigilant to the potential for complex interactions between environmental factors to result in likely significant effects; including direct, indirect, secondary and cumulative effects; and, where identified as likely, were adequately assessed. This also included an assessment of the possible accumulation of effects arising from the mitigation measures proposed in this EIAR that could unintentionally result in adverse effects such that they could become both likely and significant.

Reference should also be made to **Chapter 2** which provides an evaluation of reasonable project alternatives and **Chapter 3** which provides a detailed description of the project. As discussed, the design of the project was an iterative process and the final project integrates numerous 'mitigation by design', or 'embedded mitigation', measures which *ex ante* mitigate likely significant adverse effects, including the interaction between effects.

15.2 INTERACTIONS

It is general practice that interactions are shown by a means of a matrix, as set out in **Table 15.1** below, examining each aspect of the receiving environment which is assessed in detail in the respective chapters of this EIAR, and cross-tabulated against all other aspects that have also been assessed. This is accompanied by a brief text describing the interactions, including during the construction and operation phases.

Where a potentially relevant interaction is identified, it is given a reference number in the matrix and the detail of the interaction is further discussed below, including whether it is weak or strong, or whether the interaction is positive or negative. Where there is no number indicated in the matrix, it is assessed that there is no likelihood for any significant effects by way of interaction between the environmental factors.

Interactions	Population and Human Health	Biodiversity	Land and Soils	Water	Air Quality	Climate	Landscape	Cultural Heritage	Noise & Vibration	Shadow Flicker	Material Assets
Population and Human Health							1		2	3	4
Biodiversity			5	6							
Land & Soil		5		7				8			
Water		6	7								
Air Quality											9
Climate											9
Landscape	1							10			
Cultural Heritage			8				10				
Noise & Vibration	2										
Shadow Flicker	3										
Material Assets	4				9	9					

Note: Numbers refer to the interactions discussed in **Sections 15.2.1–15.2.10**.

Table 15.1: Matrix of Interactions

15.2.1 INTERACTION 1: POPULATION & HUMAN HEALTH AND LANDSCAPE

The likely effects of the project on landscape, and the interaction with population and human health, have been discussed in **Chapter 4** and **Chapter 10** of this EIAR. The assessment considers landscape sensitivity, the scale and prominence of the turbines, residential visual amenity, recreational receptors and representative viewpoints supported by photomontages. The effects of the proposed three turbines are considered both individually and in combination with the permitted Phase I turbines and other relevant wind energy developments.

Chapter 10 identifies the greatest landscape and visual change within the site and its immediate surroundings, with effects reducing at greater distances. Localised residual landscape and visual effects reach Substantial-moderate, while more distant effects are lower. These findings are retained in this assessment; the presence of a local visual effect does not, in itself, establish a significant adverse effect on health, tourism or recreational use. **Chapter 4** considers those wider consequences and does not predict significant adverse effects on population and human health.

The underground electricity line will not introduce a continuing above-ground visual feature following reinstatement. Temporary visual disturbance during construction and decommissioning will be limited through the construction management and reinstatement measures described in **Chapter 3** and **Chapter 10**. The interaction is principally a long-term, negative visual-amenity effect during operation, but does not give rise to an additional likely significant adverse population or human health effect.

15.2.2 INTERACTION 2: POPULATION & HUMAN HEALTH AND NOISE & VIBRATION

During the construction phase, noise will be generated through a number of typical on-site construction stage activities which will be mitigated through appropriate mitigation and good construction practices. Likely effects will therefore be short-term

and temporary in nature and a perceptible increase in noise, which is sufficient to cause a significant effect to local residential amenity, is not likely. No significant vibration generating activities are proposed to be undertaken.

Operation phase noise predictions account for the assessed turbine dimension range through the assessment sound-power profile and the modelling approach described in **Chapter 12**. The cumulative assessment includes Cush Wind Farm Phase I and other relevant wind farms. The required turbine-specific operating controls and curtailment will be implemented for Phase II, irrespective of the final turbine model selected, together with compliance monitoring and the investigation and management of complaints, tonality and excessive amplitude modulation.

The Phase II mitigation commitments do not substitute for compliance by Phase I with its own permission and noise conditions. Subject to implementation of the controls described in **Chapter 12**, residual operation phase noise effects are assessed as negative, long-term and not significant. No additional significant adverse interaction with population and human health is identified.

15.2.3 INTERACTION 3: POPULATION & HUMAN HEALTH AND SHADOW FLICKER

Once the project is operational, there is potential for shadow flicker to occur, depending on certain and highly infrequent, coincident set of meteorological conditions, as explained in detail in **Chapter 13**. All properties within 2,000m of the proposed Phase II and permitted Phase I turbines have been assessed for shadow flicker, with a total of 131 no. properties being identified and assessed.

The shadow flicker assessment considers the turbine dimension range and cumulative effects with the permitted Cush Wind Farm Phase I and other relevant wind farms. The unmitigated model identifies circumstances in which shadow flicker could occur at nearby receptors. These model predictions inform the operating controls and are not treated as the residual effect.

The proposed three turbines will be fitted with automated shutdown controls to eliminate shadow flicker attributable to Phase II. The final control schedule will reflect the installed turbine configuration and the cumulative assessment, with verification monitoring and a procedure for investigating complaints. Following implementation of these measures, no residual shadow flicker contribution from Phase II is predicted and no likely significant adverse interaction with population and human health will arise.

15.2.4 INTERACTION 4: POPULATION & HUMAN HEALTH AND MATERIALS ASSETS

The principal interaction between population and human health and material assets relates to transport and access, as assessed in **Chapter 4** and **Chapter 14**. Construction traffic, including concrete deliveries and abnormal turbine-component loads, will temporarily increase traffic on the receiving road network. The underground electricity line and haul route accommodation works also have the potential to cause localised disruption to road users, residents, businesses and agricultural access.

Traffic management, the coordination and scheduling of deliveries, advance communication, management of abnormal loads, maintenance of access and road cleanliness, and the other measures in **Chapter 14** will limit these effects. The assessment considers the potential for concurrent construction with Cush Wind Farm Phase I. The temporary concentration of traffic, noise and dust at a receptor has been considered through **Chapter 8**, **Chapter 12** and **Chapter 14**; these controls will operate

together rather than as independent measures. Residual traffic effects are assessed as short-term and not significant. Traffic during operation will be limited principally to inspection and maintenance visits.

The project also interacts with aviation, telecommunications and existing utilities. The aviation marking and lighting, service-provider liaison, link-protection and utility-protection measures identified in **Chapter 14** will be implemented. The physical presence of underground electrical infrastructure is considered alongside land use and human health in **Chapter 3** and **Chapter 4**. With these measures, no likely significant adverse interaction with population and human health is predicted.

15.2.5 INTERACTION 5: BIODIVERSITY AND LAND & SOILS

The excavation and removal of soils for the construction of the project will result in habitat loss or disturbance. Peat and spoil deposition and vegetation clearance can also affect habitats and species. These interactions are assessed in **Chapter 5** and **Chapter 6** and the supporting ecological, peat stability and peat/spoil management documents.

The proposed turbines are situated on Galros Bog, a former industrial peatland with cutaway peat, while the underground electricity line predominantly crosses agricultural land. This setting does not remove the need to protect the habitats and species identified in **Chapter 5**. The infrastructure layout, defined working areas, ecological supervision, seasonal and species-specific controls, reinstatement, off-setting and habitat-management measures will be implemented as described in that chapter and the Habitat and Species Management Plan.

Bat mitigation buffers and their ongoing vegetation management have been considered alongside peat stability, erosion, drainage and habitat reinstatement. Similarly, spoil deposition areas will be managed to maintain stability and establish vegetation, avoiding the creation of a continuing sediment source. These measures will be coordinated with the wider rehabilitation objectives for Galros Bog, as described in the draft rehabilitation plan at **Annex 6.2**.

The ecological consequences of habitat disturbance and the physical effects on land and soils are assessed separately using their respective criteria. **Chapter 5** concludes that no significant residual effects on important ecological features are likely with full implementation of mitigation. No additional likely significant adverse effect is identified through this interaction.

15.2.6 INTERACTION 6: BIODIVERSITY AND WATER

There is a direct relationship between water quality, drainage and aquatic or wetland habitats and species. As assessed in **Chapter 5** and **Chapter 7**, exposed ground, peat and spoil handling, excavation dewatering, concrete works, fuels and other construction materials could affect surface water or groundwater and, through those pathways, ecological receptors. The interaction extends to downstream designated sites and species rather than being confined to the immediate works footprint.

The wind farm drainage connects to the local drainage network and ultimately the Rapemills River system. The c.5km underground electricity line runs alongside the Rapemills River for part of its route and crosses under it at two locations using horizontal directional drilling (HDD). The assessment therefore considers both routine construction runoff and risks specific to HDD, including drilling-fluid management and inadvertent returns.

The drainage and pollution-prevention measures in **Chapter 7**, the CEMP, Surface Water Management Plan and Water Quality Monitoring Plan will be implemented with the ecological controls in **Chapter 5** and the NIS. These include separation of clean and potentially contaminated water, sediment interception and treatment, controlled dewatering, protection of watercourse buffers, containment of drilling fluids and implementation of the HDD contingency measures. Drainage maintenance, reinstatement and monitoring will continue as specified for the relevant phase.

The NIS addresses the project as a whole, alone and in combination with other plans and projects. Subject to the independent Appropriate Assessment by Offaly County Council, it concludes that the project will not adversely affect the integrity of any European site with the identified mitigation implemented. The EIAR assessments likewise identify no likely significant residual ecological effect through the water pathway. This interaction should be read with Interactions 5 and 7.

Accordingly, the interaction is not assessed as giving rise to an additional likely significant residual adverse effect on Biodiversity or water.

15.2.7 INTERACTION 7: LAND & SOIL AND WATER

The principal interaction between land and soils and water is the potential for erosion, sediment mobilisation and contamination during excavation, peat/spoil handling and storage. Drainage changes can also influence peat stability, while instability or failure could release peat or sediment into the drainage network. These linked mechanisms are considered in **Chapter 6**, **Chapter 7** and the Peat Stability Assessment at **Annex 6.1**.

The assessment is based on the maximum assumed physical footprint and construction quantities identified for the relevant disciplines. The peat/spoil management arrangements, restrictions on loading and stockpiling, drainage provision, erosion protection and geotechnical supervision will operate together. Drainage will be managed to avoid uncontrolled water accumulation or diversion, and deposition areas and exposed ground will be stabilised and reinstated as specified. Monitoring will identify signs of erosion or instability and trigger remedial measures.

The underground electricity line also crosses the Kilcormac Esker County Geological Site. Excavation and reinstatement will preserve the wider landform and limit local disturbance, while water-management measures will protect adjacent drainage features. The adopted controls address both the source of sediment and its transport pathway. Accordingly, the interaction is not assessed as giving rise to an additional likely significant residual adverse effect on land, soils or water.

15.2.8 INTERACTION 8: LAND & SOIL AND CULTURAL HERITAGE

The excavation of peat, soil and subsoil raises the possibility of disturbing previously unrecorded archaeological remains. This interaction applies to the turbine bases and hardstands, access tracks, underground electricity line and other groundworks, and is assessed in **Chapter 6** and **Chapter 11**. The absence of recorded monuments from the works footprint does not, of itself, exclude the potential for buried remains.

Chapter 11 specifies pre-construction archaeological test trenching within the turbine-base and hardstand footprints and archaeological monitoring of construction excavations, including those along the underground electricity line and at relevant

historic boundaries. The work will be undertaken under the applicable licences and requirements, with provision for excavation and recording of any remains identified.

The archaeological requirements will be coordinated with excavation support, peat stability, drainage and construction sequencing. Decommissioning monitoring will apply where ground not previously disturbed during construction is affected. With the mitigation in **Chapter 11** implemented, no likely significant adverse interaction between land and soils and the archaeological resource is predicted.

15.2.9 INTERACTION 9: AIR QUALITY & CLIMATE AND MATERIALS ASSETS (TRANSPORT & ACCESS)

Construction materials, turbine components, plant and personnel will be transported to and from the project, generating vehicle exhaust emissions and the potential for dust and trackout. **Chapter 8**, **Chapter 9** and **Chapter 14** consider these activities, including the underground electricity line, haul route accommodation works and the potential for concurrent construction with Phase I.

The air-quality interaction is principally local and short-term during construction and decommissioning. Vehicle and plant management, control of speeds on unsealed surfaces, covering of loads where appropriate, wheel washing, road cleaning and the dust-control measures in **Chapter 8** will limit emissions and nuisance. Traffic scheduling and management under **Chapter 14** will support these measures. Following mitigation, no significant adverse air-quality interaction is predicted.

Transport and plant fuel use also contribute to greenhouse gas emissions. These emissions are included within the quantified construction-stage assessment in **Chapter 9**, together with the embodied emissions of non-turbine construction materials. Turbine manufacture is considered separately using the representative Vestas lifecycle assessment discussed in that chapter. The same activity can therefore influence both local air quality and global climate, but its effects on those receptors are assessed using the separate methods in **Chapter 8** and **Chapter 9**. Inspection and maintenance traffic during operation will be infrequent, with much lower associated emissions.

15.2.10 INTERACTION 10: LANDSCAPE AND CULTURAL HERITAGE

The physical presence and visibility of the turbines can alter the setting of archaeological monuments, historic buildings and designed landscapes. This interaction is assessed in **Chapter 10** and **Chapter 11**, using the landscape and visual assessment, heritage receptor analysis and the photomontages at **Annex 10.2** and **Annex 10.3**. It is distinct from direct disturbance of buried archaeological material during excavation.

Chapter 11 identifies long-term, reversible, moderate visual effects on 10 Recorded Monuments within 2km of the proposed wind farm site. For the 15 Protected Structures within 5km, 13 of which are also included in the National Inventory of Architectural Heritage, effects range from imperceptible to moderate. These are the assessed receptor-specific effects and are not replaced by a general assumption that all heritage effects will be negligible.

The underground electricity line will not create an operation phase visual effect on the nearby heritage structures following reinstatement. The turbine setting effects will persist during operation and will be reversed following removal of the turbines. Having regard to the specialist assessments, no additional likely significant adverse cultural heritage effect is identified through the interaction with landscape and visual change.

15.3 SUMMARY OF INTERACTIONS & EFFECTS

All environmental factors are interrelated to some degree, and the assessment of these interactions is an important requirement of the EIAR process. Having assessed the interaction of likely effects during the construction, operation and decommissioning phases; the interaction of effects is not assessed as likely to result in any significant effects that could magnify effects through the interaction or accumulation of effects. All interactions of effects are assessed and have been fully considered in the relevant chapters of this EIAR.

The project will result in positive effects at international, national, regional and local level, particularly in relation to population, human health, air quality and climate. During the operation phase, the project will result in a long-term positive effect on both air quality and climate. The generation of approximately 48.3–55.1GWh per annum of electricity will lead to a net saving in terms of greenhouse gas emissions.

Overall, it is assessed that the additional adverse residual effect arising from the interactions assessed is not likely to be significant. Likely adverse effects from the project vary in significance but are generally in the slight to imperceptible range, with localised moderate and substantial-moderate effects retained as assessed in the relevant topic chapters. A number of positive impacts have also been identified such as community benefits; a reduction in the use of fossil fuels and the generation of greenhouse gases; and a significant contribution towards achieving Ireland's national and European targets for energy production from renewable sources.